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For UPSC CSE
PRELIMS 2025
JAN 2024 - APR 2025

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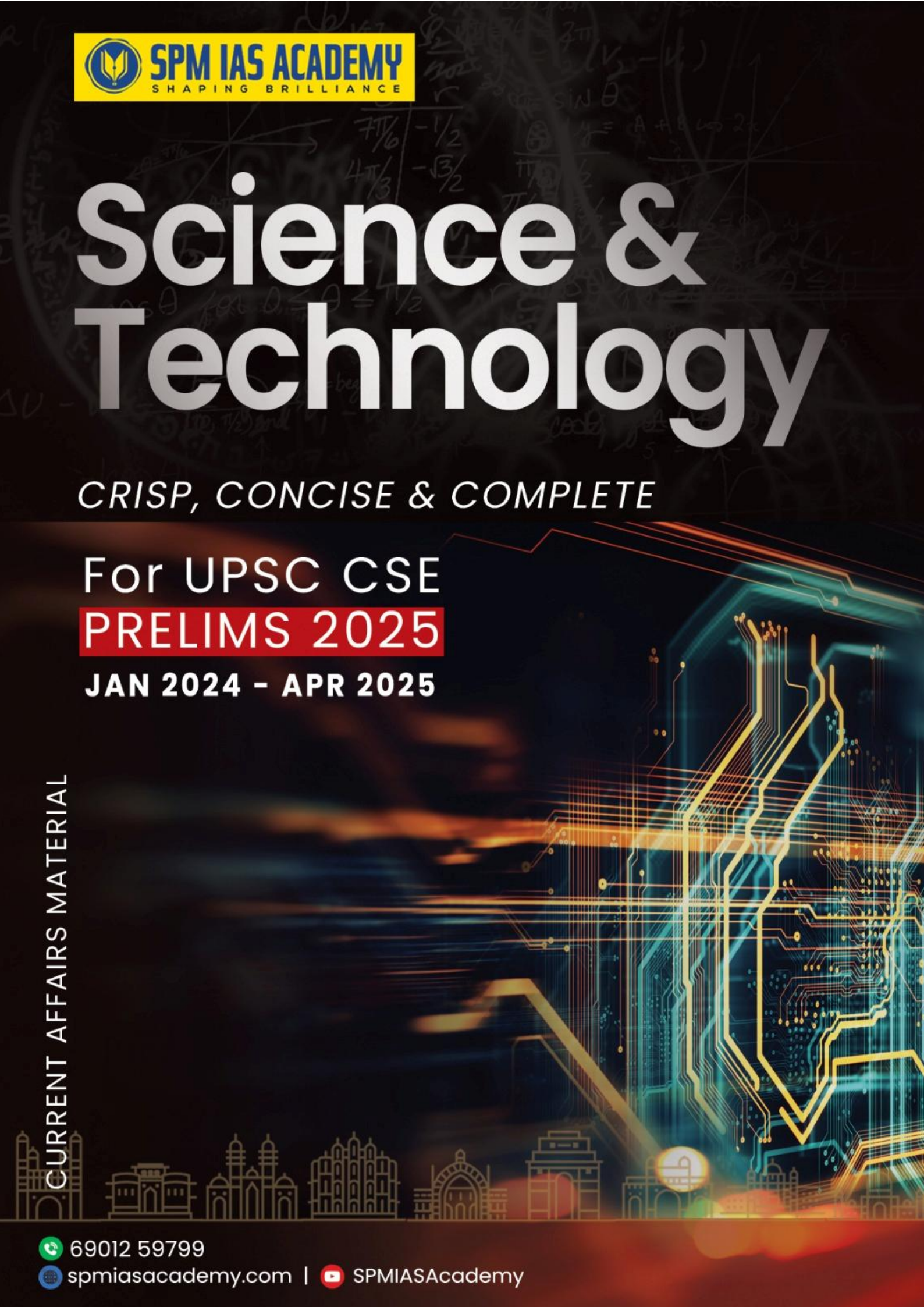

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CURRENT AFFAIRS - SCIENCE & TECHNOLOGY

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Day 13

Topic 121

121. Nobel Prize in Medicine or Physiology-2024

- to **American scientists Victor Ambros** and **Gary Ruvkun** for their **discovery of microRNA.**

Discovery of microRNA

- Helped in understanding **gene activity** regulation ie **how organisms develop and function.**

Lets understand about Messenger RNA first

- Body **DNA** produces **messenger RNA.**Messenger RNA is **converted into protein by ribosome.**This protein is carried through blood plasma **as signal protein.**This way one **body cell communicates** with **another body cell** and **genetic information** is passed from the **parents to their children.**

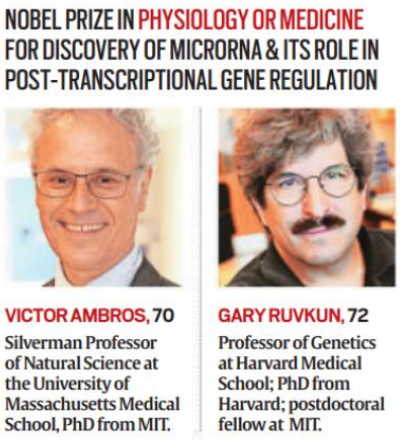
micro RNA

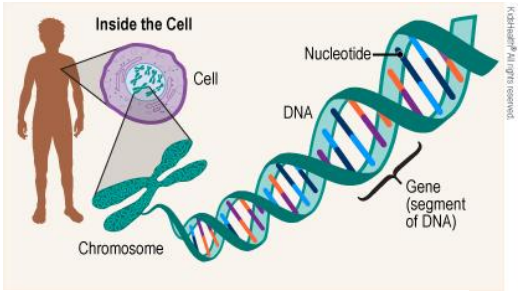
- Apart from messenger RNA **another RNA named micro RNA** is produced by DNA.Controls how **much of those signal proteins get made** by either slowing down or stopping the process.

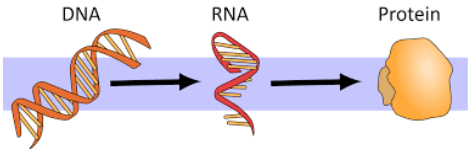
An analogy to understand relations-

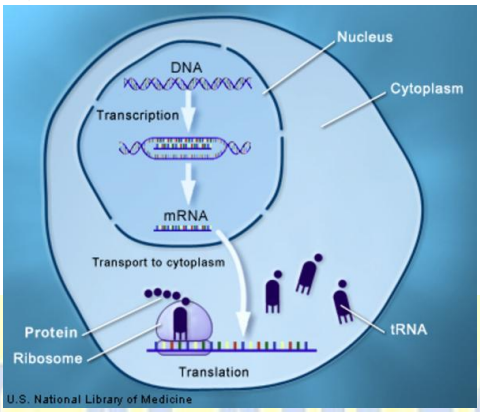
- **DNA-Master** of the house who has ordered his servants to cook food for his friends(other cells)
- **messenger RNA- Recipe**
- **Ribosome- Kitchen**
- **Micro RNA-Cook**
- **Signal protein- food**

If the **Cook makes mistake** the entire **food may go wrong**. Similarly if **Micro RNA doesn't work properly** a person may develop **cancer.**









Q361. With reference to the discovery of microRNA and its implications, consider the following statements:

1. MicroRNA plays a role in regulating gene activity, influencing organismal development and function.
2. Messenger RNA is produced directly from ribosomes during protein synthesis.
3. Signal proteins synthesized in cells are transported via blood plasma to facilitate intercellular communication.

Which of the statements given above is/are correct?

(a) 1 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is correct: MicroRNA regulates gene activity and influences development.
- Statement 2 is incorrect: Messenger RNA is transcribed from DNA, not produced by

ribosomes; ribosomes translate messenger RNA into protein.
- Statement 3 is correct: Signal proteins are transported through blood plasma to mediate cell communication.

Q362. Consider the following statements regarding the Nobel Prize:
1. Originally, the prize was awarded in the fields of Physics, Chemistry, Medicine, Literature, and Peace,
2. The first woman to win the Nobel Prize was Marie Curie, and she won the award thrice.
3. Rabindranath Tagore was the first non-European and Indian to get a Nobel Prize in 1913 in peace.

How many of the statements given above is/are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

Ans: a

Sol:
- Statement 1 is correct: The Nobel Prizes were originally awarded in five fields: Physics, Chemistry, Medicine (or Physiology), Literature, and Peace.
- Statement 2 is incorrect: Marie Curie was the first woman to win a Nobel Prize, but she won it twice—in Physics (1903) and Chemistry (1911), not thrice.
- Statement 3 is incorrect: Rabindranath Tagore was the first non-European and Indian to receive the Nobel Prize, but it was in Literature, not Peace, in 1913.

Q363. Consider the following statements:
1. 1.Cells use Deoxyribonucleic Acid (DNA) as a blueprint to make messenger RNA (mRNA).
2. 2.DNA editing makes permanent changes to a person's genetic code, while RNA editing makes temporary changes.
3. 3.ADAR (Adenosine Deaminase Acting on RNA) technique is used in RNA editing.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: d

Sol: Statements 1, 2 and 3 are correct. Cells use DNA as a template to synthesize mRNA in a process called transcription. The mRNA then carries the genetic instructions from DNA to produce proteins. DNA editing results in permanent changes to the genome, while RNA editing is temporary, allowing the effects to fade over time. The ADAR enzyme is used in RNA editing by converting adenosine in mRNA to inosine, which helps correct errors in mRNA sequences.

Topic 122

122. Nobel Prize in Chemistry -2024

- **Nobel Prize in Chemistry 2024** will be shared by **scientists David Baker, Demis Hassabis, and John Jumper**.

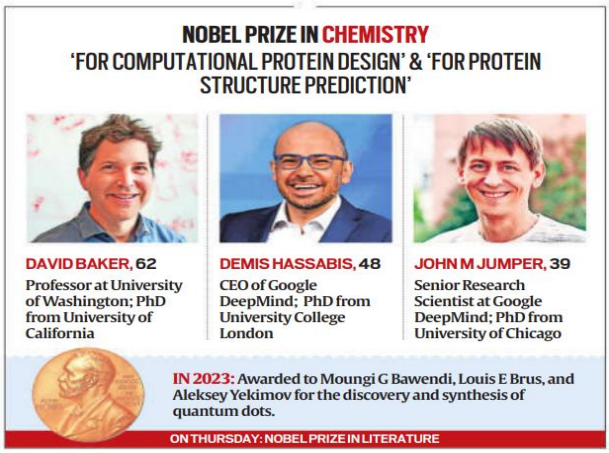
David Baker's Contribution
- **Used softwares** to designed a **new protein** and then **refine its structures**.

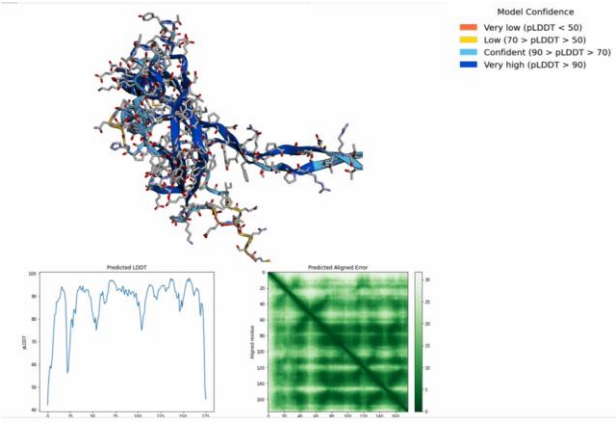
Demis Hassabis and John Jumper's Contribution
- Developed **AlphaFold 2,** an **artificial intelligence model** that can **predict the structures** of **millions of proteins.**
- It has been **further developed** by an **AI** based company **Deep Mind.**

What is AlphaFold?
- It works with **Input-Output model.**
- When **protein sequences** enter through **one end,** the predicted **three-dimensional structures come out through the other.**
- **AlphaFold 2** significantly **outperformed traditional methods** in **protein structure prediction.**

Applications
- **Drug Design, Enzyme Design, Disease Research**

Current methods used for Protein structuring
- **x-ray crystallography, nuclear magnetic resonance spectroscopy,** or **cryogenic electron** microscopy.
- These techniques are **very much time-consuming** (they often take years).
- These are **based** mainly on **trial-and-error methods.**





Q364. With reference to the 2024 Nobel Prize in Chemistry, consider the following statements:

1. David Baker's work primarily involved using artificial intelligence to predict protein structures without experimental validation.
2. AlphaFold 2, developed by Demis Hassabis and John Jumper, can predict millions of protein structures with atomic-level accuracy.
3. DeepMind, an AI research company, played a significant role in advancing AlphaFold 2's capabilities in structural biology.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is incorrect: David Baker's work involved designing and refining protein structures using computational tools, not predicting them purely with AI like AlphaFold 2.
- Statement 2 is correct: AlphaFold 2 predicts protein structures with exceptional accuracy.
- Statement 3 is correct: DeepMind, an AI company, was integral to AlphaFold 2's development and its application in biology.

Q365. With reference to AlphaFold, consider the following statements:

1. AlphaFold operates on an input-output model, where protein sequences are input, and their predicted three-dimensional structures are output.
2. AlphaFold 2 has surpassed traditional methods in protein structure prediction.
3. Applications of AlphaFold include drug design, enzyme design, and predicting the genetic code of proteins.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: a

Sol:

- Statement 1 is correct: AlphaFold uses an input-output model to predict protein structures.
- Statement 2 is correct: AlphaFold 2 has significantly outperformed traditional methods in accuracy.
- Statement 3 is incorrect: While AlphaFold aids in drug and enzyme design, it does not predict the genetic code of proteins—it predicts their three-dimensional structures.

Q366. AlphaFold, an AI model that can predict the interactions of all life's molecules, is developed by:

(a) Microsoft
(b) Intel
(c) Meta
(d) Google Deepmind

Ans: d

Sol: AlphaFold is an artificial intelligence model developed by DeepMind, a subsidiary of Google,

known for its breakthroughs in AI and machine learning. It is a transformative tool in structural biology, capable of accurately predicting the three-dimensional structures of proteins and their interactions.

Topic 123

123. Nobel Prize in Physics -2024

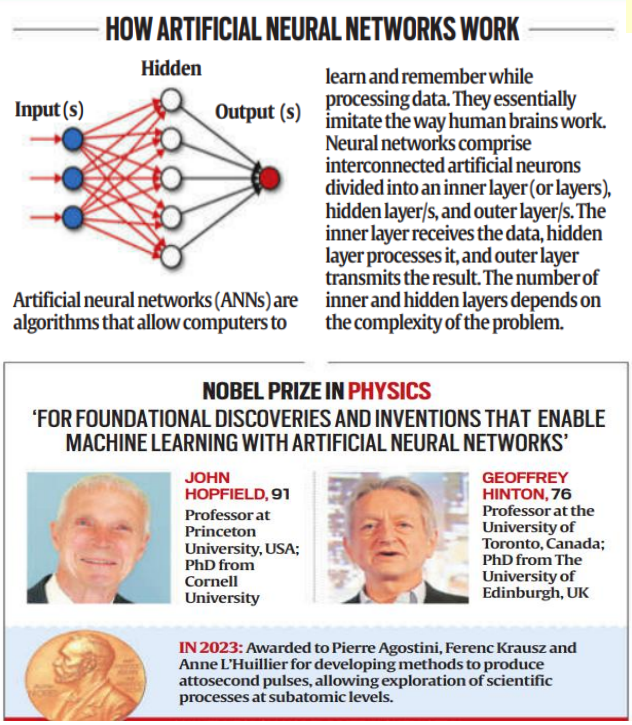
- **2024 Nobel Prize in Physics** has been awarded to **John Hopfield** and **Geoffrey Hinton** for their **foundational contributions** to **machine learning** using **artificial neural networks.**
- The research behind these networks has **led to modern advancements** in **artificial intelligence (AI)**, particularly in tasks such as pattern recognition and the **development of systems like ChatGPT.**

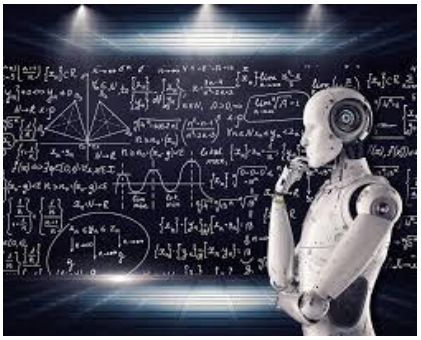
Artificial Neural Networks

- Artificial Neural Networks (ANNs) are models **mimicking the human brain**, made up of nodes (neurons) **capable of processing information** and **learning from data** without human intervention.

Machine Learning

- Machine learning is a **type of technology** that allows computers to **learn from data and improve their performance** over time without being explicitly programmed for each task.





Q367. With reference to the 2024 Nobel Prize in Physics, consider the following statements:

1. John Hopfield and Geoffrey Hinton received the prize for their pioneering work on artificial neural networks.
2. Their research has contributed to advancements in artificial intelligence, including applications in pattern recognition.
3. Artificial neural networks, as developed by these scientists, are directly responsible for the creation of generative AI systems like ChatGPT.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: d

Sol:

- Statement 1 is correct: John Hopfield and Geoffrey Hinton's work on artificial neural networks is foundational to modern AI.
- Statement 2 is correct: Their contributions have enabled advancements in tasks like pattern recognition.
- Statement 3 is correct: The research behind these networks has led to modern advancements in artificial intelligence (AI), particularly in tasks such as pattern recognition and the development of systems like ChatGPT.

Q368. Consider the following pairs:

Large Language Models (LLMS) - Key Characteristics

1. Autoregressive Models - Encode input text into a representation

2. Transformer-based Models - Predict the next word based on past words
3. Encoder-decoder Models - Artificial neural network for language processing

How many of the above pairs are correctly matched?
(a) Only one
(b) Only two
(c) All three
(d) None of the pairs

Ans: d

Sol: Autoregressive Models: Predict next word based on past words.
Transformer-based Models: Artificial neural network for language processing.
Encoder-decoder Models: Encode input text into a representations

Q369. Consider the following statements regarding Machine Learning (ML):
1. It is a branch of Artificial Intelligence (AI) focused on building computer systems that learn from data.
2. Using historical data as input, these algorithms can make predictions, classify information, and generate new content.

Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: c

Sol:
- Statement 1 is correct: Machine Learning (ML) is a branch of Artificial Intelligence (AI) that focuses on developing systems that can learn from data and improve over time without being explicitly programmed.
- Statement 2 is correct: ML algorithms utilize historical data to make predictions, classify information, and in some cases, generate new content (e.g., text, images, etc.).

Topic 124

124. Indians in Science Nobel Prize

Nobel Prizes

- **Alfred Nobel (inventor of dynamite),** a prosperous entrepreneur, inventor, and from **Sweden** during the **19th century**, created his **will** for **rewarding people** for their endeavours in **5 different fields-**Medicine, Physics, Chemistry, Literature, Peace.
- The **inaugural Nobel Prizes** were **conferred in 1901.**
- The **Nobel Peace Prize** is presented in **Norway** while the **other awards are handed** out in **Sweden.**

Who can nominate a candidate?

- **Thousands of people** around the world are eligible to submit nominations for the Nobel Prizes, including **university professors, lawmakers, previous Nobel laureates and the committee members themselves.**

Nobel Prizes in Science for Indians

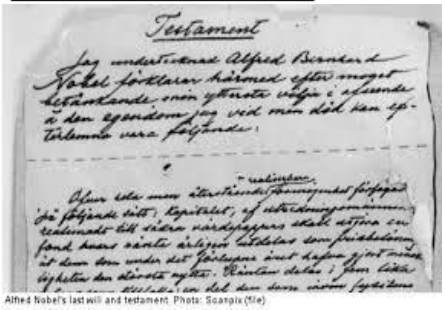
- The **1930 Nobel Prize** in **Physics** for **Sir C V Raman** remains the **only such honour.**

Three more Indian-origin scientists have won the **Nobel Prize**

1. **Har Gobind Khorana** in **Physiology or Medicine in 1968**
2. **Subrahmanyan Chandrasekhar** in **Physics in 1983**
3. **Venkatraman Ramakrishnan** in **Chemistry in 2009**

But **each one of these scientists** did their **work outside India,** and **none** of them was an **Indian citizen** at the time they **won the prize.**


Alfred Nobel



Alfred Nobel's last will and testament. Photo: Scanpix (file)

Q370. Consider the following statements regarding Nobel Prizes awarded to Indian-origin scientists in the field of science:

1. Sir C.V. Raman, who won the Nobel Prize in Physics in 1930, is the only laureate who was an Indian citizen at the time of receiving the prize.
2. Har Gobind Khorana (1968, Medicine), Subrahmanyan Chandrasekhar (1983, Physics), and Venkatraman Ramakrishnan (2009, Chemistry) conducted their Nobel-winning research outside India.
3. No Indian-origin scientist has won the Nobel Prize in Physiology or Medicine.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 2 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: a

Sol:
- Statement 1 is correct: Sir C.V. Raman is the only Nobel laureate in science to win the prize while being an Indian citizen.
- Statement 2 is correct: Har Gobind Khorana, Subrahmanyan Chandrasekhar, and Venkatraman Ramakrishnan conducted their research outside India.
- Statement 3 is incorrect: Har Gobind Khorana won the Nobel Prize in Physiology or Medicine in 1968.

Q371. Consider the following statements regarding the Nobel Prizes:
1. The Nobel Peace Prize is presented in Sweden, while other Nobel Prizes are awarded in Norway.
2. The Nobel Prizes were instituted through the will of Alfred Nobel, an inventor and entrepreneur from Sweden.
3. Only previous Nobel laureates and members of the Nobel Committees are eligible to nominate candidates for the prizes.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 2 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: b

Sol: Statement 1 is incorrect: The Nobel Peace Prize is presented in Norway, not Sweden, while the other awards are handed out in Sweden.
Statement 2 is correct: Alfred Nobel, a Swedish inventor and entrepreneur, established the prizes in his will.
Statement 3 is incorrect: Thousands of individuals, including university professors, lawmakers, previous Nobel laureates, and Nobel Committee members, can nominate candidates, not just laureates and committee members.

Q372. Albert Einstein was awarded the Nobel Prize in Physics in 1921 for his:
(a) Theory of Relativity
(b) Explanation of the Photoelectric Effect
(c) Discovery of the Photon
(d) Contributions to Quantum Mechanics

Ans: b

Sol: While Albert Einstein is widely known for his Theory of Relativity, he was awarded the Nobel Prize specifically for his explanation of the photoelectric effect, which provided crucial support for quantum theory.

Topic 125

125. Nobel Prizes for Indians

1. **Rabindranath Tagore (1913) – Literature**
   - The first Asian to win the Nobel Prize, awarded for his collection of poems, **Gitanjali**.
2. **C.V. Raman (1930) – Physics**
   - Awarded for his work on the **scattering of light** and the discovery of the **Raman effect**.
3. **Mother Teresa (1979) – Peace**
   - An Albanian-Indian, she won the Nobel Peace Prize for her **humanitarian work** through the Missionaries of Charity.
4. **Kailash Satyarthi (2014) – Peace**
   - Awarded for his efforts to **combat child labor** and advocate for children's rights in India.

Mother Teresa
- Bharat Ratna **(India's highest civilian award)** in 1980

Q373. Consider the following statements regarding Nobel Prize winners from India:
1. Rabindranath Tagore was the first Asian to win the Nobel Prize, recognized for his literary work Gitanjali.
2. C.V. Raman received the Nobel Prize in Physics for his research on the Raman effect and the scattering of light.
3. Mother Teresa and Kailash Satyarthi both won the Nobel Peace Prize for their contributions to humanitarian and social causes.
4. Mother Teresa was an Indian citizen when she won the Nobel Peace Prize in 1979.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 1, 2, 3, and 4
(d) 2 and 4 only

Ans: b

Sol: Statement 1 is correct: Rabindranath Tagore was the first Asian to win the Nobel Prize for his collection of poems, Gitanjali.
Statement 2 is correct: C.V. Raman was recognized for his discovery of the Raman effect.
Statement 3 is correct: Both Mother Teresa and Kailash Satyarthi won the Nobel Peace Prize for their humanitarian and social efforts.
Statement 4 is incorrect: Mother Teresa was of Albanian origin and held Indian citizenship later, but the Nobel Prize citation emphasized her global humanitarian contributions, not solely as an Indian citizen.

Q374. Which of the following UN organisations has been awarded with Nobel Prize twice?
(a) IPCC
(b) IAEA
(c) UNHCR
(d) UNICEF

Ans: c

Sol: The United Nations High Commissioner for Refugees (UNHCR) is the UN organization that has been awarded the Nobel Peace Prize twice, in 1954 and 1981:
1954: For its efforts to help and protect refugees around the world, and "heal the wounds of war"
1981: For promoting the fundamental rights of refugees.
The International Committee of the Red Cross (ICRC) has been awarded the Nobel Peace Prize three times, in 1917, 1944, and 1963.

Q375. Assertion (A): Narges Mohammadi was awarded Nobel Peace Prize for 2023.
Reason (R): She fights in the favour of freedom of Press.
Select the correct answer using the code given below -
(a) (A) is false and (R) is true
(b) Both (A) and (R) are true but (R) is not correct explanation of (A)
(c) Both (A) and (R) are true, (R) is correct explanation of (A)
(d) (A) is true and (R) is false.

Ans: d

Sol: Narges Mohammadi was awarded the Nobel Peace Prize in 2023 for her fight against the oppression of women in Iran and her advocacy for human rights. While freedom of the press is an important issue, her recognition was not directly tied to this cause, making the reason (R) false.

Topic 126

126. Raman Effect

- The Raman effect refers to the **phenomenon** discovered by **Sir C. V. Raman in 1928**.
- It describes **scattering of light** when it **interacts with matter**, particularly **molecules**.
- Known as **Raman spectroscopy** or **Raman Scattering.**
- **non-destructive chemical analysis** technique
- provides detailed information about **chemical structure**

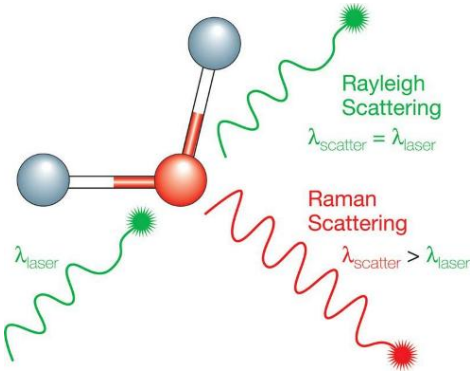
How it works?

- It is a light scattering technique, **whereby a molecule scatters incident light** from a **high intensity laser light source.**
- Most of the **scattered light** is at the **same wavelength-** does not provide useful information – this is called **Rayleigh Scatter.**
- A **small amount of light (typically 0.0000001%)-**scattered at **different wavelengths** (or colors), which depend on the chemical structure of the analyte – this is called **Raman Scatter.**

- The Raman Scatter help in **understanding molecular structure.**

National Science Day

- **28 February** (celebrated since 1986)
- **CV Raman**-this day in **1928 discovered Raman effect-Nobel Prize in Physics in 1930**



Q376. Consider the following statements regarding the Raman Effect:

1. The Raman Effect, discovered by C.V. Raman, explains the scattering of light upon interaction with matter.
2. Raman spectroscopy is a destructive technique used to analyze chemical structures.
3. The discovery of the Raman Effect earned C.V. Raman the Nobel Prize in Physics in 1930.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is correct: The Raman Effect describes the scattering of light when it interacts with matter, providing insights into molecular structures.
- Statement 2 is incorrect: Raman spectroscopy is a non-destructive chemical analysis technique.
- Statement 3 is correct: C.V. Raman was awarded the Nobel Prize in Physics in 1930 for his discovery of the Raman Effect.

Q377. Consider the following statements regarding Raman Scattering:

1. Most of the light scattered in Raman spectroscopy is at the same wavelength as the incident light, known as Rayleigh Scatter.
2. Raman Scatter, a small fraction of scattered light, occurs at different wavelengths based on the molecular structure of the analyte.
3. Raman Scatter is a key phenomenon used to analyze molecular structures in a non-destructive manner.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: d

Sol:

- Statement 1 is correct: Most scattered light in Raman spectroscopy is at the same wavelength as the incident light, known as Rayleigh Scatter.
- Statement 2 is correct: Raman Scatter involves a small fraction of light scattered at different wavelengths, determined by the molecular structure of the substance.
- Statement 3 is correct: Raman Scatter is essential for non-destructive molecular analysis.

Q378. Consider the following statements regarding National Science Day in India:

1. National Science Day is celebrated annually on 28th February to commemorate the discovery of the Raman Effect by C.V. Raman.
2. The celebration of National Science Day began in 1928, the year of the Raman Effect's discovery.
3. C.V. Raman was awarded the Nobel Prize in Physics in 1930 for his discovery of the Raman Effect.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is correct: National Science Day is celebrated on 28th February to honor C.V. Raman's discovery of the Raman Effect.
- Statement 2 is incorrect: The celebration of National Science Day began in 1986, not in 1928.
- Statement 3 is correct: C.V. Raman was awarded the Nobel Prize in Physics in 1930 for his discovery.

Topic 127

127. Diabetes

- It is a condition that occurs when **blood glucose** or **blood sugar,** is too **high.**
- **Diabetes** happens because of **lack of insulin in the blood** or **failure of insulin** in **absorbing the sugar of blood**.

Insulin

1. **Generates energy**

- Insulin is a **hormone made by the pancreas** that allows body to **use sugar (glucose) from carbohydrates** in the food **for energy**.

2. **Controls blood sugar**

- Insulin helps **keeps your blood sugar level** from getting **too high (hyperglycemia)** or **too low (hypoglycemia).**

Types of Diabetes

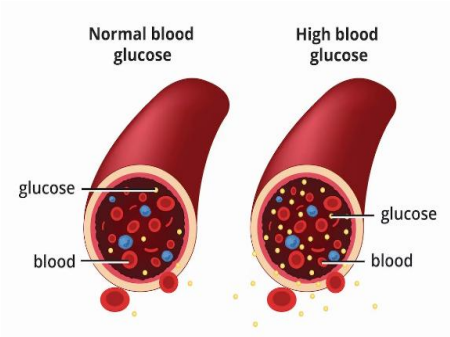
1. **Type I**

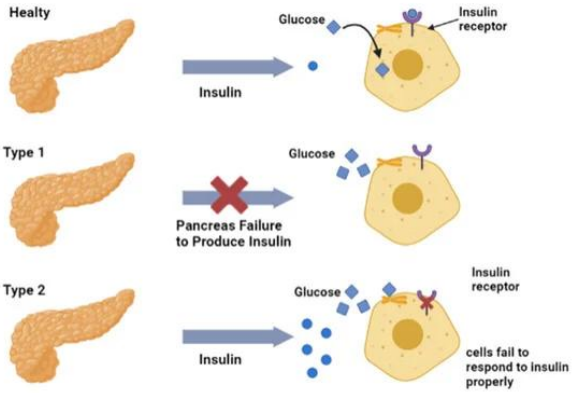
- This happens because of **genetic disorder/autoimmune condition**. In such cases the **insulin is not present** in the **blood** of the person**.** It can happen **by birth.**
- It **can't be preventable.**
- It is very **rare.**

2. **Type II**

- This happens when **the pancreas** produces **less insulin.**
- This happens mainly **because of poor lifestyle** like **eating junk foods.**

This is **preventable.**





Q379. Consider the following statements regarding diabetes:

1. It is caused by the over secretion of insulin by pancreas.
2. The glucose level increases in the blood.
3. The patient urinates frequently, loses weight and becomes lethargic.

How many of the statements given above are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

Ans: b

Sol:

- Statement 1 is incorrect: Diabetes is not caused by the over secretion of insulin. It is often caused by either insufficient insulin production (Type 1 diabetes) or insulin resistance (Type 2 diabetes).
- Statement 2 is correct: In diabetes, the glucose level in the blood increases (hyperglycemia) due to either insufficient insulin or the body's inability to use insulin properly.
- Statement 3 is correct: Frequent urination, weight loss, and lethargy are common symptoms of diabetes, particularly when blood sugar levels are poorly controlled.

Q380. With reference to the diabetes and its types, consider the following statements:

1. Diabetes is a Non-Communicable Disease (NCD) that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces.

2. Type 2 diabetes is also known as juvenile diabetes as it mostly affects children aged 14-16 years, this type occurs when the body fails to produce sufficient insulin.
3. Type 1 diabetes affects the way the body uses insulin. While the body still makes insulin.

How many of the above given statements are correct?
(a) Only one
(b) Only two
(c) All tree
(d) None

Ans: a

Sol:

- Statement 1 is correct: Diabetes is a Non-Communicable Disease (NCD) that occurs when the pancreas does not produce enough insulin (as in Type 1 diabetes) or when the body cannot effectively use the insulin it produces (as in Type 2 diabetes).
- Statement 2 is incorrect: Type 2 diabetes is not known as juvenile diabetes. Juvenile diabetes refers to Type 1 diabetes, which typically affects children and adolescents. Type 2 diabetes is more common in adults and is related to insulin resistance.
- Statement 3 is incorrect: Type 1 diabetes is characterized by the body's inability to produce insulin at all, not by the body still making insulin. In Type 1 diabetes, the immune system attacks and destroys insulin-producing cells in the pancreas.

Q381. Consider the following statements:
1. Statement-I: Obesity is a major risk factor for chronic diseases like cardiovascular diseases, diabetes, musculoskeletal disorders, and certain cancers.
2. Statement-II: Obesity is a chronic disease that occurs when the body stores excess calories as fat.

Which one of the following is correct in respect of the above statements?
(a) Both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement I
(b) Both Statement-I and Statement-II are correct and Statement-II is not correct explanation for Statement I
(c) Statement-I is correct but Statement-II is Incorrect
(d) Statement-I is incorrect but Statement-II is correct

Ans: b

Sol:

- Statement-I is correct: Obesity is indeed a major risk factor for several chronic diseases, including cardiovascular diseases, diabetes, musculoskeletal disorders, and certain types of cancers.
- Statement-II is correct: Obesity is a chronic condition that occurs when the body stores excess calories as fat, typically due to an imbalance between calorie intake and energy expenditure.

However, Statement-II does not directly explain Statement-I. While Statement-II describes the process of obesity, it doesn't explain why obesity is a risk factor for the diseases mentioned in Statement-I.

Topic 128

128. Type I diabetes reversal with stem cell transplant

Stem Cell

- **Stem cells** are those cells from which **other cells with specialized functions** are generated.
- **Stem cells divide** to form more cells called **daughter cells.**

These **daughter cells** are of 2 types-
a. **new stem cells (self-renewal)**
b. **specialized cells (differentiation)** with a **more specific function,** such as **blood cells, brain cells, heart muscle cells or bone cells.**

- **No other cell** in the body has the **natural ability to generate new cell types.**

Types of Stem Cell

1. **Embryonic stem cells.** It come from unused embryos**(abortion).** They are donated to science. These embryonic stem cells are **pluripotent.** This means that they can turn into **more than one type of cell.**
2. **Adult stem cells.** There are **2 types of adult stem cells.**
   a. **Fully developed tissues** such as the **brain, skin, and bone marrow.** They are more **likely to generate** only **certain**

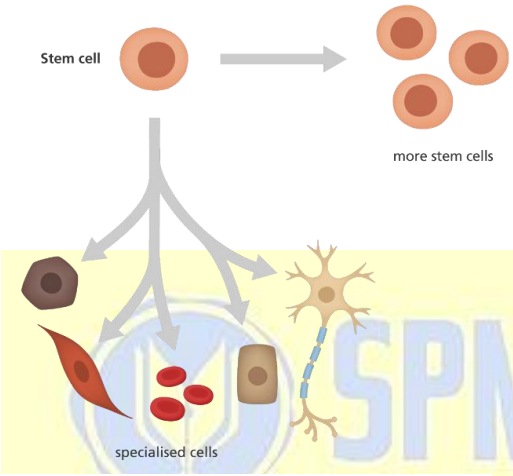
types of cells only. For example, a stem cell that comes from the **liver will only make more liver cells.**

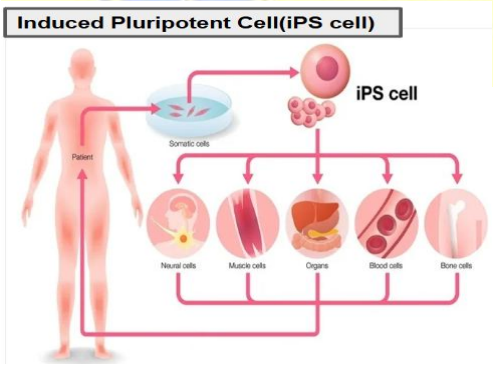
b. **Induced pluripotent stem cells**

- These are adult stem cells that have been **changed in** a lab to be more like **embryonic stem cells to produce other cells.**

Stem Cell Therapy

- known as **regenerative medicine**, promotes the **repair response** of **diseased,** dysfunctional or injured **tissue/organs** by using **Induced pluripotent stem cells.**





Current news?

- Chinese scientists successfully performed a **chronic type-1 diabetes** treatment **using stem cell therapy.**

Q382. Consider the following statements regarding stem cells:

1. Stem cells have the unique ability to divide and produce both new stem cells (self-renewal) and specialized cells (differentiation).
2. Stem cells are capable of generating any type of cell in the body, including specialized cells such as blood, brain, heart muscle, or bone cells.
3. No other type of cell in the body possesses the ability to generate new cell types like stem cells.

Which of the above statements is/are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol: Statement 1 is correct: Stem cells can divide to form both new stem cells (self-renewal) and specialized cells (differentiation).
Statement 2 is incorrect: While stem cells can generate various specialized cells, they do not have the ability to generate every type of cell in the body; their differentiation is typically limited to certain cell types.
Statement 3 is correct: No other cell type in the body has the same capacity for self-renewal and differentiation into specialized cells as stem cells.

Q383. Consider the following statements regarding types of stem cells:

1. Embryonic stem cells are pluripotent and can differentiate into multiple types of cells.
2. Adult stem cells, found in fully developed tissues such as the brain, skin, and bone marrow, are multipotent and can only generate specific cell types.
3. Induced pluripotent stem cells are adult stem cells that have been artificially reprogrammed to exhibit properties similar to embryonic stem cells.

Which of the above statements is/are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1, 2, and 3
(d) 1 and 3 only

Ans: c

Sol:

- Statement 1 is correct: Embryonic stem cells are pluripotent, meaning they can differentiate into a wide variety of cell types.
- Statement 2 is correct: Adult stem cells are typically multipotent and can generate only a

limited range of cell types related to their tissue of origin.
- Statement 3 is correct: Induced pluripotent stem cells are reprogrammed adult stem cells that can acquire pluripotency and produce various cell types, similar to embryonic stem cells.

Q384. Consider the following statements regarding Stem Cell Therapy:
1. Stem cell therapy, also known as regenerative medicine, uses induced pluripotent stem cells to promote the repair of diseased, dysfunctional, or injured tissues or organs.
2. Induced pluripotent stem cells are used in stem cell therapy primarily to treat genetic disorders by replacing damaged cells with healthy ones.
3. Stem cell therapy exclusively uses embryonic stem cells for tissue repair and organ regeneration.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 only
(d) 1 and 3 only

Ans: a

Sol:
- Statement 1 is correct: Stem cell therapy uses induced pluripotent stem cells (iPSCs) to promote tissue repair and regeneration.
- Statement 2 is correct: iPSCs are employed in various therapies to replace damaged or dysfunctional cells, particularly in treating genetic disorders.
- Statement 3 is incorrect: Stem cell therapy does not exclusively use embryonic stem cells; induced pluripotent stem cells, derived from adult cells, are also widely used in regenerative medicine.

Topic 129

129. X-band radar

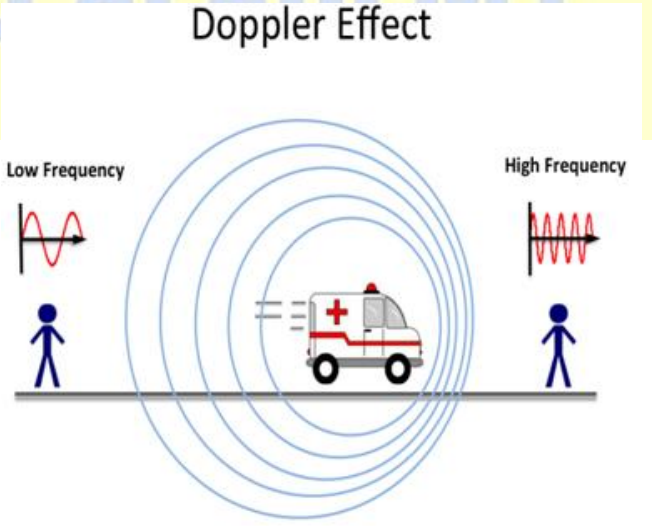
Current news?
- **Wayanad district** of **Kerala** faced **landslides** in **July 2024.**
- Thus **Ministry of Earth Sciences** has approved installation of an **X-band doppler radar** in **Wayanad district** to **predict and mitigate such disasters.**

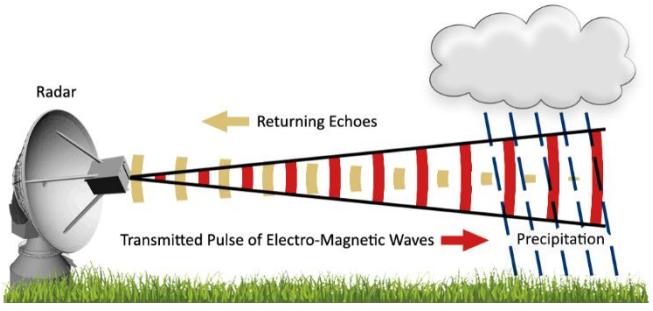
Function of Doppler Radar
- Doppler radar **emits radio waves** to detect the **distance, velocity, and movement** of **rain and wind.**
- It works on **Doppler effect phenomenon.**

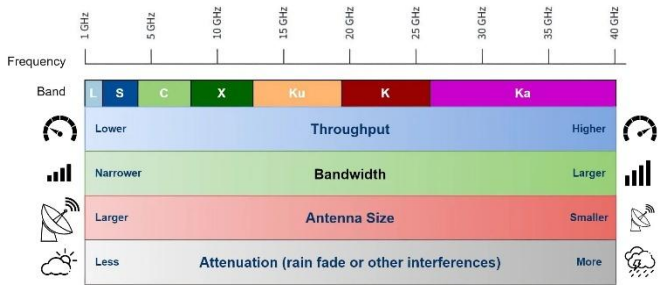
Doppler effect
- When the **source and the receiver** are **in relative motion** to each other there is a change in the frequency observed by the observer.
- If they are **moving closer frequency increases** and vice versa.

Difference between X-band and Other Radars
- X-band radar uses **shorter wavelengths (3 cm) compared to traditional radars** like S-band radar, which uses longer wavelengths.
- This **allows X-band radars to detect smaller particles** like raindrops, making them useful for monitoring short-range weather patterns.

Note-
- **Higher the frequency lower is the wavelength** of a wave and vice versa.
- **Bandwidth is the maximum amount of data** that can be transferred over a network, while **throughput is the actual amount of data** that is transferred.







A **lower wavelength** means **higher attenuation (loss of Signal)** because **shorter wavelengths interact more readily** with the **molecules in a medium**, causing **more energy to be absorbed** and **scattered**, leading to a **faster signal loss** as it travels through the medium

Q385. Consider the following statements regarding Doppler Radar and its function:

1. Doppler radar uses radio waves to detect the distance, velocity, and movement of rain and wind, working on the Doppler effect.
2. The Doppler effect explains that when the source and receiver are in relative motion, the frequency observed changes: it increases when they move closer and decreases when they move apart.
3. X-band radar, with shorter wavelengths than traditional radars like S-band, is better at detecting larger objects like thunderstorms, while S-band is more effective for detecting raindrops.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1, 2, and 3
(d) 1 and 3 only

Ans: a

Sol:

- Statement 1 is correct: Doppler radar uses radio waves to detect various weather patterns, including distance and velocity, based on the Doppler effect.
- Statement 2 is correct: The Doppler effect describes the change in frequency when the source and receiver move relative to each other.
- Statement 3 is incorrect: X-band radar, with shorter wavelengths, is more effective at detecting smaller particles, like raindrops, whereas S-band radar is typically used for detecting larger weather patterns, including thunderstorms.

Q386. Consider the following statements regarding waves and data transfer:

1. Higher the frequency, the lower the wavelength, and vice versa.
2. Bandwidth refers to the actual amount of data transferred over a network, while throughput refers to the maximum capacity for data transfer.
3. Throughput is the actual amount of data that is transferred over a network, while bandwidth refers to the maximum capacity for data transfer.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is correct: The relationship between frequency and wavelength is inversely proportional: higher frequency results in shorter wavelength, and lower frequency results in longer wavelength.
- Statement 2 is incorrect: Bandwidth refers to the maximum data transfer capacity, not the actual data transferred. Throughput refers to the actual data transfer.
- Statement 3 is correct: Throughput refers to the actual amount of data transferred, while bandwidth is the maximum data transfer capacity.

Q387. Consider the following statements regarding the X-band radar system:

1. It emits smaller wavelengths which allow the radar to produce images of higher resolution.
2. It is used for studies about cloud development and light precipitation.

Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: c

Sol:

- Statement 1 is correct: X-band radar uses shorter wavelengths (around 3 cm), which allows it to produce higher resolution images compared to radars with longer wavelengths (such as S-band).
- Statement 2 is correct: X-band radar is indeed used for studies related to cloud development and light precipitation, as its higher resolution allows it to detect smaller particles, such as raindrops.

Topic 130

130. NISAR

- Stands for **NASA-ISRO Synthetic Aperture Radar.**
- A satellite developed in **NASA and ISRO collaboration.**
- **It will be a satellite with radar** hat will help **monitor weather patterns** and **natural disasters globally.**
- It will produce **high-resolution images.**
- It will **detect movements** on the **Earth's surface** as small as **0.4 inches in an area of a Tennis court size.**
- The radar can penetrate clouds and darkness.
- It can collect **data day and night in any weather.**
- It is an **SUV-size satellite** weighing **2,800 kilograms.**
- NISAR is a **Low Earth Orbit (LEO)** observatory.
- consists of both **L-band and S-band** synthetic aperture radar (SAR) instruments.

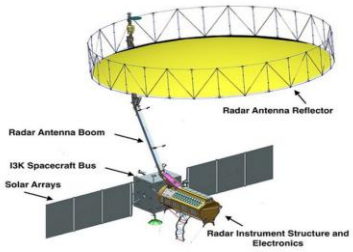
NASA-ISRO Synthetic Aperture Radar (NISAR) satellite **has not yet been launched.**

NASA's contribution

- L-band SAR Instrument
- Global Positioning System (GPS) Receivers
- Radar Reflector Antenna

ISRO's contribution

- S-band SAR Instrument
- Satellite Bus
- Launch Vehicle



NISAR will contain **39-foot(diameter) stationary antenna reflector** made of a **gold-plated wire mesh.**

Q388. Consider the following statements regarding the NASA-ISRO Synthetic Aperture Radar (NISAR) satellite:

1. NISAR is a joint satellite mission developed by NASA and ISRO to monitor weather patterns and natural disasters globally.
2. NISAR can detect surface movements as small as 0.4 inches in an area the size of a tennis court and operates day and night, in any weather condition.
3. NISAR consists of only L-band synthetic aperture radar (SAR) instruments.
4. NISAR is a Low Earth Orbit (LEO) satellite weighing approximately 2,800 kilograms and is yet to be launched.

Which of the above statements is/are correct?

(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 1, 2, and 3 only
(d) 1, 2, 3, and 4

Ans: b

Sol:

- Statement 1 is correct: NISAR is indeed a joint satellite mission between NASA and ISRO aimed at monitoring weather patterns and natural disasters globally.
- Statement 2 is correct: The satellite can detect surface movements as small as 0.4 inches and operates continuously, regardless of weather or time of day.
- Statement 3 is incorrect: NISAR consists of both L-band and S-band synthetic aperture radar (SAR) instruments, not just the L-band.
- Statement 4 is correct: NISAR is a Low Earth Orbit (LEO) satellite weighing approximately 2,800 kilograms and has not yet been launched.

Q389. Consider the following statements regarding the contributions to the NASA-ISRO Synthetic Aperture Radar (NISAR) mission:

1. NASA contributed the L-band SAR instrument, GPS receivers, and radar reflector antenna.
2. ISRO contributed the S-band SAR instrument, satellite bus, and launch vehicle.

3. The L-band SAR instrument and S-band SAR instrument were jointly developed by NASA and ISRO.

Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 only
(d) 1, 2, and 3

Ans: a

Sol:
- Statement 1 is correct: NASA's contribution to the NISAR mission includes the L-band SAR instrument, GPS receivers, and radar reflector antenna.
- Statement 2 is correct: ISRO's contribution includes the S-band SAR instrument, satellite bus, and the launch vehicle.
- Statement 3 is incorrect: The L-band SAR and S-band SAR instruments are independently developed by NASA and ISRO, respectively, not jointly.

Q390. Consider the following statements regarding the NASA-ISRO Synthetic Aperture Radar (NISAR) satellite:
1. NISAR will feature a 39-foot diameter stationary antenna reflector made of a gold-plated wire mesh.
2. The antenna reflector on NISAR will be movable to enhance its data collection capabilities.
3. The 39-foot diameter antenna reflector is part of NASA's contribution to the NISAR mission.

Which of the above statements is/are correct?
(a) 1 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:
- Statement 1 is correct: NISAR will indeed have a 39-foot diameter stationary antenna reflector made of gold-plated wire mesh.
- Statement 2 is incorrect: The antenna reflector is stationary, not movable.
- Statement 3 is correct: The antenna reflector is part of NASA's contribution to the NISAR mission.

Day 14

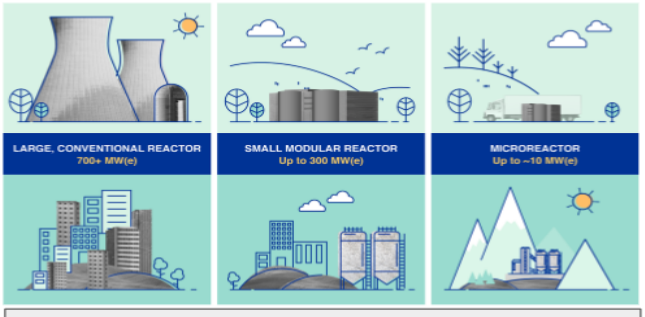
Topic 131

131. Small Modular Nuclear reactors

- **Nuclear reactors** that have a **power capacity** of up to **300 MW(e) per unit.**
- produce a **low-carbon electricity.**

Current news?
- **US based company Holtec International** is developing a **small modular reactor (SMR)** called the **SMR-300.**
- Holtec has **pitched for fostering** a **public-private initiative** for establishing **Small Modular Nuclear reactors** in India.
- If finalised, the **SMR-300** agreement with Holtec could be **first outcome** of **Civil Nuclear agreement** between **India and the US.**

Indo-US Civil Nuclear Agreement,2008
- Also known as **"123 Agreement"**(as signed under article 123 of **United States Atomic Energy Act of 1954).**
- The agreement allowed the **US Nuclear reactor companies** to go for **Civil Nuclear Cooperation** with **India.**
- This agreement was important because **the US doesn't sign Civil Nuclear agreement,** in general, with **a country** that is **not signatory of Nuclear Non-Proliferation Treaty (NPT)** or not a **member of Nuclear Suppliers Group (NSG).**



Small Modular Reactors
- Simpler and safer
- Flexible in design

Q391. Consider the following statements about Small Modular Reactors (SMRs)
1. They are advanced nuclear reactors that have a power capacity of up to 300 MW(e) per unit
2. SMRs work on similar principles as conventional nuclear reactors by using thermal

energy from nuclear fission to generate electrical power.
3. The cost of operation of SMRs is low compared to conventional plants.
How many of the given above statements is/are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

Ans: c

Sol:
- Statement 1: Correct. Small Modular Reactors (SMRs) are advanced nuclear reactors with a power capacity of up to 300 MW(e) per unit, making them suitable for smaller grids and remote locations.
- Statement 2: Correct. SMRs work on the same principles as conventional nuclear reactors, using thermal energy generated from nuclear fission to produce electrical power.
- Statement 3: Correct. Small Modular Reactors (SMRs) have the potential to be cheaper to operate than conventional nuclear power plants.

Q392. 1. Statement-I: Small Modular Reactors are advanced nuclear reactors that have a power capacity of up to 300 MW(e) per unit, which is about one-third of the generating capacity of traditional nuclear power reactors.
2. Statement-II: Small Modular Reactors however have lower safety features than traditional nuclear power reactors.
Which one of the following is correct in respect of the above statements?
(a) Both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement-I
(b) Both Statement-I and Statement-II are correct and Statement-II is not correct explanation for Statement-I
(c) Statement-I is Correct but Statement II is incorrect
(d) Statement-I is incorrect but Statement-II is correct

Ans: c

Sol:
- Statement-I: Correct.
  Small Modular Reactors (SMRs) are advanced nuclear reactors with a power capacity of up to 300 MW(e) per unit, roughly one-third of the capacity of traditional nuclear reactors. This smaller size makes them suitable for smaller grids and remote locations, offering flexibility in deployment.
- Statement-II: Incorrect.
  SMRs are designed with enhanced safety features compared to traditional nuclear power reactors. They incorporate passive safety systems and simplified designs that reduce the likelihood of accidents and the impact of potential incidents. These advanced safety mechanisms often make SMRs safer, not less safe, than traditional reactors.

Q393. The Indo-US Civil Nuclear Agreement, 2008, has been a landmark event in India's nuclear policy. Analyse the following statements about the agreement:
1. The agreement marked a significant departure in US nuclear policy as it allowed cooperation with a country that is not a signatory to the NPT.
2. While enhancing India's access to civilian nuclear technology, the agreement obligated India to place all its nuclear reactors under international safeguards.
3. The agreement indirectly facilitated India's growing stature in global nuclear trade by enabling a waiver from the Nuclear Suppliers Group (NSG).
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:
- Statement 1: Correct. The Indo-US Civil Nuclear Agreement was an unprecedented exception in US nuclear policy, as the US typically does not engage in nuclear cooperation with nations outside the NPT framework.
- Statement 2: Incorrect. The agreement required India to place only its civilian nuclear

reactors, not all, under IAEA safeguards. India's strategic nuclear reactors were excluded from these safeguards to maintain its nuclear deterrence capabilities.

- Statement 3: Correct. The agreement helped India secure a waiver from the NSG, allowing it to participate in global civilian nuclear trade despite not being an NPT member.

Topic 132

132. Haber-Bosch process

Importance of Nitrogen

- Nitrogen is **essential** for **plants and animals** to create **proteins and enzymes.**
- **Atmospheric nitrogen (N2)** is **abundant (78% of air)** but **inert**, making it **unusable by plants.**
- Plants require **reactive nitrogen in form of NH3(Ammonia)** or **NO3-(Nitrates)** for growth.

Nitrogen Fixation

- process by which **nitrogen** is taken from its **molecular form (N2)** in the atmosphere and **converted into nitrogen compounds**(NH3 or NO3-)

Natural Nitrogen Fixation

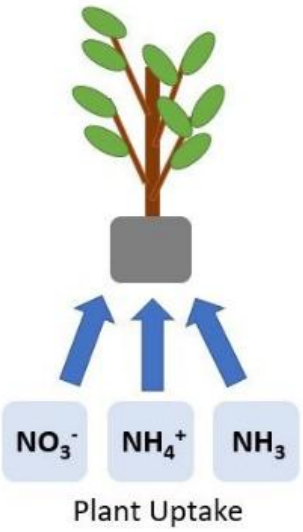
1. **Lightning**
2. **Nitrogen-fixing bacteria** like **Rhizobium** (generally found in the **root nodules of leguminous plants).**
   - But these natural methods are **insufficient to meet global food needs.**

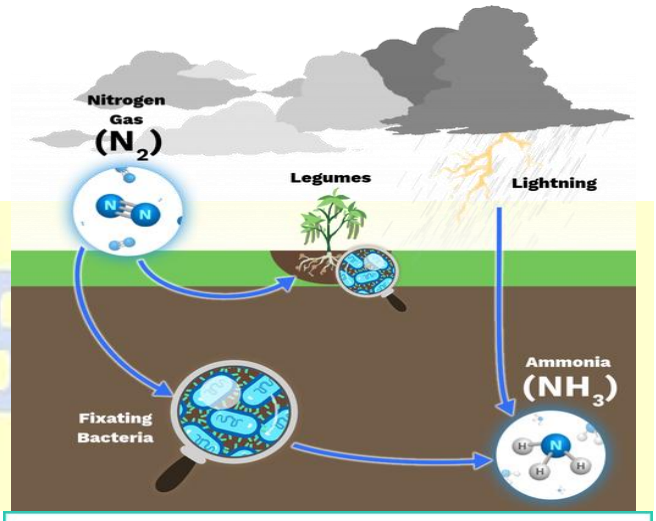
Haber-Bosch process

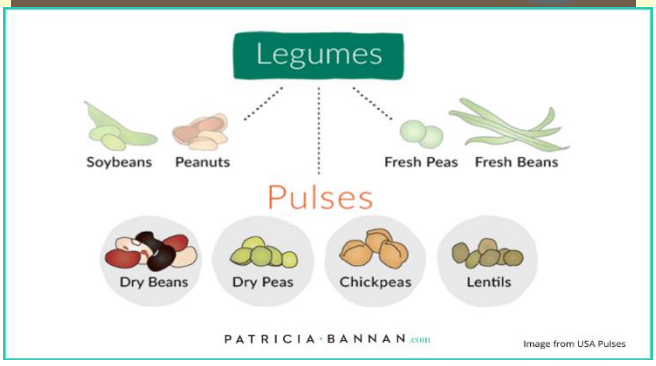
- Developed by **Fritz Haber** and **Carl Bosch in 20th century**
- **Produces ammonia (NH3)** from **atmospheric (N2)** and **(H2) under high pressure** and **temperature** with a iron based **catalyst** .
- **Without** this synthetic fertilizers, around **one-third** of the **global population** would **face food shortages.**

Environmental issues due to excessive Nitrogen based fertiliser use

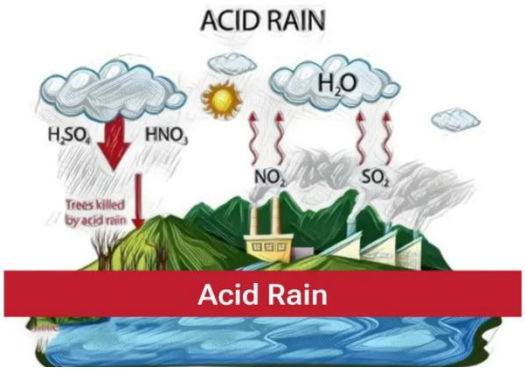
1. **Excess Nitrogen Use-soil degradation**, **water pollution** (eutrophication)
2. **Air contamination-acid rain**







Eutrophication and Algal Bloom



Q394. What is the primary product of the Haber-Bosch process?
(a) Sulphuric Acid
(b) Ammonia
(c) Methane
(d) Hydrogen peroxide

Ans: b

Sol:
- The Haber-Bosch process is an industrial method for synthesizing ammonia (NH3NH_3NH3) from nitrogen (N2N_2N2) and hydrogen (H2H_2H2) gases. It uses high pressure and temperature, along with an iron-based catalyst, to break the strong triple bond in nitrogen molecules, allowing it to react with hydrogen.
- This process is crucial for producing ammonia, which is widely used in fertilizers and other chemical industries.

Q395. Nitrogen fixation plays a critical role in supporting global agriculture and ecosystems. Consider the following statements:
1. Natural nitrogen fixation occurs through both abiotic processes like lightning and biotic processes involving nitrogen-fixing bacteria.
2. Rhizobium bacteria are symbiotic nitrogen-fixers found exclusively in the root nodules of leguminous plants.
3. The insufficiency of natural nitrogen fixation to meet global food demand led to the development of industrial processes like the Haber-Bosch process.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:
- Statement 1: Correct. Natural nitrogen fixation occurs via abiotic processes such as lightning, which converts nitrogen into usable compounds, and biotic processes, where specialized bacteria fix nitrogen into ammonia or related compounds.
- Statement 2: Incorrect. Rhizobium bacteria are a prominent example of symbiotic nitrogen-fixing bacteria, but they are not the only ones, nor are they exclusive to legumes. Other bacteria (e.g., Frankia) also fix nitrogen in association with non-leguminous plants.
- Statement 3: Correct. Natural nitrogen fixation is insufficient to sustain the nitrogen demands of modern agriculture, necessitating the development of industrial processes like the Haber-Bosch process to synthesize ammonia.

Q396. The Haber-Bosch process is a landmark achievement in chemical engineering. Consider the following statements regarding the process:
1. The process synthesizes ammonia by reacting atmospheric nitrogen (N2N_2N2) with hydrogen (H2H_2H2) under high pressure and temperature using an iron-based catalyst.
2. The development of the Haber-Bosch process was instrumental in mitigating global food shortages by enabling the mass production of synthetic fertilizers.
3. The process significantly reduces greenhouse gas emissions by increasing agricultural efficiency.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: a

Sol:
- Statement 1: Correct. The Haber-Bosch process involves the reaction of atmospheric nitrogen (N2N_2N2) and hydrogen (H2H_2H2) under high pressure (150–200 atm) and high temperature (400–500°C) using an iron-based catalyst to produce ammonia (NH3NH_3NH3).

- Statement 2: Correct. By enabling the large-scale production of ammonia, the process revolutionized agriculture through synthetic fertilizers, significantly boosting crop yields and preventing global food shortages.
- Statement 3: Incorrect. While the Haber-Bosch process increases agricultural productivity, it is energy-intensive and heavily reliant on fossil fuels, leading to substantial greenhouse gas emissions, particularly CO2CO_2CO2 from hydrogen production via natural gas reforming.

Key Analysis:

The question tests understanding of the dual nature of the Haber-Bosch process: its critical role in addressing food security and its environmental consequences. It highlights the complex trade-offs in technological advancements.

Topic 133

133. Europa Clipper mission

- **NASA has sent Europa Clipper mission** to explore **Europa**.
- Europa is one of **Jupiter's moon.**
- The Europa Clipper mission is **designed to orbit** and study Europa from afar, **not to land** on its surface.

Significance of the Mission

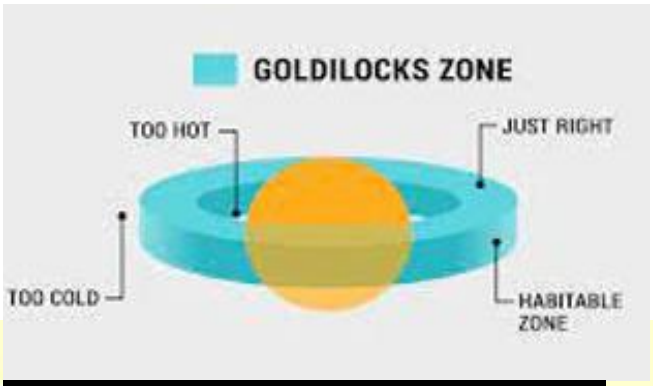
- Europa is considered one of the **most likely** places **to find extraterrestrial life** in the solar system.
- Europa is considered a **prime candidate** for **sustaining life** due to its **subsurface ocean**, which resembles conditions found on Earth.

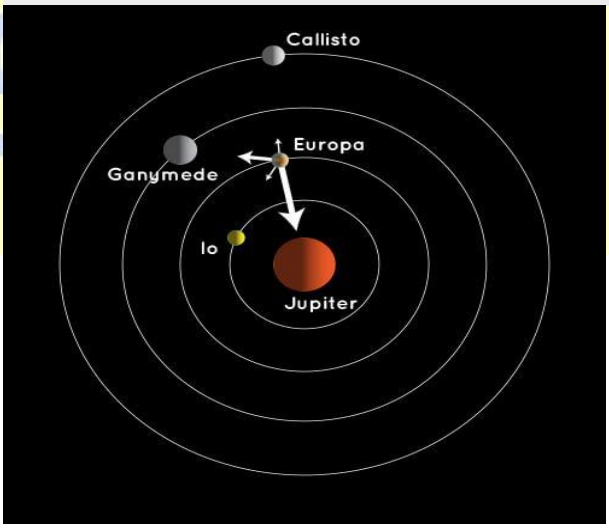
Goldilocks Zone

- The 'Goldilocks Zone,' or **habitable zone,** is the range of distance with the **right temperatures for water** to **remain liquid.**

Note-

- **Jupiter** is **not** in the **Sun's habitable zone**, also known as the **Goldilocks zone**
- **Only Earth** is considered to be in **habitable zone of the Sun.**





Q397. The Europa Clipper mission is a significant step in exploring extraterrestrial environments. Consider the following statements about the mission:

1. The Europa Clipper mission is aimed at studying Europa, one of Jupiter's moons, which is believed to have a subsurface ocean beneath its icy crust.
2. The mission is designed to orbit Europa and collect data on its surface and atmosphere, with plans for a future lander mission.

3. Europa is considered one of the most promising locations in the solar system for the potential existence of microbial life.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1: Correct. The Europa Clipper mission is focused on studying Europa, which is believed to have a vast subsurface ocean beneath its icy crust, making it a key target for understanding potential extraterrestrial habitats.
- Statement 2: Incorrect. The Europa Clipper mission is not designed to orbit Europa but will orbit Jupiter and perform multiple flybys of Europa to collect data. It is not equipped to land on Europa or study its atmosphere in detail.
- Statement 3: Correct. Europa's subsurface ocean, with potential hydrothermal activity, makes it one of the prime candidates for the search for microbial life in the solar system.

Key Analysis:
This question examines the nuances of NASA's Europa Clipper mission, including its objectives, technical limitations, and broader implications for astrobiology. It underscores the importance of precise understanding of mission design and goals.

Q398. The concept of the Goldilocks Zone is critical to the search for habitable planets. Consider the following statements regarding the Goldilocks Zone:
1. The Goldilocks Zone refers to the range of distances from a star where temperatures allow water to exist in liquid form.
2. Jupiter and its moons are located within the Sun's Goldilocks Zone, making them potential candidates for life.
3. Among the planets in our solar system, only Earth is firmly within the Sun's Goldilocks Zone.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1: Correct. The Goldilocks Zone, also known as the habitable zone, is the range of distances from a star where conditions are "just right" for liquid water to exist, a key requirement for life as we know it.
- Statement 2: Incorrect. Jupiter and its moons are located beyond the Sun's Goldilocks Zone, where temperatures are too cold for liquid water to exist on the surface under normal conditions. However, subsurface oceans (e.g., on Europa) may still support life, but this is not due to being in the Goldilocks Zone.
- Statement 3: Correct. In our solar system, only Earth is firmly within the Sun's Goldilocks Zone, making it uniquely suited to support liquid water and life.

Key Analysis:
This question challenges the understanding of the Goldilocks Zone's definition and its implications for planetary habitability, emphasizing the nuances of astrobiological exploration.

Q399. Consider the following statements:
1. Statement I: Callisto ranks as one of Jupiter's largest moons and is the third-largest moon in the Solar System, following Ganymede (Jupiter) and Titan (Saturn).
2. Statement II: As per NASA, after Saturn, Mars boasts of the highest number of moons in the Solar System.
Which one of the following is correct in respect of the above statements?
(a) Both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement-I
(b) Both Statement-I and Statement-II are correct and Statement-II is not correct explanation for Statement-I
(c) Statement-I is Correct but Statement II is incorrect
(d) Statement-I is incorrect but Statement-II is correct

Ans: c

Sol:

- Statement I: Correct.
  Callisto, one of Jupiter's largest moons, is indeed the third-largest moon in the Solar System after Ganymede (Jupiter) and Titan (Saturn). It is a heavily cratered moon with a distinct, ancient surface.
- Statement II: Incorrect.
  Saturn has the highest number of moons in the Solar System, with over 80 confirmed moons (as of recent observations). Jupiter comes next with slightly fewer moons. Mars, on the other hand, has only two small moons, Phobos and Deimos, and does not rank close to Saturn or Jupiter in terms of the number of moons.

Topic 134

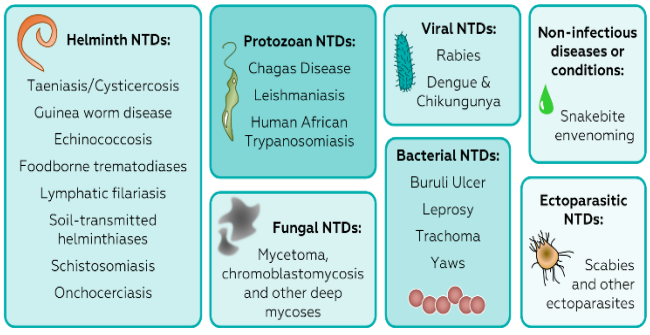
134. Kala-azar elimination certificate

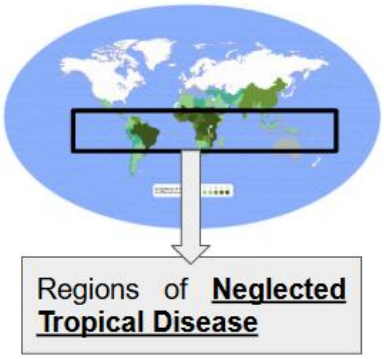
Kala-Azar

- **Parasitic disease** caused by **Leishmania parasites**
- A **neglected tropical disease**
- **second-largest parasitic killer** in the world (**after malaria** which is caused by parasites of the genus Plasmodium).
- transmitted through the **bite of infected sandflies.**
- Kala-azar primarily **affects the spleen, liver,** and bone marrow.
- **Fatality rate is 95%**, if left **untreated.**

Current news?

- **India-threshold of eliminating Kala-azar** as a **public health problem.**
- India **managed to keep** the number of cases **under one in 10,000 people** for **two consecutive years** which is **required by WHO.**





Neglected Tropical Diseases

- Infectious diseases- primarily **affect people** living in **poverty** in **tropical and subtropical regions.**
- Termed **"neglected"** because they receive **less attention from public health systems** and funding agencies **compared to other major diseases** like **HIV/AIDS and malaria.**

Q400. Consider the following statements about Kala Azar:
1. It spreads through bites of infected male sandflies and can prove deadly if not treated on time.
2. In 2023, Bangladesh became the first country in the world to eradicate Kala Azar.
3. In India, Leishmania donovani is the only bacteria causing this disease
How many of the given above statements is/are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

Ans: b

Sol:

- Statement 1: Incorrect.
  Kala Azar is spread through the bites of infected female sandflies, not males. Female sandflies transmit the protozoan parasite Leishmania donovani, which causes the disease.
- Statement 2: Correct.
  In 2023, Bangladesh became the first country in the world to eradicate kala-azar, also known as visceral leishmaniasis, as a public health problem in 2023
- Statement 3: Correct.

In India, Leishmania donovani is the only protozoan parasite responsible for Kala Azar.

Key Analysis:
This question tests knowledge of the epidemiology, global efforts, and causative agents of Kala Azar, a significant neglected tropical disease, emphasizing the need for precision in medical and health-related facts.

Q401. Neglected Tropical Diseases (NTDs) pose significant challenges to global health equity. Consider the following statements:
1. Neglected Tropical Diseases primarily affect populations living in poverty in tropical and subtropical regions and disproportionately impact women and children.
2. The term "neglected" reflects the fact that these diseases receive less attention and funding compared to diseases like HIV/AIDS, tuberculosis, and malaria.
3. Unlike malaria and HIV/AIDS, NTDs are non-infectious and largely caused by environmental factors.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: a

Sol:
- Statement 1: Correct.
  NTDs predominantly affect marginalized populations in tropical and subtropical regions, with women and children bearing a significant burden due to their increased exposure and vulnerability.
- Statement 2: Correct.
  These diseases are termed "neglected" because they receive less global attention, funding, and research compared to diseases like HIV/AIDS, tuberculosis, and malaria, despite their significant health impact.
- Statement 3: Incorrect.
  NTDs are infectious diseases caused by pathogens such as bacteria, viruses, parasites, and fungi. They are not purely environmental but rather result from a combination of poverty-related conditions and exposure to infectious agents.

Key Analysis:
This question emphasizes the socio-economic and health disparities associated with NTDs, as well as the need for policy interventions and equitable resource allocation in global health systems.

Q402. Regarding the Kala Azar, consider the following statements:
1. It is a slow-progressing indigenous disease caused by a protozoan parasite of the genus Leishmania.
2. It is also known as Black Fever or Dumdum Fever.
3. In India, Leishmania donovani is the only parasite causing this disease.
How many of the given above statements is/are not correct?
(a) Only one
(b) Only two
(c) All three
(d) None

Ans: d

Sol:
- Statement 1: Correct.
  Kala Azar is a slow-progressing disease caused by a protozoan parasite of the genus Leishmania. It primarily affects the bone marrow, liver, and spleen and is transmitted through the bites of infected female sandflies.
- Statement 2: Correct.
  Kala Azar is also referred to as Black Fever or Dumdum Fever. These names are derived from the darkening of the skin and the region where the disease was historically identified.
- Statement 3: Correct.
  In India, Leishmania donovani is the only parasite responsible for causing Kala Azar. This is distinct from other forms of leishmaniasis caused by different species in other parts of the world.

Key Analysis:
This question reinforces the understanding of Kala Azar's scientific, clinical, and epidemiological aspects, focusing on accurate identification of the disease's characteristics and causative agents.

Topic 135

135. Pandemic fund for Zoonotic diseases

Zoonosis

- **Transmission of pathogen** from **animals to humans.**
- Diseases arising out of zoonosis are termed **Zoonotic Diseases.**
- Zoonoses may be **bacterial, viral, or parasitic** etc
- **Rabbies, SARS, MERS, Covid-19** are examples of Zoonotic diseases.
- German Pathologist **Rudolf Virchow (1821)**-coined the term **"zoonosis"**

Concept of 'One Health'

- **recognizes the interconnection** between **humans, animals, plants.**
- **Dr. Calvin Schwabe** called for a **"One Medicine"**-collaboration between **human and wildlife pathologists**

'Animal Health Security Strengthening in India for Pandemic Preparedness and Response'

- Project launched by **government of India**
- To monitor **animal health-**prevent pandemic

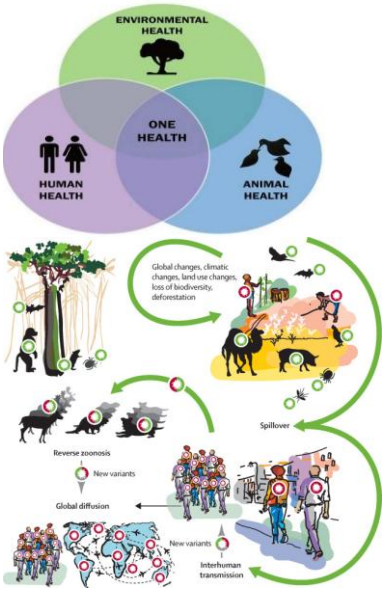
Funding

- From the **G 20Pandemic Fund** (established in 2022-Indonesia presidency).
- **India has received $25 million** from the pandemic fund **to implement** the **project to monitor animal health.**

Executing agencies

1. Asian Development Bank (ADB)
2. World Bank
3. Food and Agriculture Organization (FAO).

Project completion is expected by August 2026.



Q403. Consider the following statements regarding Zoonoses:
1. Zoonoses refer to the transmission of pathogens exclusively through bacterial agents from animals to humans.
2. Diseases such as Rabies, SARS, and COVID-19 are examples of zoonotic diseases.
3. The term "zoonosis" was first coined by Rudolf Virchow in the 19th century.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is incorrect because zoonoses are not limited to bacterial agents but can also be viral, parasitic, or caused by other pathogens.
- Statement 2 is correct as Rabies, SARS, and COVID-19 are zoonotic diseases.
- Statement 3 is correct as Rudolf Virchow, a German pathologist, coined the term "zoonosis" in the 19th century.

Q404. With reference to the 'One Health' concept, consider the following statements:
1. The 'One Health' approach emphasizes the interconnectedness of human health, animal health, and environmental health.
2. Dr. Calvin Schwabe introduced the concept of 'One Medicine' to promote collaboration between human and veterinary pathologists.
3. The 'One Health' concept excludes plant health from its scope as it primarily focuses on zoonotic diseases.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: a

Sol:

- Statement 1 is correct as the 'One Health' concept recognizes the interconnection

between human health, animal health, and the environment.
- Statement 2 is correct as Dr. Calvin Schwabe proposed 'One Medicine' to encourage collaboration between human and veterinary pathologists.
- Statement 3 is incorrect because the 'One Health' concept explicitly includes plant health as part of its comprehensive approach to health.

Q405. With reference to the 'Animal Health Security Strengthening in India for Pandemic Preparedness and Response' project, consider the following statements:
1. The project aims to enhance pandemic preparedness by monitoring animal health in India.
2. The G20 Pandemic Fund, established during Indonesia's presidency in 2022, has provided funding for the project.
3. The project is implemented exclusively by the World Bank and is expected to be completed by 2026.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: a

Sol:
- Statement 1 is correct as the project focuses on monitoring animal health to prevent pandemics.
- Statement 2 is correct as the funding comes from the G20 Pandemic Fund established in 2022 during Indonesia's presidency.
- Statement 3 is incorrect because the project is being executed by multiple agencies, including the Asian Development Bank (ADB), World Bank, and Food and Agriculture Organization (FAO), not exclusively by the World Bank.

Topic 136

136. GIS Survey of Guwahati by GMC

Geospatial data
- data that includes **information related to locations** on the **Earth's surface**.

Different types of Geospatial data

1. Global Positioning Systems (GPS)
- Used to find the **exact live location of things.**

2. Geographic Information Systems (GIS)
- used to **record information on to maps eg Google Maps.**

Current news?
- The **Guwahati Municipal Corporation (GMC)** has started a **city-wide Geographic Information System (GIS) survey.**

Purpose
- The survey aims to **enhance civic services** by **assigning unique smart addresses** to all properties in Guwahati, including **houses, businesses**, and other establishments.

Data Collection Method
- GMC officials are **conducting door-to-door visits** to gather detailed information on each property.

Smart House Number Plates
- After data collection, **smart house number plates will be installed** and tagged online on all properties for better streamlining of services.

Smart House Number Plates already **applied** in other cities like **Srinagar and Bhopal**

Q406. With reference to geospatial data, consider the following statements:
1. Global Positioning Systems (GPS) provide real-time location data by determining the exact position of objects on Earth.
2. Geographic Information Systems (GIS) are primarily used for navigation and tracking live locations.
3. GIS integrates geospatial data into maps to analyze spatial relationships and patterns.
Which of the statements given above is/are correct?
(a) 1 and 2 only

(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is correct as GPS is used to find the real-time location of objects by determining their exact position on Earth.
- Statement 2 is incorrect because GIS is not primarily used for navigation but rather for recording and analyzing information on maps, such as spatial patterns and relationships.
- Statement 3 is correct as GIS integrates geospatial data onto maps and facilitates the analysis of spatial relationships.

Q407. With reference to the Geographic Information System (GIS) survey initiated by the Guwahati Municipal Corporation (GMC), consider the following statements:
1. The primary objective of the GIS survey is to assign unique smart addresses to all properties in Guwahati for enhancing civic services.
2. Data for the survey is collected through satellite mapping and automated digital systems.
3. Smart house number plates will be tagged online to streamline service delivery across the city.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is correct as the GIS survey aims to assign unique smart addresses to properties for improved civic services.
- Statement 2 is incorrect because data collection is conducted through door-to-door visits, not satellite mapping or automated digital systems.
- Statement 3 is correct as smart house number plates will be installed and tagged online to streamline services.

Q408. With reference to the Geospatial Intelligence, consider the following statements:
1. Geospatial technology uses tools like GIS (Geographic Information System), GPS (Global Positioning System) and Remote Sensing for geographic mapping and analysis.
2. The technology may be used to create intelligent maps to help identify spatial patterns in large volumes of data.
Which of the statement(s) given above is/are not correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: d

Sol:

- Statement 1 is correct as geospatial technology employs tools like GIS, GPS, and Remote Sensing for mapping and geographic analysis.
- Statement 2 is correct as the technology enables the creation of intelligent maps to identify spatial patterns and relationships within extensive datasets.

Since both statements are correct, the answer is "Neither 1 nor 2."

Topic 137

137. Deception detection tests

- Employed to detect **probable deception** during interrogation of **suspected criminals.**

Mainly 3 types-

1. **Polygraph tests(popularly known as a lie detector test)**

- administered by attaching instruments like **cardio-cuffs** or sensitive electrodes to the suspect to measure variables such as **blood pressure**, **galvanic skin response (a proxy for sweat)**, **breathing**, and **pulse rate**.
- The polygraph test operates on the presumption that **specific physiological responses** are **triggered** when a **person is lying.**
- The **efficacy of deception detection** tests, especially Polygraphs test, **remains contentious** in the **medical field.**

2. **Narco-analysis**

- This involves the injection of a drug called **sodium pentothal** (called “truth serum”) into

the accused inducing a **hypnotic or sedated state**.

- The assumption is that a subject in such a state the person is **more likely to divulge information.**

3. Brain mapping

- It measures a **subject's neural activity(brainwaves)** using electrodes.
- It operates on the principle that the **brain generates distinctive brain waves** when **exposed to familiar stimuli.**

Supreme Court Ruling on Deception detection tests Selvi case 2010)

1. **Voluntary Use only-** involuntarily violates **Article 20(3)** of the Constitution **(right against self incrimination).**
2. **Admissibility of Results-Not directly admissible as evidence in court.**

Polygraph tests

Narco analysis tests

Brain mapping

Q409. With reference to Deception Detection Tests, consider the following statements:
1. The polygraph test measures physiological variables like blood pressure, galvanic skin response, breathing, and pulse rate to detect deception.
2. Sodium pentothal, used in narco-analysis, is known to induce a state in which the subject can provide accurate and voluntary information.
3. Brain mapping detects neural activity based on the assumption that the brain generates specific waves when exposed to familiar stimuli.

Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is correct as the polygraph test relies on measuring physiological responses such as blood pressure, galvanic skin response, breathing, and pulse rate to detect potential deception.
- Statement 2 is incorrect because while narco-analysis aims to induce a sedated or hypnotic state using sodium pentothal, the accuracy and voluntariness of the information provided in such a state remain scientifically contested.
- Statement 3 is correct as brain mapping uses electrodes to detect neural activity and assumes that the brain produces specific waves when exposed to familiar stimuli.

Q410. With reference to the Supreme Court ruling in the Selvi v. State of Karnataka (2010) case, consider the following statements:
1. The court held that the involuntary administration of deception detection tests violates Article 20 (3) of the Constitution.
2. The results of deception detection tests are directly admissible as evidence in courts of law.
3. Voluntary administration of deception detection tests is permissible under the ruling.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: b

Sol:

- Statement 1 is correct as the Supreme Court held that involuntary use of deception detection tests violates Article 20(3), which provides the right against self-incrimination.
- Statement 2 is incorrect because the results of deception detection tests are not directly

admissible as evidence in court; they can only be used as corroborative evidence.
- Statement 3 is correct as voluntary administration of deception detection tests is permitted under the ruling, provided the subject gives informed consent.

Q411. Consider the following statements:
1. In a narco test, a drug called sodium pentothal is injected into the body of the accused, which transports them to a hypnotic or sedated state.
2. In India, narco analysis, brain mapping and polygraph tests cannot be conducted on any person without his or her consent
Choose the incorrect statements:
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: d

Sol:
- Statement 1 is correct as narco analysis involves administering sodium pentothal to induce a hypnotic or sedated state in the subject.
- Statement 2 is correct as per the Supreme Court ruling in the Selvi v. State of Karnataka (2010) case, narco analysis, brain mapping, and polygraph tests cannot be conducted without the subject's consent.

Since both statements are correct, the answer is "Neither 1 nor 2."

Topic 138

138. Quartz veins and Piezoelectricity

Quartz
- A **hard mineral** consisting of **silica**, **colourless**-used in **glassmaking**.

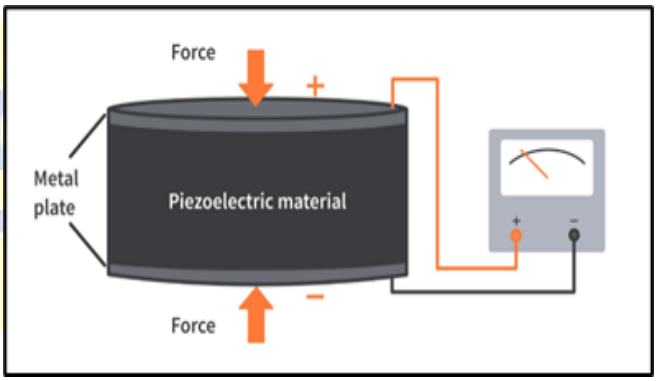
Quartz veins
- Quartz veins are **natural formations** of quartz that occur when **silica rich mineral fluids fill cracks** in a larger rock and then solidify.
- found widely in **igneous and metamorphic rocks.**

Quartz veins and Gold
- Up to **75% of all gold mined** comes from **Quartz veins**

Why?
- Due to **Piezoelectricity in Quartz.**

Piezoelectricity
- **Piezoelectric materials** are materials that can **produce electricity** due to **mechanical stress.**
- Piezoelectric materials are both **natural and manmade.**
- **Quartz** is a **piezoelectric crystal.**
- when it is squeezed its shape is mechanically distorted in some way, it **develops a voltage.**

How Piezoelectricity in Quartz attracts Gold nuggets into it?
- **Seismic activity** causes **mechanical stress in quartz veins**, creating **piezoelectric effects.**
- This **attracts gold nuggets** in **Quartz veins.**

Piezoelectric effect is **reversible in nature. It means-**
a. the **generation of electricity** when **stress is applied**
b. the **generation of stress** when an **electric field is applied.**

Q412. With reference to Quartz and its association with gold, consider the following statements:
1. Quartz is a hard mineral composed of silica and is commonly used in glassmaking.
2. Quartz veins are natural formations that occur when silica-rich fluids solidify in cracks within igneous and metamorphic rocks.
3. Up to 75% of all gold mined is associated with quartz veins due to the piezoelectric properties of quartz.
Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: d

Sol:

- Statement 1 is correct as quartz is a hard, silica-based mineral commonly used in glassmaking.
- Statement 2 is correct as quartz veins form when silica-rich fluids fill cracks in rocks and solidify, typically in igneous or metamorphic formations.
- Statement 3 is correct as a significant portion of gold is found in quartz veins, often linked to the piezoelectric properties of quartz, which may influence gold deposition.

Q413. With reference to Piezoelectricity and its role in attracting gold into quartz veins, consider the following statements:
1. Piezoelectric materials generate electricity when subjected to mechanical stress, and quartz is one such material.
2. The piezoelectric effect in quartz occurs when it is compressed, leading to the generation of an electric voltage.
3. Seismic activity causes mechanical stress in quartz veins, which in turn attracts gold nuggets due to the piezoelectric effect.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: d

Sol:

- Statement 1 is correct as piezoelectric materials, including quartz, generate electricity when subjected to mechanical stress.
- Statement 2 is correct as the piezoelectric effect in quartz occurs when mechanical stress distorts its shape, creating an electrical voltage.
- Statement 3 is correct because seismic activity creates mechanical stress in quartz veins, and the piezoelectric effect may play a role in attracting gold nuggets to quartz veins.

Q414. With reference to the Piezoelectric effect, consider the following statements:
1. The piezoelectric effect is reversible, meaning it can generate electricity when mechanical stress is applied.
2. The piezoelectric effect is also reversible in that it generates mechanical stress when an electric field is applied.
Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: c

Sol:

- Statement 1 is correct because the piezoelectric effect generates electricity when mechanical stress is applied to a material.
- Statement 2 is also correct as the piezoelectric effect is reversible; applying an electric field can induce mechanical stress in piezoelectric materials.

Topic 139

139. Genome mapping of Chandipura virus

- The Chandipura virus is a pathogen that was **first identified in 1965** in **Chandipura, Maharashtra**.
- This virus primarily **affects humans** and has been associated with acute **encephalitis outbreaks**.

Encephalitis

- It is **inflammation** of the active **tissues of the brain**

Chandipura virus (CHPV) infection

- It primarily **affects children** under **15 years old.**
- CHPV is transmitted by various species of **sandflies and mosquitoes.**

Treatment

- Currently, there is **no specific** antiviral treatment

Current news?

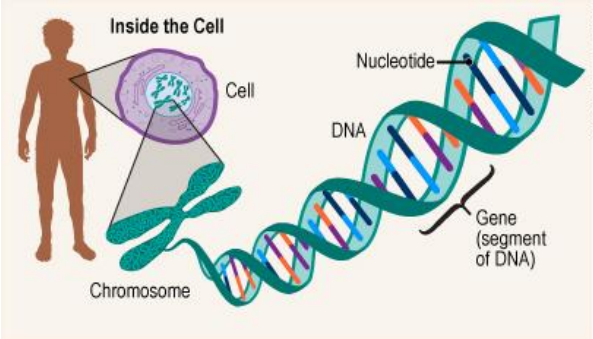
- The **Gujarat Biotechnology Research Centre (GBRC)** has published the **complete genome map** of the **Chandipura virus**.

What is Genome Mapping?

- Genome mapping is the process of **identifying the locations of genes** on an **organism's chromosomes**.

Significance of the Study

- For viruses like CHPV, Genome mapping helps **understand the virus's origin, mutations,** and possible therapeutic targets.



Q415. With reference to the Chandipura virus, consider the following statements:
1. The Chandipura virus was first identified in 1965 in Chandipura, Maharashtra.
2. The virus primarily affects animals and has not been associated with human infections.
3. The Chandipura virus is known to cause outbreaks of acute encephalitis in humans.
Which of the statements given above is/are correct?
(a) 1 and 3 only
(b) 2 and 3 only
(c) 1 and 2 only
(d) 1, 2, and 3

Ans: a

Sol:

- Statement 1 is correct as the Chandipura virus was indeed first identified in 1965 in Chandipura, Maharashtra.
- Statement 2 is incorrect because the Chandipura virus primarily affects humans and is known for causing acute encephalitis outbreaks.
- Statement 3 is correct as the virus has been associated with outbreaks of acute encephalitis in humans.

Q416. With reference to Encephalitis and the Chandipura virus (CHPV), consider the following statements:
1. Encephalitis is the inflammation of the active tissues of the brain and primarily affects children under 15 years old in the case of CHPV infection.
2. The Chandipura virus is transmitted by various species of sandflies and mosquitoes.
3. There is a specific antiviral treatment available for CHPV infection.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: a

Sol:

- Statement 1 is correct as encephalitis refers to inflammation of the brain's active tissues, and CHPV primarily affects children under 15 years old.
- Statement 2 is correct as the Chandipura virus is transmitted by various species of sandflies and mosquitoes.
- Statement 3 is incorrect because there is currently no specific antiviral treatment for CHPV infection.

Q417. With reference to Genome Mapping, consider the following statements:
1. Genome mapping involves identifying the locations of genes on an organism's chromosomes.
2. For viruses like Chandipura virus (CHPV), genome mapping is significant for understanding its origin, mutations, and identifying potential therapeutic targets.
3. Genome mapping is primarily used to study the external traits of an organism and has no direct relevance to understanding viral infections.
Which of the statements given above is/are correct?
(a) 1 and 2 only

(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: a

Sol:

- Statement 1 is correct as genome mapping is the process of identifying the locations of genes on chromosomes.
- Statement 2 is correct as genome mapping for viruses like CHPV helps understand their origin, mutations, and potential therapeutic targets.
- Statement 3 is incorrect because genome mapping is crucial for understanding viral genomes, not just external traits.

Topic 140

140. Saturn ring will briefly disappear in 2025

- **Saturn's enormous ring system**, comprised of **bits of ice, dust and rocks**
- The **rings orbit directly above Saturn's equator**
- The **majestic ringed** planet Saturn, which is clearly visible sky **through a telescope** from Earth.

Tilted axis

- Like **Earth's axis of rotation,** is **tilted by 23.5 degrees, Saturn's axis** of rotation has a **26.7 degree.**
- As a result, **when Saturn revolves around the Sun,** it's ring **seems to nod up and down.**

Why Saturn rings are in news?

- In **2025, Saturn's rings** will seemingly **disappear from view.**
- Saturn's rings will **not actually disappear in** 2025.
- Although they will become **almost invisible from Earth for sometime due to relative positioning.**
- The **last time was in 2009** and the **rings gradually became visible again**

Q418. With reference to Saturn's characteristics and its ring system, consider the following statements:
1. Saturn's rings, consisting of ice, dust, and rocks, orbit directly above its equator.
2. Saturn's axis of rotation is tilted by 23.5 degrees, similar to Earth's axis, causing its rings to appear stationary.
3. Due to Saturn's axial tilt of 26.7 degrees, its rings appear to nod up and down as it revolves around the Sun.
4. Saturn's rings are clearly visible from Earth without the use of a telescope.
Which of the statements given above is/are correct?
(a) 1 and 3 only
(b) 1, 3, and 4 only
(c) 2 and 4 only
(d) 1, 2, and 3 only

Ans: a

Sol:

- Statement 1 is correct as Saturn's rings orbit directly above its equator, made up of ice, dust, and rocks.
- Statement 2 is incorrect because Saturn's axis is tilted by 26.7 degrees, not 23.5 degrees as Earth's axis.
- Statement 3 is correct as the tilt of Saturn's axis causes its rings to appear to nod up and down during its orbit around the Sun.
- Statement 4 is incorrect because Saturn's rings are visible through telescopes, not directly with the naked eye.

Q419. With reference to Saturn's rings and their visibility, consider the following statements:
1. In 2025, Saturn's rings will seemingly disappear from view due to their relative positioning, but they will not actually vanish.
2. The rings of Saturn will be completely invisible from Earth in 2025 for the first time since 2009.
3. The last time Saturn's rings became almost invisible was in 2009, and they gradually became visible again after that.
Which of the statements given above is/are correct?
(a) 1 and 3 only
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans: a

Sol:

- Statement 1 is correct because Saturn's rings will appear almost invisible from Earth in 2025 due to their relative positioning, though they will not actually disappear.
- Statement 2 is incorrect because the rings are not completely invisible in 2025, but will be nearly invisible.
- Statement 3 is correct as Saturn's rings became almost invisible in 2009 due to a similar positioning, and they gradually became visible again afterward.

Q420. Which of the following groups of planets is termed as 'gas planets' as they are composed primarily of lighter ices, liquids and gases?
(a) Mars, Jupiter, Neptune, Uranus
(b) Jupiter, Uranus, Neptune, Saturn
(c) Saturn, Mars, Jupiter, Neptune
(d) Neptune, Saturn, Mars, Uranus

Ans: b

Sol: The term "gas planets" typically refers to the gas giants, which are primarily composed of lighter elements like hydrogen, helium, and other gases, along with ices and liquids in some cases. These planets are Jupiter, Saturn, Uranus, and Neptune, with Jupiter and Saturn being the classic gas giants, and Uranus and Neptune considered "ice giants" due to their higher proportion of icy materials. Mars, on the other hand, is a terrestrial planet and not a gas planet.

Day 15

Topic 141

141. Science behind Solar cells

Solar cells/photovoltaic (PV) cells

- Devices that **convert sunlight into electricity** through a process known as the **photoelectric effect.**

Einstein's Quantum theory

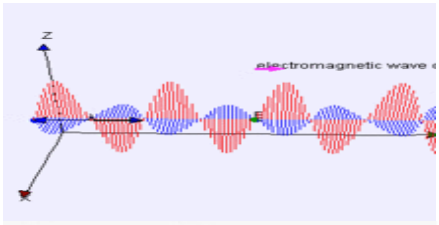
- On the basis of experimental evidence, German physicist **Albert Einstein** first showed **(1905) that light**, which had been considered a **form of electromagnetic waves**, must also be thought of as **particle-like, localized energy packets** and mass (in a **quanta**) known as **photons.**

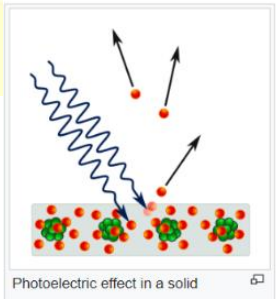
Photoelectric effect

- **On the basis** of concept of Photons, Einstein developed **concept photoelectric effect.**

Photoelectric effect-

- The photoelectric effect is a fundamental phenomenon in which **electrons are emitted from a material** when it **absorbs light (or electromagnetic radiation) of a certain frequency or higher.**
- It was first observed by **Heinrich Hertz** in 1887 and later explained by **Albert Einstein** in 1905, for which he r**eceived the Nobel Prize in Physics in 1921.**





Q421. Recently, Models and Manufacturers of Solar Photovoltaic Modules (Requirement for Compulsory Registration) Order, 2019 was approved. In this context, consider the following statements:
1. The order requires solar module makers to submit to an inspection of their manufacturing facilities by the National Institute of Solar Energy.
2. National Institute of Solar Energy is headquartered in Gurugram, Haryana.
3. India plans to source nearly half its electricity requirements from non-fossil fuel sources by 2030.

Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: d

Sol:

- Statement 1 is correct: The "Models and Manufacturers of Solar Photovoltaic Modules (Requirement for Compulsory Registration) Order, 2019" mandates that solar module manufacturers undergo inspections of their facilities by the National Institute of Solar Energy (NISE) to ensure compliance with specified standards.
- Statement 2 is correct: The National Institute of Solar Energy (NISE) is headquartered in Gurugram, Haryana. It is an autonomous institution under the Ministry of New and Renewable Energy, India.
- Statement 3 is correct: India has a target under its commitments for climate change and renewable energy to achieve nearly 50% of its electricity requirements from non-fossil fuel sources by 2030, in line with its updated Nationally Determined Contributions (NDCs) under the Paris Agreement.

Q422. Consider the following statements about Einstein's Quantum Theory and the Photoelectric Effect:
1. Einstein proposed that light exhibits both wave-like and particle-like behaviour based on experimental evidence.
2. The concept of photons, introduced by Einstein, forms the foundation of the photoelectric effect.
3. The photoelectric effect demonstrates that the energy of ejected electrons depends on the intensity of incident light.
4. The quantum nature of light explained the limitations of classical electromagnetic theory in understanding the photoelectric effect.
Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) 1, 3, and 4 only

Ans: b

Sol:

- Statement 1 is correct: Einstein's Quantum Theory proposed that light behaves as both a wave and a particle, introducing the concept of localized energy packets (photons).
- Statement 2 is correct: The concept of photons was instrumental in explaining the photoelectric effect, where electrons are ejected from a material when exposed to light of a specific frequency.
- Statement 3 is incorrect: The energy of ejected electrons depends on the frequency of the incident light, not its intensity. The intensity affects the number of electrons ejected, not their energy.
- Statement 4 is correct: The quantum nature of light explained phenomena like the photoelectric effect, which classical theories (e.g., the wave theory of light) could not adequately address.

Q423. Consider the following statements about the Photoelectric Effect:
1. The phenomenon occurs only if the incident light has a frequency above a certain threshold value.
2. The intensity of light determines the kinetic energy of the emitted electrons.
3. The photoelectric effect provided experimental evidence for the particle nature of light.
4. Heinrich Hertz was awarded the Nobel Prize for discovering the photoelectric effect.
Which of the statements given above are correct?
(a) 1 and 3 only
(b) 1, 2, and 4 only
(c) 1, 3, and 4 only
(d) 2 and 4 only

Ans: a

Sol:

- Statement 1 is correct: The photoelectric effect occurs only if the frequency of the incident light is above a specific threshold, irrespective of its intensity.
- Statement 2 is incorrect: The kinetic energy of the emitted electrons depends on the frequency of the light, not its intensity. Intensity affects the number of electrons ejected, not their energy.

- Statement 3 is correct: The photoelectric effect demonstrated the particle-like behaviour of light, as electrons are ejected when photons transfer their energy to them.
- Statement 4 is incorrect: Although Heinrich Hertz discovered the phenomenon, Albert Einstein explained it and received the Nobel Prize for his explanation in 1921.

Topic 142

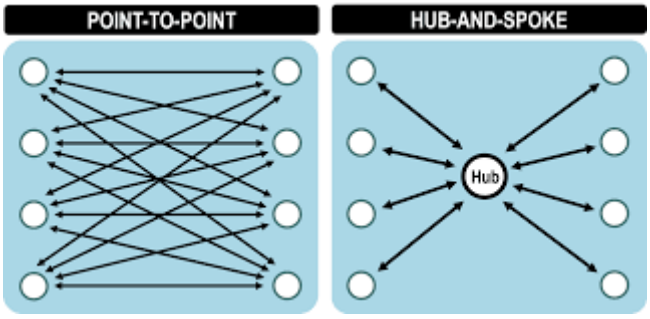
142. Anusandhan Research Foundation

- An institution established to **boost R&D,foster innovation** across **India's universities, research institutions.**
- It is a **statutory body** established under the **Anusandhan National Research Foundation Act, 2023.**
- **The ANRF** has a **funding target of ₹50,000 crore** for the period **2023-2028.**

Key features of Anusandhan Research Foundation-

1. **Hub-and-spoke model**
   - Emphasis on **connecting top-tier research institutions** with **smaller universities** to expand research activities.
2. ANRF is in line with **National Education Policy 2020**
3. Research priority areas **electric vehicle technology** and **advanced materials**, aligning with the country's strategic goals.

R&D investment as a percentage of **GDP is 0.64% in India**, lower compared to major economies like **China (2.4%), Germany (3.1%), South Korea (4.8%), and the U.S. (3.5%).**



Hub-and-spoke vs Point to Point model

Q424. Which of the following statements is/are correct regarding the Anusandhan National Research Foundation's initiatives?
1. The Prime Minister Early Career Research Grant (PMECRG) aims to support early-stage researchers in their pursuit of groundbreaking research.
2. The Mission for Advancement in High-Impact Areas -Electric Vehicle (MAHA-EV) Mission focuses on developing advanced technologies for electric vehicles, specifically batteries, power electronics, and charging infrastructure.
3. Both initiatives aim to strengthen the connection between academic research and industrial applications.
4. The PMECRG is primarily focused on promoting research in humanities and social sciences.
Choose the correct answer from the given codes:
(a) 1 and 2 only
(b) 2 and 4 only
(c) 1, 2 and 3 only
(d) 1, 2 and 4 only

Ans: c

Sol:

- Statement 1: Correct. The PMECRG is explicitly designed to support early career researchers.
- Statement 2: Correct. The MAHA-EV Mission's goal is to advance EV technology, including battery cells, power electronics, and charging infrastructure.
- Statement 3: Correct. Both initiatives aim to bridge the gap between academia and industry.
- Statement 4: Incorrect. The PMECRG is likely to support research across various scientific disciplines, including STEM fields.

Q425. Which of the following is/are the primary objectives of the Mission for Advancement in High-Impact Areas -Electric Vehicle (MAHA-EV) Mission?
1. To promote indigenous research and development in electric vehicle components.
2. To reduce India's dependence on foreign technology in the EV sector.
3. To encourage collaborations between academia and industry to accelerate EV adoption.
4. To support basic research in physics and chemistry related to battery technology.
Choose the correct answer from the given codes:
(a) 1 and 2 only
(b) 2 and 4 only
(c) 1, 2 and 3 only

(d) 1, 2 and 4 only

Ans: c

Sol:

- Statement 1: Correct. The mission aims to build a domestic R&D ecosystem for EV components.
- Statement 2: Correct. By developing indigenous technologies, India can reduce reliance on foreign imports.
- Statement 3: Correct. The mission is designed to foster industry-academia partnerships.
- Statement 4: Incorrect. While basic research is important, the MAHA-EV Mission is more focused on applied research and development.

Q426. Consider the following statements regarding the Vigyan Dhara Scheme, recently seen in the news:
1. It is a central sector scheme managed by the Department of Science and Technology (DST) designed to enhance India's Science and Technology (S&T) capabilities through a streamlined approach.
2. Focused interventions will be taken up under the scheme to enhance the participation of women in the field of Science and Technology (S&T).
Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: c

Sol: Statement 1 is correct: The Vigyan Dhara Scheme is a central sector scheme implemented by the Department of Science and Technology (DST). It is aimed at strengthening India's Science and Technology (S&T) ecosystem through targeted initiatives and strategic planning.
Statement 2 is correct: The scheme includes focused interventions to increase the participation of women in S&T, recognizing the need for gender equity in this domain.

Topic 143

143. Mission Mausam

- A **₹2,000-crore project** by Government of India.
- To be executed by the **Ministry of Earth Sciences**.
- The first phase of the mission will run **until 2026.**

Aim of the mission

1. Upgrading India's **weather forecasting infrastructure**
2. **Weather modification**

How weather forecasting will be improved?

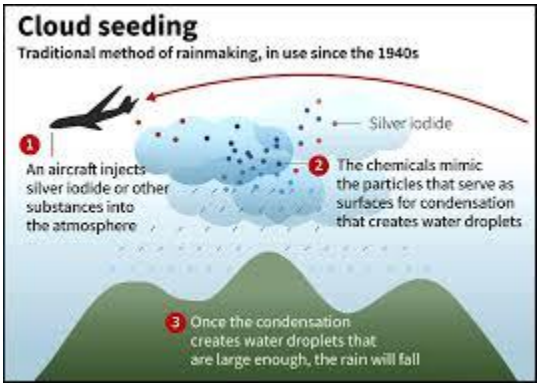
- India's current **weather radar coverage is sparse**, with **only 39 radars** across the country, averaging **one radar per 432 km**.
- The plan includes installing **60 new weather radars.**

How Weather modification

- A **cloud-simulation chamber** will be set up at the **Indian Institute of Tropical Meteorology, Pune**, to assist in **cloud seeding** and weather modification.

What is cloud seeding?

- **Water vapour condenses** around **small particles** to form the **droplets** that make up a **cloud.**
- In cloud seeding, **clouds are** usually **injected with hygroscopic salts(water attracting)** like **silver iodide, potassium iodide, or sodium chloride,** which is the **'seed'.**
- These salts are **expected to provide additional nuclei** around which more **cloud droplets can form.**
- Apart from **silver iodide, potassium iodide** and **dry ice (solid carbon dioxide)** is used for **cloud seeding.**



Q427. Which of the following statements is/are correct regarding the Mission Mausam?
1. It is a ₹2,000 crore project aimed at improving India's weather forecasting capabilities.

2. The mission includes plans to install additional weather radars across the country.
3. One of the key goals of the mission is to modify weather patterns through cloud seeding.
4. The mission will be executed by the Ministry of Environment, Forest and Climate Change.
Choose the correct answer from the given codes:
(a) 1 and 2 only
(b) 2 and 4 only
(c) 1, 2 and 3 only
(d) 1, 2 and 4 only

Ans: c

Sol:

- Statement 1: Correct. The mission is indeed a ₹2,000 crore project aimed at improving weather forecasting.
- Statement 2: Correct. The plan includes installing 60 new weather radars to enhance coverage.
- Statement 3: Correct. Cloud-seeding is a weather modification technique that the mission aims to explore.
- Statement 4: Incorrect. The mission will be executed by the Ministry of Earth Sciences.

Q428. Which of the following statements is/are correct regarding cloud seeding?
1. Cloud seeding can induce rainfall in arid regions.
2. The process involves introducing hygroscopic substances into clouds.
3. Cloud seeding is a highly effective and precise technique to control precipitation.
4. While cloud seeding has been practiced for decades, its efficacy remains a subject of debate.
Choose the correct answer from the given codes:
(a) 1 and 2 only
(b) 2 and 4 only
(c) 1, 2 and 3 only
(d) 1, 2 and 4 only

Ans: b

Sol:

- Statement 1: While cloud seeding can increase precipitation, its effectiveness in arid regions is limited by factors like atmospheric conditions and the availability of seedable clouds.
- Statement 2: Correct. Hygroscopic substances like silver iodide and dry ice are commonly used in cloud seeding.
- Statement 3: Incorrect. Cloud seeding is not a precise technique and its success depends on various atmospheric conditions.
- Statement 4: Correct. While cloud seeding has been used for many years, its effectiveness is still debated due to the complexity of atmospheric processes.

Q429. Consider the following statements regarding Project Mausam:
1. India's current weather radar coverage averages one radar per 432 km, indicating sparse coverage.
2. The project aims to improve weather forecasting by installing 60 new weather radars across the country.
3. A cloud-simulation chamber will be established to enhance weather modification techniques, including cloud seeding.
4. The cloud-simulation chamber will be set up at the Indian Meteorological Department (IMD) headquarters in New Delhi.
Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) 1, 3, and 4 only

Ans: b

Sol:

- Statement 1 is correct: India currently has only 39 weather radars, averaging one radar per 432 km, which is sparse for effective nationwide coverage.
- Statement 2 is correct: Project Mausam plans to install 60 additional weather radars to significantly enhance forecasting capabilities.
- Statement 3 is correct: A cloud-simulation chamber will be established to support cloud seeding and weather modification research.
- Statement 4 is incorrect: The cloud-simulation chamber will be set up at the Indian Institute of Tropical Meteorology (IITM) in Pune, not at IMD headquarters in New Delhi.

Topic 144

144. LFP batteries

- **Phosphoric acid**, a key **ingredient in fertilizers**
- These days it is **diverted to produce** electric vehicle **(EV) batteries**.
- This is creating **"food vs cars" dilemma**

Phosphoric Acid Usage

- Di-Ammonium Phosphate **(DAP) fertilizers**(second-most consumed fertilizer in India after Urea)
- **Lithium Iron Phosphate (LFP)** batteries used in **EVs.**
- In **LFP batteries** Phosphate is used as **Cathode or Positive electrode.**

Lithium Iron Phosphate (LFP) batteries

- Though share of **Lithium Iron Phosphate (LFP) batteries** in EV is **less than 10%** but it is **rising** due to **longer lifespan and thermal stability.**
- Countries like **China, the U.S., and Russia,** major DAP exporters, are **reducing supplies** as they increase LFP battery production.
- This diversion is affecting the **global availability of phosphoric acid** for fertilizer production.

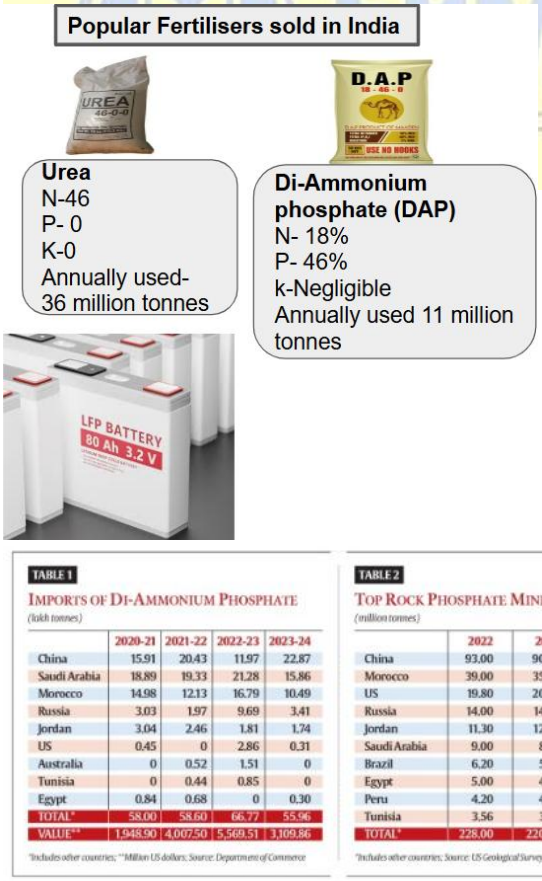


TABLE 1
IMPORTS OF DI-AMMONIUM PHOSPHATE
(lakh tonnes)

	2020-21	2021-22	2022-23	2023-24
China	15.91	20.43	11.97	22.87
Saudi Arabia	18.89	19.33	21.28	15.86
Morocco	14.98	12.13	16.79	10.49
Russia	3.03	1.97	9.69	3.41
Jordan	3.04	2.46	1.81	1.74
US	0.45	0	2.86	0.31
Australia	0	0.52	1.51	0
Tunisia	0	0.44	0.85	0
Egypt	0.84	0.68	0	0.30
TOTAL*	58.00	58.60	66.77	55.96
VALUE**	1,948.90	4,007.50	5,569.51	3,109.86

*Includes other countries; **Million US dollars; Source: Department of Commerce

TABLE 2
TOP ROCK PHOSPHATE MINE PRODUCERS
(million tonnes)

	2022	2023	Reserves
China	93.00	90.00	3,800.0
Morocco	39.00	35.00	50,000.0
US	19.80	20.00	1,000.0
Russia	14.00	14.00	2,400.0
Jordan	11.30	12.00	1,000.0
Saudi Arabia	9.00	8.50	1,400.0
Brazil	6.20	5.30	1,600.0
Egypt	5.00	4.80	2,800.0
Peru	4.20	4.20	210.0
Tunisia	3.56	3.60	2,500.0
TOTAL*	228.00	220.00	74,000.0

*Includes other countries; Source: US Geological Survey.

Q430. Consider the following statements regarding Phosphoric acid:
1. It is a non-combustible and colourless acid obtained from phosphate rock deposits.
2. It is used in the manufacturing of superphosphate fertilizer and livestock feeds.
Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: c

Sol:

- Statement 1 is correct: Phosphoric acid is a non-combustible, colourless liquid that is derived from phosphate rock deposits. It is widely used in various industrial and agricultural applications.
- Statement 2 is correct: Phosphoric acid is a key ingredient in the production of superphosphate fertilizers, which enhance soil fertility. It is also used as an additive in livestock feeds to provide essential phosphates for animal nutrition.

Q431. Consider the following statements about Lithium Iron Phosphate (LFP) batteries:
1. LFP batteries are gaining popularity in electric vehicles (EVs) due to their longer lifespan and thermal stability.
2. The increasing production of LFP batteries by countries like China, the U.S., and Russia is impacting the global availability of phosphoric acid for fertilizers.
3. The share of LFP batteries in the EV market currently exceeds 50%.
4. The rising demand for LFP batteries is leading to a reduction in the export of Diammonium Phosphate (DAP) fertilizers by key exporting nations.
Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) 1, 3, and 4 only

Ans: b

Sol:

- Statement 1 is correct: LFP batteries are becoming more popular in EVs due to their longer lifespan and thermal stability, despite their current market share being less than 10%.
- Statement 2 is correct: The increased production of LFP batteries in countries like China, the U.S., and Russia is causing a diversion of phosphoric acid, a critical component for fertilizers, towards battery production.
- Statement 3 is incorrect: The market share of LFP batteries in EVs is less than 10%, though it is rising.
- Statement 4 is correct: The shift in focus to LFP battery production by DAP-exporting countries is leading to a decline in global DAP fertilizer availability.

Q432. With reference to the Battery Electric Vehicles (BEVs), consider the following statements:
1. They do not have an internal combustion engine (ICE) and produce little tailpipe emissions compared to other EVs.
2. They rely on advanced battery technology, primarily Lithium- ion (Li-ion) batteries.
3. Hybrid EVs considered as an alternative to BEVs offer improved fuel efficiency without requiring extensive charging infrastructure.
How many of the given statements is/are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

Ans: b

Sol:
- Statement 1 is incorrect: While Battery Electric Vehicles (BEVs) do not have an internal combustion engine (ICE), they produce no tailpipe emissions at all, as they run entirely on electric power. The phrase "little tailpipe emissions" is inaccurate for BEVs, as they emit none.
- Statement 2 is correct: BEVs rely on advanced battery technology, primarily Lithium-ion (Li-ion) batteries, which provide high energy density and are essential for powering electric motors.
- Statement 3 is correct: Hybrid EVs, which combine an internal combustion engine with an electric motor, offer improved fuel efficiency and do not require extensive charging infrastructure, as they can recharge through regenerative braking and the ICE.

Topic 145

145. Telescopes

- **Scientific equipments-**to **observe distant celestial bodies**.
- Telescope involves the **use of lenses or mirrors**

Two types of telescopes-

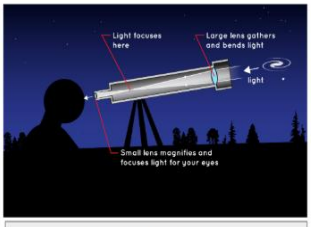
1. **Refracting telescopes**
- **Uses lens**
- The objective of lens is to **bends light rays** and brings them together at a **focal point to form a small image**.

2. **Reflecting Telescope**
- **Uses Mirrors**
- Light enters the telescope and **reflects** the **light to a focal point**.

On the basis of position Telescopes are of two types

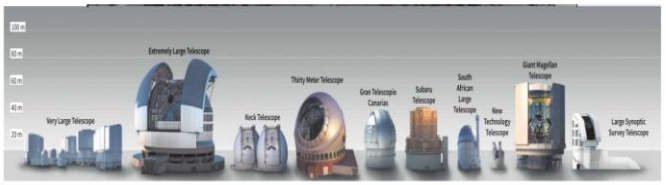
1. **Ground-based Telescopes**
- Telescopes that are located on Earth's surface and are used to observe celestial objects from the ground.

2. **Space based Telescopes**
- Telescopes that are launched into space to observe celestial objects without interference from Earth's atmosphere. Eg **James Webb Telescope**



Refracting telescopes

Reflecting Telescope



Ground-based Telescopes

Why are telescopes setup on mountains?

- The earth's tumultuous atmosphere interferes with the **telescope's functioning.**
- When **starlight** passes through the **turbulence of air, it twinkles.**
- The **higher we go**, the **less is the air,** which is why most telescopes are placed atop mountains.

Q433. Consider the following statements about telescopes:
1. Refracting telescopes use lenses to form an image.
2. Reflecting telescopes use lenses to bend light rays to a focal point.
3. Space-based telescopes avoid interference from Earth's atmosphere.
4. Ground-based telescopes are typically located on mountaintops to minimize atmospheric distortion.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol:
- Statement 1: Correct. Refracting telescopes use lenses to form images by bending light rays.
- Statement 2: Incorrect. Reflecting telescopes use mirrors, not lenses, to reflect light to a focal point.
- Statement 3: Correct. Space-based telescopes are designed to operate outside Earth's atmosphere, avoiding atmospheric interference.
- Statement 4: Correct. Ground-based telescopes are often placed on mountaintops to reduce the effects of atmospheric distortion.

Q434. Which of the following statements is/are correct about the classification of telescopes?
1. Refracting telescopes use mirrors, while reflecting telescopes use lenses.
2. Space-based telescopes include examples like the James Webb Telescope.
3. Ground-based telescopes can be used to observe celestial objects without any atmospheric interference.
(a) Only 1 is correct
(b) Only 2 is correct
(c) Both 1 and 2 are correct
(d) Both 2 and 3 are correct

Ans: b

Sol:
- Statement 1: Incorrect. Refracting telescopes use lenses, while reflecting telescopes use mirrors.
- Statement 2: Correct. Space-based telescopes, like the James Webb Telescope, operate in space for clear observation.
- Statement 3: Incorrect. Ground-based telescopes face atmospheric interference, which is why they are sometimes complemented by space-based telescopes.

Q435. Which of the following statements explains why telescopes are often placed on mountains?
1. The Earth's atmosphere is less turbulent at higher altitudes.
2. Starlight becomes brighter at higher altitudes.
3. There is less air at higher altitudes, reducing atmospheric interference.
(a) Only 1 and 2 are correct
(b) Only 1 and 3 are correct
(c) Only 2 and 3 are correct
(d) All 1, 2, and 3 are correct

Ans: b

Sol:
- Statement 1: Correct. Higher altitudes experience reduced atmospheric turbulence, improving telescope functionality.
- Statement 2: Incorrect. Starlight does not become inherently brighter at higher altitudes; it simply appears clearer due to reduced interference.
- Statement 3: Correct. Thinner air at higher altitudes minimizes atmospheric distortion.

Topic 146

146. James Webb Telescopes

- Joint venture of **NASA (US), ESA (Europe), and CSA (Canada).**
- Succeeded the **Hubble Space Telescope**
- Launched in **2021**

JWST vs Hubble Telescope

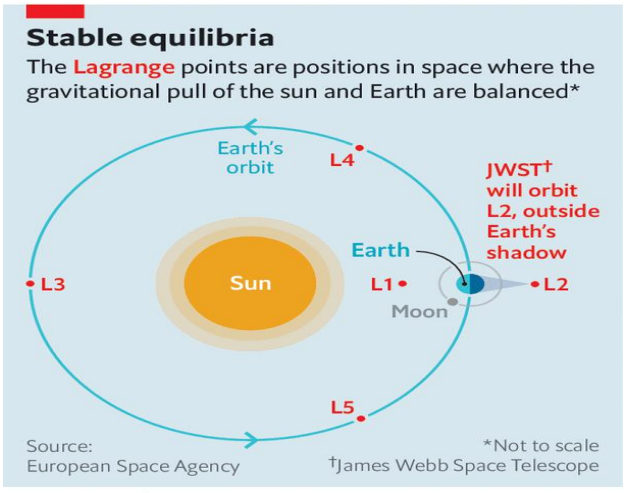
- JSWT is **100 times more powerful** than Hubble.
- **JWST- Infrared**- reveal clearer details/**Hubble- Ultraviolet**
- **Hubble**-**Low** Earth Orbit (597 Km)
- **JWST**-It will **not orbit the Earth** but will **sit at Lagrange Point 2** (1.5 million kilometers away from Earth).

Major Scientific Goals of James Webb Telescopes

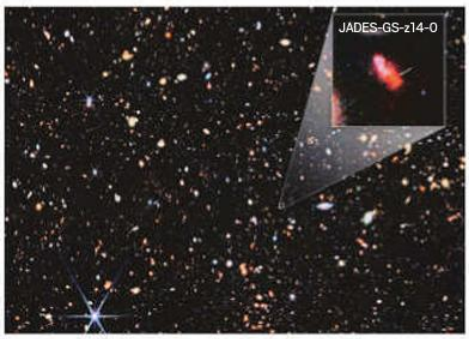
1. **Provides a look into the past**
   - Study the first galaxies formed after the **Big Bang, about 13.8 billion years ago.**
2. **Universe exploration**
   - knowing **mysterious elements** of the Universe like **Dark Matter, Dark Energy etc**

Current news?

- **NASA's James Webb Space Telescope (JWST)** has spotted the earliest-known **galaxy JADES-GS-z14-0(Formed during the universe's infancy — at only 2% its current age).**



The Economist



An infrared image of the JADES-GS-z14-0 *(shown in the pullout)* galaxy from James Webb Space Telescope. *NASA*

Q436. Consider the following statements about the James Webb Space Telescope (JWST):
1. JWST is a joint project involving NASA, ESA, and CSA.
2. JWST is positioned at Lagrange Point 2, approximately 1.5 million kilometers away from Earth.
3. JWST primarily uses ultraviolet light to observe celestial objects.
4. JWST is 100 times more powerful than the Hubble Space Telescope.
How many of the above statements are correct?
(a) Only 2
(b) Only 3
(c) All 4
(d) Only 1

Ans: b

Sol:

- Statement 1: Correct. JWST is a collaboration between NASA, ESA, and CSA.
- Statement 2: Correct. JWST is positioned at Lagrange Point 2, far from Earth's orbit.
- Statement 3: Incorrect. JWST primarily uses infrared light, not ultraviolet light.
- Statement 4: Correct. JWST is 100 times more powerful than the Hubble Space Telescope.

Q437. Which of the following statements about the differences between the James Webb Space Telescope (JWST) and the Hubble Space Telescope is/are correct?
1. JWST operates primarily in the infrared spectrum, while Hubble observes mainly in the ultraviolet spectrum.
2. Hubble orbits the Earth at a distance of 597 km, whereas JWST is located 1.5 million kilometers away from Earth.
3. Hubble is 100 times more powerful than JWST.

(a) Only 1 is correct
(b) Only 1 and 2 are correct
(c) Only 2 and 3 are correct
(d) All 1, 2, and 3 are correct

Ans: b

Sol:

- Statement 1: Correct. JWST observes in the infrared spectrum, whereas Hubble primarily observes in the ultraviolet.
- Statement 2: Correct. Hubble orbits Earth in low Earth orbit, while JWST is positioned at Lagrange Point 2.
- Statement 3: Incorrect. JWST is 100 times more powerful than Hubble, not the other way around.

Q438. Consider the following scientific goals of the James Webb Space Telescope (JWST):
1. To study the earliest galaxies formed after the Big Bang, about 13.8 billion years ago.
2. To investigate mysterious elements of the Universe, such as Dark Matter and Dark Energy.
3. To orbit Earth at low altitude for enhanced observations of nearby stars.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) All 3
(d) None

Ans: b

Sol:

- Statement 1: Correct. One of JWST's primary goals is to study the first galaxies formed after the Big Bang.
- Statement 2: Correct. JWST aims to explore elements like Dark Matter and Dark Energy.
- Statement 3: Incorrect. JWST does not orbit Earth; it is located at Lagrange Point 2.

Topic 147

147. Upcoming Space Missions of India

- The Indian government has approved **four big-ticket space projects**.

They are-

1. **Bhartiya Antriksh Station**
   - India's own Space Station by **2035**.
2. **Next Generation Launch Vehicle (NGLV)**
   - **a three-stage launch vehicle** powered by-

a. semi-cryogenic engine
b. a liquid engine
c. a cryogenic engine

   - **NGLV** will offer **three times the current payload capacity** of the LVM3, at **1.5 times the cost.**
   - It is designed to carry up to **30 tonnes to Low Earth Orbit (LEO)**.
   - ISRO **will discontinue** the use of the **GSLV** once the NGLV is ready.
3. **Venus Mission/Shukrayaan**
   - scheduled for **March 2028**, will be India's **first mission to Venus** and the **second planetary mission** after the 2013 **Mars Orbiter Mission**.
   - It will **study Venus's atmosphere, volcanoes on venus**,**surface of the planet** and **interaction with the sun**.
4. **Chandrayaan-4**
   - Focus on **bringing samples from the Moon**.
   - The mission will also focus on **lunar surface exploration** support future lunar exploration and potential human missions.


Moon habitats

Q439. Consider the following statements about India's upcoming space projects:
1. Bhartiya Antriksh Station is expected to be India's own space station by 2035.
2. The Next Generation Launch Vehicle (NGLV) will have three stages powered by a semi-cryogenic engine, a liquid engine, and a cryogenic engine.

3. Chandrayaan-4 aims to bring back samples from the Moon and support future lunar exploration.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) All 3
(d) None

Ans: c

Sol:
- Statement 1: Correct. Bhartiya Antriksh Station is planned to be India's own space station by 2035.
- Statement 2: Correct. NGLV will feature three stages powered by the specified engines.
- Statement 3: Correct. Chandrayaan-4 aims to bring back samples and support future lunar exploration missions.

Q440. Which of the following statements is/are correct regarding the Next Generation Launch Vehicle (NGLV)?
1. It will replace the GSLV once it becomes operational.
2. NGLV is designed to carry up to 30 tonnes to Low Earth Orbit (LEO).
3. NGLV will cost three times as much as the LVM3 for the same payload capacity.
(a) Only 1 is correct
(b) Only 1 and 2 are correct
(c) Only 2 and 3 are correct
(d) All 1, 2, and 3 are correct

Ans: b

Sol:
- Statement 1: Correct. ISRO plans to discontinue the GSLV after the NGLV is operational.
- Statement 2: Correct. NGLV is designed to carry up to 30 tonnes to LEO.
- Statement 3: Incorrect. NGLV will offer three times the payload capacity of LVM3 at 1.5 times the cost, not three times the cost.

Q441. Consider the following statements about India's Venus Mission (Shukrayaan):
1. It will be India's second planetary mission after the Mars Orbiter Mission.
2. The mission is scheduled for March 2028.
3. Shukrayaan will focus on studying Venus's atmosphere, volcanoes, surface, and its interaction with the Sun.
4. It will include a lander to explore Venus's surface.
How many of the above statements are correct?
(a) Only 2
(b) Only 3
(c) All 4
(d) Only 1

Ans: b

Sol:
- Statement 1: Correct. Shukrayaan will be India's second planetary mission after the Mars Orbiter Mission.
- Statement 2: Correct. The mission is scheduled for March 2028.
- Statement 3: Correct. Shukrayaan will study Venus's atmosphere, volcanoes, surface, and its interaction with the Sun.
- Statement 4: Incorrect. Shukrayaan does not include a lander; it focuses on atmospheric and surface studies.

Topic 148

148. ISRO's mission to Venus

Why is it important to study Venus?

- Venus is often referred to as **Earth's "twin"** because of the **two planets' similarities in mass**, **density, and size.**
- It is thought to have had **liquid water in the past.**
- For a long time, **scientists believed that Venus** would have **supported life — like Earth.**
- But with more study it was found that the surface temperature of Venus is around **462 degrees Celsius,making Venus hottest planet** in our **solar system.**
- This makes the **possibility of life difficult on Venus.**

Q. What makes Venus hottest planet in our solar system?

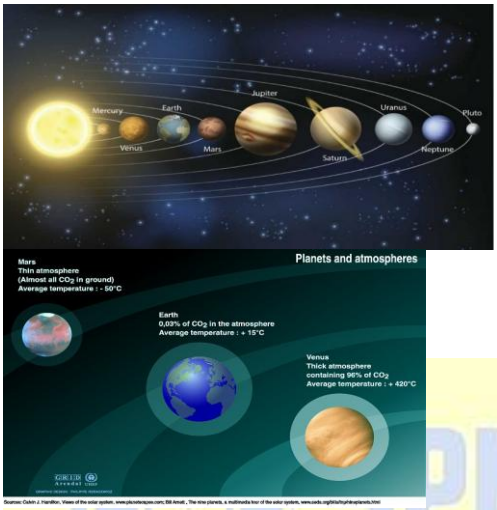
High concentration of carbon dioxide in atmosphere

- More than **96.5% of the dense atmosphere of Venus** is made up of **carbon dioxide**, a Greenhouse Gas.(**3%** Nitrogen, other gases like sulphur dioxide,

carbon monoxide, water vapour, and helium)

Other peculiar facts about Venus

1. **Very high atmospheric pressure**
   - Atmosphere of Venus is about **93 times thicker** than **Earth**.
2. **Very long day**
   - Venus rotates **very slowly on its axis** as compared to Earth.
   - **One rotation** of Venus lasts around **243 Earth days**.



Q442. Consider the following statements about Venus:
1. Venus is referred to as Earth's "twin" because of similarities in mass, density, and size.
2. Venus has a surface temperature of around 462°C, making it the hottest planet in our solar system.
3. Venus's atmosphere is about 93 times thicker than Earth's atmosphere.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) All 3
(d) None

Ans: c

Sol:
- Statement 1: Correct. Venus is called Earth's "twin" due to its similarities in mass, density, and size.
- Statement 2: Correct. Venus is the hottest planet with a surface temperature of approximately 462°C.
- Statement 3: Correct. The atmosphere of Venus is about 93 times thicker than Earth's atmosphere.

Q443. Which of the following factors contribute to Venus being the hottest planet in the solar system?
1. The high concentration of carbon dioxide in its atmosphere.
2. The presence of sulphur dioxide and water vapor in the atmosphere.
3. Its proximity to the Sun.
(a) Only 1 is correct
(b) Only 1 and 2 are correct
(c) Only 2 and 3 are correct
(d) All 1, 2, and 3 are correct

Ans: a

Sol:
- Statement 1: Correct. The high concentration of carbon dioxide (96.5%) creates a runaway greenhouse effect, making Venus the hottest planet.
- Statement 2: Incorrect. Although other gases are present, their contribution to Venus's heat is negligible compared to carbon dioxide.
- Statement 3: Incorrect. Mercury is closer to the Sun but cooler than Venus, indicating that Venus's atmospheric composition is the primary reason for its extreme heat.

Q444. Consider the following peculiar characteristics of Venus:
1. One rotation of Venus lasts around 243 Earth days.
2. Venus has a dense atmosphere composed of over 96.5% carbon dioxide.
3. Venus was once thought to have liquid water and the potential to support life.
4. Venus has the fastest rotation speed of any planet in the solar system.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol:

- Statement 1: Correct. Venus rotates very slowly, with one rotation taking about 243 Earth days.
- Statement 2: Correct. The dense atmosphere of Venus is composed of more than 96.5% carbon dioxide.
- Statement 3: Correct. Venus was thought to have had liquid water and the potential for life in the past
- Statement 4: Incorrect. Venus has a very slow rotation, not the fastest in the solar system.

Topic 149

149. Satellite launch vehicle

How satellites are launched by a rocket(launch vehicle)?

- Rockets or Launch vehicle have **several detachable energy-providing parts.**
- They burn **different kinds of fuels** to **power the rocket.**
- Once their **fuel is exhausted,** they detach from the **rocket and fall off.**

Indian Space Research Organisation (ISRO) has three active launch vehicles

1. Polar Satellite Launch Vehicle (PSLV)
2. Geosynchronous Satellite Launch Vehicle (GSLV)

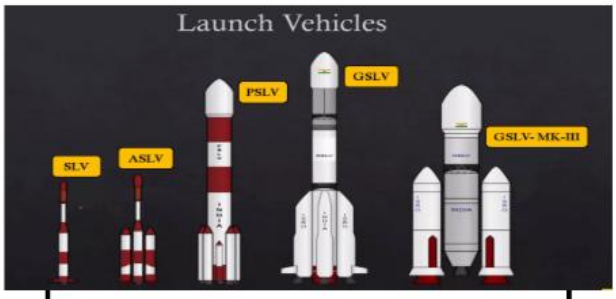
Polar Satellite Launch Vehicle (PSLV)

- PSLV has **four stages using solid and liquid** propulsion systems alternately.
- Its **first successful** launch in **October 1994.**
- Till now it has conducted **more than 60 launches-57 successful(95% success rate)**
- Due to its unmatched reliability, earned its **title "the workhorse of ISRO".**
- **Launched Missions → Chandrayaan-1, Mars Orbiter Mission, Space Capsule Recovery Experiment, IRNSS, Astrosat.**

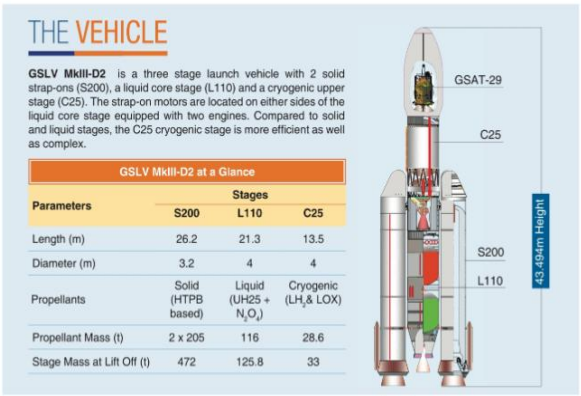
Geosynchronous Satellite Launch Vehicle (GSLV)

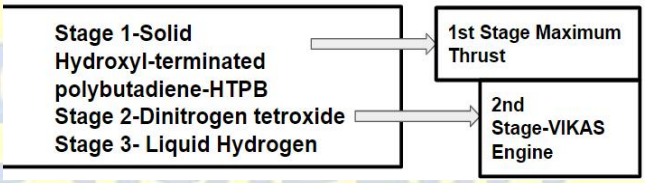
- Three stage-**Solid-Liquid-Cryogenic**
- Its **MKIII version**-has been renamed as **LVM 3-Carried Chandrayan III**

ISRO Scientists named **GSLV-naughty boy**-since the **rocket failed in six of its 15 flights - a 40 percent fail rate**



India's Rocket Family





- **GSLV Mk-I : (Russian Cryogenic)**
- **GSLV Mk-II : (Indigenous Cryogenic)**
- **GSLV Mk-III : (Indigenous Cryogenic)**

PSLV-C53 mission

- the **spent final stage** will be utilised as a **"stabilised platform"** to **perform experiments.**
- This will be known as **'POEM'-PSLV Orbital Experimental Module.**

Q445. Consider the following statements about the Polar Satellite Launch Vehicle (PSLV):
1. PSLV uses a four-stage propulsion system alternating between solid and liquid propellants.
2. PSLV earned the title "the workhorse of ISRO" due to its reliability and success rate.
3. PSLV has been used to launch missions like Chandrayaan-1 and the Mars Orbiter Mission.
4. PSLV has a failure rate of 40%.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol:

- Statement 1: Correct. PSLV uses a four-stage propulsion system alternating between solid and liquid propellants.
- Statement 2: Correct. Its high reliability earned it the title "the workhorse of ISRO."
- Statement 3: Correct. PSLV launched key missions such as Chandrayaan-1 and the Mars Orbiter Mission.
- Statement 4: Incorrect. PSLV has a 95% success rate, not a 40% failure rate.

Q446. Which of the following statements about the Geosynchronous Satellite Launch Vehicle (GSLV) is/are correct?
1. GSLV has a three-stage propulsion system: solid, liquid, and cryogenic.
2. The GSLV MkIII version is also known as LVM3 and was used for the Chandrayaan-3 mission.
3. GSLV has been nicknamed "naughty boy" due to its failure rate.
(a) Only 1 is correct
(b) Only 1 and 2 are correct
(c) Only 2 and 3 are correct
(d) All 1, 2, and 3 are correct

Ans: d

Sol:

- Statement 1: Correct. GSLV has a three-stage propulsion system: solid, liquid, and cryogenic.
- Statement 2: Correct. The GSLV MkIII version, renamed LVM3, was used for Chandrayaan-3.
- Statement 3: Correct. GSLV is nicknamed "naughty boy" due to its 40% failure rate.

Q447. Consider the following statements about ISRO's PSLV-C53 mission:
1. The final stage of the PSLV rocket will be used as a stabilised platform for experiments.
2. This experimental module is called the PSLV Orbital Experimental Module (POEM).
3. POEM is designed to reduce the rocket's failure rate.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) None

Ans: b

Sol:

- Statement 1: Correct. The PSLV-C53 mission involves using the final stage as a stabilised platform for experiments.
- Statement 2: Correct. This module is called the PSLV Orbital Experimental Module (POEM).
- Statement 3: Incorrect. POEM is for performing experiments, not for reducing failure rates.

Topic 150

150. Square Kilometer Array Telescope

- **intergovernmental telescope.**
- It is **used for radio astronomy.**
- It is **world's largest radio telescope** in the making
- It is **headquartered in the UK.**
- At the moment, organisations from **ten countries** (Australia, Canada, China, **India,** Italy, New Zealand, South Africa, Sweden, the Netherlands and the UK) are a part of the SKAO.
- The name "Square Kilometre Array" refers to the **total collecting area** of **1 square kilometer** (1 million square meters) **across thousands of antennas.**

Locations

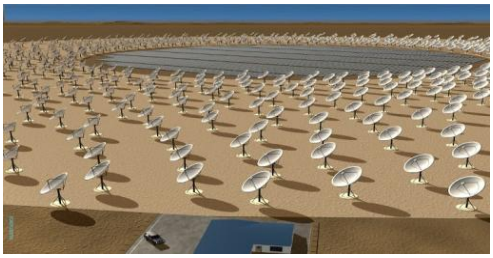
1. **South Africa-Karoo Region** in the Northern Cape province
2. **Australia-Murchison** Radio-astronomy Observatory in Western Australia.

Difference between Optical and Radio Telescope?

- Unlike **optical telescopes,** radio telescopes can **detect invisible gas** and can reveal areas of space that may be **covered by cosmic dust.**

Scientific Objectives

- formation of the **first stars and galaxies** after the **Big Bang**.
- Understand the nature of **dark matter and dark energy.**
- Investigate **gravitational waves** and **cosmic magnetism**.
- Search for signs of **extraterrestrial life**.



Radio astronomy

- It is a **branch of Astronomy**- study of cosmic bodies in the universe.
- It uses **Radio Telescopes.**
- Radio telescopes **detect and amplify radio waves** from space.
- It helps the astronomers **to know about space.**

Q448. Consider the following statements about the Square Kilometer Array Observatory (SKAO):
1. SKAO is the world's largest radio telescope under construction.
2. Its headquarters is located in Australia.
3. The name "Square Kilometre Array" refers to the total collecting area of 1 square kilometer across thousands of antennas.
4. India is one of the ten countries currently part of the SKAO.
How many of the above statements are correct?
(a) Only 2
(b) Only 3
(c) All 4
(d) Only 1

Ans: b

Sol:

- Statement 1: Correct. SKAO is the world's largest radio telescope under construction.
- Statement 2: Incorrect. SKAO's headquarters is located in the UK, not Australia.
- Statement 3: Correct. The name refers to a total collecting area of 1 square kilometer.
- Statement 4: Correct. India is among the ten countries part of the SKAO.

Q449. Which of the following scientific objectives are associated with the Square Kilometer Array Telescope (SKAO)?
1. Investigating the formation of the first stars and galaxies after the Big Bang.
2. Studying the surface features of exoplanets.
Understanding the nature of dark matter and dark energy.
3. Searching for signs of extraterrestrial life.
(a) Only 1, 2, and 3 are correct
(b) Only 1, 3, and 4 are correct
(c) Only 2 and 4 are correct
(d) All 1, 2, 3, and 4 are correct

Ans: b

Sol:

- Statement 1: Correct. SKAO aims to study the formation of the first stars and galaxies after the Big Bang.
- Statement 2: Incorrect. SKAO does not focus on surface features of exoplanets, which is more relevant to optical telescopes.
- Statement 3: Correct. SKAO aims to understand dark matter and dark energy.
- Statement 4: Correct. Searching for extraterrestrial life is a key objective of SKAO.

Q450. Consider the following differences between optical telescopes and radio telescopes:
1. Optical telescopes can detect visible light, while radio telescopes detect radio waves.
2. Radio telescopes can reveal areas of space covered by cosmic dust, unlike optical telescopes.
3. Optical telescopes are better suited for detecting invisible gases in space than radio telescopes.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) All 3
(d) None

Ans: b

Sol:

- Statement 1: Correct. Optical telescopes detect visible light, while radio telescopes detect radio waves.
- Statement 2: Correct. Radio telescopes can reveal areas of space obscured by cosmic dust, unlike optical telescopes.
- Statement 3: Incorrect. Radio telescopes are better suited for detecting invisible gases in space than optical telescopes.

Day 16

Topic 151

151. Intercontinental Ballistic Missile

Ballistic missiles

- A ballistic missile follows a **ballistic trajectory.**
- **No active propulsion** during its **actual flight**

The trajectory is fully determined by a given

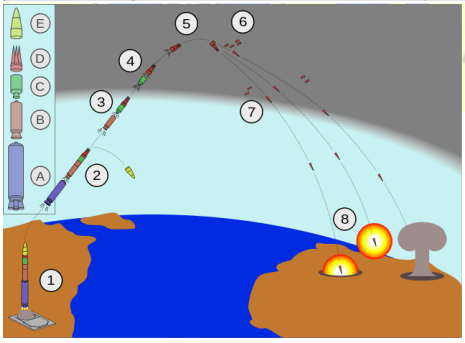
1. **Initial velocity**
2. **Effects of gravity**
3. **Air resistance,**
4. **Motion of the earth (Coriolis Force).**

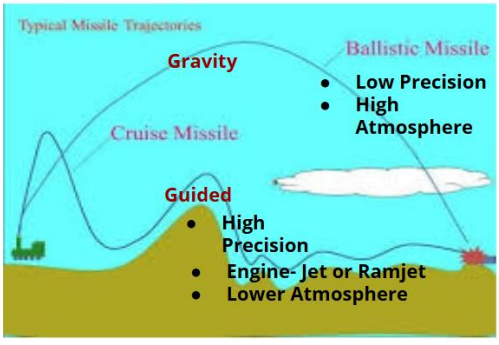
- Ballistic missiles have **longer range, thus generally called Intercontinental Ballistic Missiles.**

Cruise missiles

- is a **guided missile** with **active propulsion throughout** the flight.
  - **constant speed** throughout the flight.
  - Modern cruise missiles are capable of travelling at **supersonic.**
  - **High precision** in hitting the target.

Characteristics	Ballistic missiles	Cruise missiles
Range	From low to very high *Up to 15 000 km*	Mostly around 1 000 km *Up to 4 000 km*
Altitude	High *Easily detectable*	Low *Hard to detect*
Precision	Low – around a few hundred metres *Fit for large targets*	High – a few metres *Fit for small and mobile targets*
Speed	Up to 25 000 km/h at impact *Very hard to intercept*	Around 1 000 km/h *Possibility to intercept*





Q451. Ballistic missiles are classified based on their range and application. Assess the following statements:

1. Tactical ballistic missiles typically have a range of up to 300 kilometers.
2. Medium-range ballistic missiles (MRBMs) have a range between 1,000 and 3,500 kilometers.
3. Submarine-launched ballistic missiles (SLBMs) are exclusively equipped with nuclear warheads.
4. Short-range ballistic missiles (SRBMs) are often used for battlefield support.

How many of the above statements are incorrect?

(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: a

Sol:

- **Statement 1** is correct: Tactical ballistic missiles generally have a range of up to 300 kilometers.
- **Statement 2** is correct: MRBMs are defined by their range of 1,000 to 3,500 kilometers.
- **Statement 3** is incorrect: SLBMs can carry both nuclear and conventional warheads, though nuclear warheads are more common.
- **Statement 4** is correct: SRBMs are indeed used for battlefield operations due to their short range and quick deployment.

Q452. Ballistic missile defense (BMD) systems are designed to intercept and destroy incoming ballistic missiles. Evaluate the following statements:

1. Ballistic missiles travel at hypersonic speeds during most phases of their flight.
2. BMD systems typically include radar, interceptor missiles, and command-and-control components.
3. Midcourse interception is considered the most challenging phase for missile defense.

Which of the above statements are correct?

(a) Only statements 1 and 3
(b) Only statements 1, 2 and 3
(c) Only statements 1 and 2 only

(d) 2,3 only

Ans: b

Sol:

- **Statement 1** is correct: Ballistic missiles indeed travel at hypersonic speeds for most of their trajectory.
- **Statement 2** is correct: BMD systems are complex, comprising radars, interceptor missiles, and command systems.
- **Statement 3** is correct: Midcourse interception is challenging due to the altitude and high speed of the missile in this phase.

Q453. Cruise missiles are a vital part of modern military arsenals. Evaluate the following statements:

1. Cruise missiles are highly accurate due to their advanced guidance systems.
2. The slow speed of subsonic cruise missiles makes them vulnerable to interception.
3. Cruise missiles can carry only small payloads due to their limited size.
4. Cruise missiles are typically more expensive to produce than ballistic missiles.

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol:

- **Statement 1** is correct: Cruise missiles achieve high accuracy using GPS and other advanced navigation systems.
- **Statement 2** is correct: Subsonic cruise missiles are slower than ballistic missiles, making them susceptible to advanced air defense systems.
- **Statement 3** is incorrect: Cruise missiles can carry varying payloads, including large warheads, depending on their design and purpose.
- **Statement 4** is correct: Cruise missiles are generally more complex and expensive to produce than ballistic missiles due to their sophisticated guidance systems and propulsion technology.

Topic 152

152. Scramjet Technology

Difference between a Jet and Rocket engine?

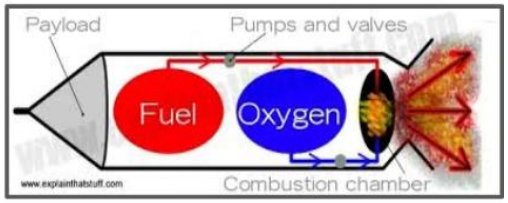
1. **Rocket**
   - **carries its own supply of oxygen (Oxidizer Tank)** for combustion
2. **Jet**
   - utilizes **oxygen from the atmosphere** (air breather)
   - Jet engine **captures oxygen** from the **surrounding atmosphere** and uses it for the **combustion purpose of the fuel.**

Ramjet engine

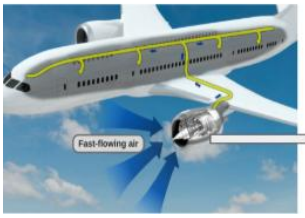
- a variant of an air breathing jet engine
- **not include a rotary compressor;** rather, it uses the **engine's forward motion** to compress the **incoming air.**

Scramjet (supersonic-combustion ramjet)

- A Scramjet (Supersonic Combustion Ramjet) is a **type of jet engine** specifically designed for **hypersonic speeds.**
- In this the **air entering** the engine remains **supersonic during combustion.**



Rocket carrying its own oxygen cylinder



Rotor to compress oxygen

Q454. Rocket engines and jet engines are propulsion systems with distinct operating principles. Analyze the following statements:

1. Rocket engines carry both fuel and oxidizer, allowing them to operate in space.
2. Jet engines rely on atmospheric oxygen for combustion, making them unsuitable for space travel.
3. Rocket engines achieve propulsion by expelling high-speed exhaust gases generated through internal combustion.
4. Jet engines are more efficient than rocket engines in Earth's atmosphere due to their ability to intake air.

How many of the above statements are correct?
(a) Only two
(b) Only three
(c) All four
(d) Only one

Ans: c

Sol:
- **Statement 1** is correct: Rocket engines carry both fuel and oxidizer, enabling them to function in the vacuum of space.
- **Statement 2** is correct: Jet engines depend on atmospheric oxygen for combustion, which is unavailable in space, making them unsuitable for space travel.
- **Statement 3** is correct: Rocket engines generate thrust by expelling high-speed exhaust gases, a principle fundamental to their operation.
- **Statement 4** is correct: Jet engines are more efficient in the atmosphere because they use ambient air for combustion, reducing the need to carry oxidizer, which increases efficiency.

Q455. Scramjet engines are a type of air-breathing jet engine designed for hypersonic speeds. Consider the following statements:
1. Scramjet engines require an onboard oxidizer to support combustion at hypersonic speeds.
2. Scramjet engines operate efficiently only at speeds greater than Mach 5.

Which of the above statements are correct?
(a) Only statement 1
(b) Only statement 2
(c) Both statements 1 and 2
(d) Neither statement 1 nor 2

Ans: d

Sol:
- **Statement 1** is incorrect: Scramjet engines do not require onboard oxidizers; they use atmospheric oxygen for combustion, making them lighter than rocket engines.
- **Statement 2** is incorrect: While scramjets are most efficient at speeds above Mach 5, they can operate at lower hypersonic speeds, starting around Mach 4, depending on the design.

Q456. Speeds in aerodynamics are categorized based on their relationship to the speed of sound. Consider the following definitions:
1. **Subsonic** speeds are those below the speed of sound.
2. **Supersonic** speeds are between Mach 1 and Mach 3.
3. **Hypersonic** speeds are defined as Mach 5 or higher.

Which of the above statements is correct?
(a) Only statement 1
(b) Only statements 1 and 2
(c) Only statements 1 and 3
(d) All three statements

Ans: c

Sol:
- **Statement 1** is correct: Subsonic speeds are indeed below the speed of sound (Mach 1).
- **Statement 2** is incorrect: Supersonic speeds start at Mach 1 and extend to about Mach 5, not just Mach 3.
- **Statement 3** is correct: Hypersonic speeds are defined as Mach 5 or greater.

Topic 153

153. National Supercomputer Mission

- Initiative by the Government-to develop a **network of supercomputers** in the country.
- **launched in 2015**

Government agencies involved-

a. Ministry of Electronics and Information Technology (MeitY)
b. Department of Science and Technology (DST)

Implementing agencies

a. Centre for Development of Advanced Computing (C-DAC)
b. Indian Institute of Science (IISc)

Goal

- Develop **73 Supercomputers** and **establish at premier institutes of the country** like IITs and IISc etc.
- **33 supercomputers** deployed in India till **November 2024.**

India's fastest Supercomputer

- **Airawat PSAI**, stands as India's **largest and fastest AI supercomputing system.**
- Speed of **13,170 teraflops,ranked 136th** fastest in the world in the TOP500 supercomputer.

Current news?

- **Three new supercomputers installed under NSM at-**

a. Giant Metrewave Radio Telescope (GMRT), **Pune- for astronomy**
b. Delhi's Inter-University Accelerator Centre (IUAC) for high-energy physics
c. S.N. Bose National Centre for Basic Sciences, **Kolkata** for high-energy physics.

C-DAC

- After being **denied a Cray supercomputer** by **the United States in 1987**, due to **military use concerns India resolved** to develop its **own Supercomputers**.
- **C-DAC was developed** in this regard only with **headquarter at Pune.**

Q457. Consider the following features of the National Supercomputer Mission (NSM):

1. The mission seeks to make India a global leader in supercomputing.
2. NSM plans to connect supercomputing facilities through the National Knowledge Network (NKN).
3. The mission promotes training and human resource development for supercomputing research.

How many of the above statements are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

Ans: c

Sol:

- **Statement 1** is correct: A long-term vision of NSM is to position India as a leader in supercomputing.
- **Statement 2** is correct: Supercomputers under the mission are interconnected via the National Knowledge Network (NKN) to facilitate collaboration and research.
- **Statement 3** is correct: The mission emphasizes human resource development to enable effective utilization of supercomputing technology.

Q458. The Centre for Development of Advanced Computing (C-DAC) is a premier research and development organization in India. Evaluate the following statements:

1. C-DAC is primarily known for developing India's first supercomputer, PARAM.
2. C-DAC works exclusively in the field of high-performance computing.
3. C-DAC operates under the Ministry of Electronics and Information Technology (MeitY).

Which of the above statements are correct?
(a) Only statements 1 and 2
(b) Only statements 1 and 3
(c) Only statements 2 and 3
(d) All three statements

Ans: b

Sol:

- **Statement 1** is correct: C-DAC developed PARAM, India's first indigenous supercomputer, marking a significant milestone in the country's technological progress.
- **Statement 2** is incorrect: While C-DAC is known for high-performance computing, it also works in areas like software development, AI, natural language processing, and cybersecurity.
- **Statement 3** is correct: C-DAC operates under the Ministry of Electronics and Information Technology (MeitY), contributing to India's IT and computing advancements.

Q459. What is the name of India's fastest supercomputer as of 2024?
(a) PARAM Shivay
(b) Mihir
(c) Pratyush
(d) PARAM Siddhi-AI

Ans: d

Sol: PARAM Siddhi-AI, developed by C-DAC, is India's fastest supercomputer as of 2024. It ranks among the top supercomputers globally and is optimized for applications in artificial intelligence, healthcare, weather modeling, and defense.

Topic 154

154. 'Infrasound' for nuclear explosion detection

Comprehensive Test Ban treaty

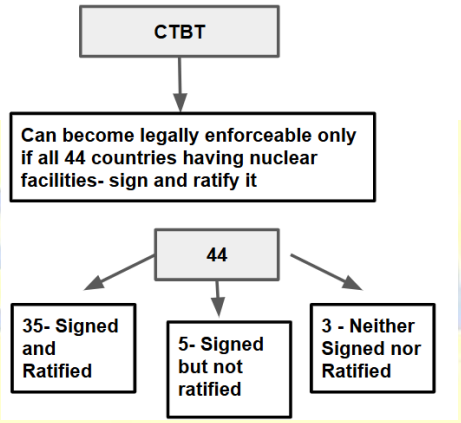
- It is a global treaty that **aims to ban all nuclear explosions** across the world.
- It was proposed in 1996.
- **Upon entering into force,** it provides a **legally binding norm** against **nuclear testing.**
- The Treaty entry into force **depends on 44 specific States** that must have **signed and ratified the Treaty.**
- These States had **nuclear facilities** at the **time the Treaty** was negotiated and adopted.
- **35 of these States** have **ratified the Treaty.**
- Comprehensive Test Ban Treaty Organization **(CTBTO)** does **surveillance to ensure** that the **signatory countries don't violate the norms.**
- The Treat has been **signed by 184 nations.**
- **India** has **not signed the treaty.**

Current news?

- The Comprehensive Test Ban Treaty Organization **(CTBTO)** is holding a **workshop for scientists on using 'infrasound' to detect nuclear explosion.**

Infrasound:

- It refers to **sound waves** with **very low frequencies.**



The Comprehensive Nuclear-Test-Ban Treaty **(CTBT) has not yet entered into force**

Q460. The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is an international treaty aimed at preventing nuclear weapon tests. Consider the following statements:
1. The CTBT prohibits all nuclear explosions for both military and civilian purposes.
2. The CTBT has entered into force and is legally binding on all signatory countries.

Which of the above statements is correct?
(a) Only statement 1
(b) Only statement 2
(c) Both statements 1 and 2
(d) Neither statement 1 nor 2

Ans: a

Sol:

- **Statement 1** is correct: The CTBT bans all nuclear explosions, regardless of their purpose.
- **Statement 2** is incorrect: Although the treaty was adopted in 1996, it has not yet entered into force because some key nations, including the United States and China, have not ratified it.

Q461. The CTBT includes a verification regime to ensure compliance. Evaluate the following statements:

1. The International Monitoring System (IMS) under the CTBT detects nuclear explosions worldwide.
2. The CTBT verification system includes on-site inspections to investigate suspicious activities.
3. The IMS uses only seismic monitoring to detect nuclear tests.

Which of the above statements are correct

(a) Only statements 1 and 2
(b) Only statement 3
(c) Only statements 2 and 3
(d) All three statements

Ans: a

Sol:

- **Statement 1** is correct: The IMS is a global monitoring network to detect nuclear explosions using technologies like seismic, hydroacoustic, infrasound, and radionuclide detection.
- **Statement 2** is correct: On-site inspections are part of the CTBT's verification regime to investigate suspicious activities.
- **Statement 3** is incorrect: The IMS uses multiple technologies, not just seismic monitoring, to detect nuclear tests.

Q462. India has taken a specific stance on the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Analyze the following statements:

1. India has signed but not ratified the CTBT.
2. India has expressed concerns over the discriminatory nature of the CTBT.

Which of the above statements is correct?

(a) Only statement 1
(b) Only statement 2
(c) Both statements 1 and 2
(d) Neither statement 1 nor 2

Ans: b

Sol:

- **Statement 1** is incorrect: India has neither signed nor ratified the CTBT, citing concerns over its discriminatory nature and lack of a time-bound commitment for nuclear disarmament by nuclear-weapon states.
- **Statement 2** is correct: India has consistently argued that the CTBT disproportionately favors established nuclear powers, failing to ensure comprehensive disarmament.

Topic 155

155. Global Innovation Index 2024

Published by the-

1. **World Intellectual Property Organization** (Specialised agency of UN, HQ-Geneva, Switzerland)
2. **Cornell University**
3. **INSEAD**

- **Switzerland** is the **most innovative** economy.
- India has moved up to **39th place among** 133 global economies in the **Global Innovation Index (GII) 2024(40th in 2023).**
- Major cities like **Mumbai, Delhi, Bengaluru, and Chennai** are listed among the world's **top 100 S&T** clusters.

Global Innovation Index 2024

Q463. Which country secured the top position in the Global Innovation Index (GII) 2024?
(a) Sweden
(b) United States
(c) Switzerland
(d) Singapore

Ans: c

Sol: Switzerland maintained its position as the most innovative economy, ranking first in the GII for the 14th consecutive year.

Q464. India's innovation ecosystem has shown significant progress in recent years. Evaluate the following statements:
1. In the Global Innovation Index (GII) 2024, India improved its ranking to 39th position among 133 economies.
2. India ranks 1st among lower-middle-income economies in the GII 2024.
3. Four Indian cities—Mumbai, Delhi, Bengaluru, and Chennai—are listed among the world's top 100 Science & Technology clusters in the GII 2024.

How many of the above statements are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

Ans: c

Sol:

- **Statement 1** is correct: India improved its ranking to 39th position among 133 economies in the Global Innovation Index 2024.
- **Statement 2** is correct: India ranks 1st among lower-middle-income economies in the GII 2024, reflecting its leadership in innovation within this income group.
- **Statement 3** is correct: Mumbai, Delhi, Bengaluru, and Chennai are recognized among the world's top 100 Science & Technology clusters in the GII 2024, highlighting India's regional innovation hubs.

Q465. What is the primary function of the World Intellectual Property Organization (WIPO)?
(a) Promoting the resolution of international trade disputes
(b) Protecting and promoting intellectual property rights worldwide
(c) Regulating international patents and trademarks exclusively
(d) Developing trade policies for global economic growth

Ans: b

Sol: WIPO, a specialized agency of the United Nations, is dedicated to protecting intellectual property (IP) globally. Its role includes fostering innovation and creativity through an effective international IP system, promoting IP policy dialogue, and providing services for patents, trademarks, and copyright management. WIPO does not regulate trade or develop trade policies; its focus is exclusively on IP-related matters.

Topic 156

156. LUX-ZEPLIN experiment

As per scientists the universe is made up of three components:

1. **Normal or visible matter (5%)**
2. **Dark matter (27%)**
3. **Dark energy (68%)**

- **If we talk of matter** only and neglect Dark energy then we can say **15%** of the universe is made up of **all matter ie Stars, gases and Planets**.
- **85%** of the **universe** is made up of an **elusive matter** called **dark matter.**

Dark Matter

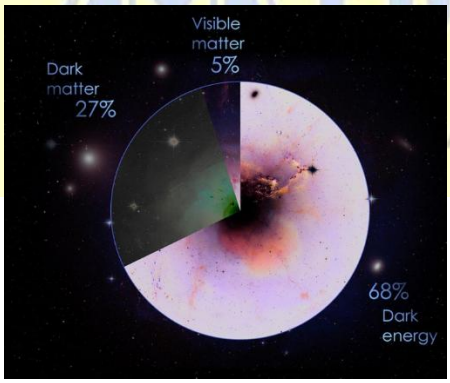
- They are named "**dark**" because **they do not emit light.**
- Dark matter **acts as an attractive force**, a kind of **cosmic mortar** that holds our **world together**.

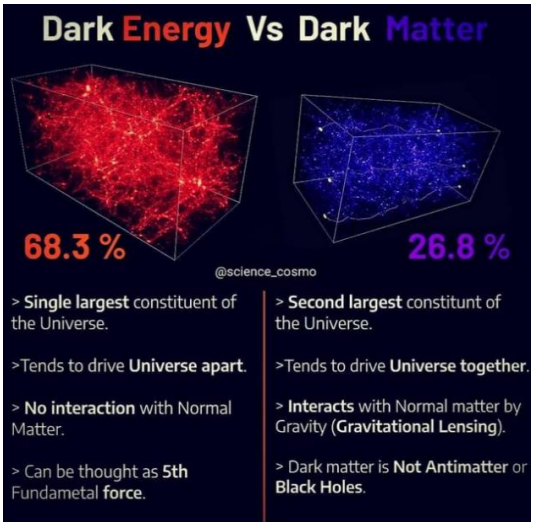
LUX-ZEPLIN experiment

- The **LUX-ZEPLIN (LZ) experiment** is one of the most advanced and sensitive efforts aimed at d**etecting dark matter particles.**
- The LZ experiment is **located 1.5 kilometers underground** at the **Sanford Underground Research Facility (SURF)** in Lead, South Dakota, **USA**.
- The **underground location shields** the **experiment from cosmic rays** and other background radiation that **could interfere** with the **detection of dark matter** particles.

Note-

- There are four fundamental forces — **gravity, electromagnetism, and the strong and weak nuclear forces.**
- Dark energy is considered **5th fundamental force.**





Q466. Evaluate the following statements:

1. Dark matter interacts with ordinary matter through gravity but does not emit, absorb, or reflect light.
2. Dark energy is hypothesized to account for the accelerated expansion of the universe.
3. The combined contribution of dark matter and dark energy constitutes about 50% of the total mass-energy of the universe.

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

Ans: b

Sol:

- **Statement 1** is correct: Dark matter interacts with ordinary matter through gravitational forces but is invisible to electromagnetic detection.
- **Statement 2** is correct: Dark energy is the mysterious force believed to drive the universe's accelerated expansion.
- **Statement 3** is incorrect: Dark matter and dark energy together account for about 95% of the universe's total mass-energy (27% dark matter and 68% dark energy). Ordinary matter constitutes only about 5%.

Q467. Evaluate the following statements:

1. The gravitational force is always attractive and acts between any two masses in the universe.
2. The strong nuclear force binds protons and neutrons together in the atomic nucleus and has the shortest range among the fundamental forces.
3. The electromagnetic force is stronger than the gravitational force but weaker than the weak nuclear force.

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

Ans: b

Sol:

- **Statement 1** is correct: The gravitational force is always attractive and acts universally

between any two masses.

- **Statement 2** is correct: The strong nuclear force binds protons and neutrons and has the shortest range (about 10^{-15} meters).
- **Statement 3** is incorrect: The electromagnetic force is one of the four fundamental forces of the universe. It is responsible for interactions between electrically charged particles and governs phenomena related to electricity, magnetism, and light. The electromagnetic force is indeed stronger than the gravitational force, but it is stronger than the weak nuclear force, not weaker. The weak nuclear force is weaker than both the strong nuclear and electromagnetic forces.

Q468. What technology does the LUX-ZEPLIN experiment use to detect dark matter particles?
(a) Liquid xenon time projection chamber
(b) Liquid argon scintillation detector
(c) Photomultiplier tubes with heavy water
(d) Large array of silicon detectors

Ans: a

Sol: The LUX-ZEPLIN experiment employs a dual-phase liquid xenon time projection chamber, which is capable of detecting faint interactions between WIMPs and xenon nuclei. This advanced technology enables precise detection of rare particle interactions. Also note the LUX-ZEPLIN experiment is designed to detect WIMPs, which are a leading candidate for dark matter. These particles are hypothesized to interact weakly with ordinary matter, making them challenging to observe directly.

Topic 157

157. Hyperandrogenism

- Modern sports is **organised on the basis of sex**, with men and women competing in different categories.
- This is **because men, on average**, have certain **physiological advantages over women**.

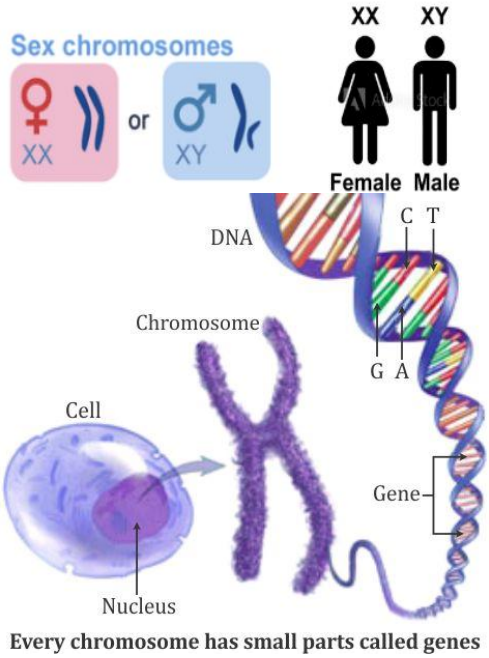
Why men have some physiological advantages over women?

- Humans have **23 pairs of chromosomes** — **22 are identical** in men and women; one, the **sex chromosome**, is different.
- The **XX sex chromosomes** result in the **development of female sex organs**, and **XY in male sex organs.**
- **The SRY gene, found on the Y chromosome, is responsible for the production of testosterone.**
- **Testosterone** is believed to be reason behind **"muscle mass and strength,** bone size and strength (density), and circulating haemoglobin giving **advantage to males in sports.**

Why in news?

- **Algeria's Imane Khelif** who won **Gold** in **women's 66 kg (welterweight) boxing** event at the **2024 Summer Olympics** was **criticised** for **hyperandrogenism** ie biological man like characteristics.

IOC "gender eligibility" determinant
- The **only determinant** for eligibility is the gender stated in an athlete's **passport.**
- **Khelif's passport** says she is **female thus eligible** for olympics.



Every chromosome has small parts called genes

Q469. Which of the following statements about sex chromosomes in humans is correct?
(a) Both males and females have identical sex chromosomes.
(b) Females have one X and one Y chromosome, while males have two X chromosomes.
(c) Females have two X chromosomes, while males have one X and one Y chromosome.
(d) The sex chromosomes are identical to the autosomes in function and structure.

Ans: c

Sol: In humans, sex chromosomes determine the biological sex. Females typically have two X chromosomes (XX), while males have one X and one Y chromosome (XY).

Q470. Evaluate the following statements about hyperandrogenism:
1. Hyperandrogenism refers to excessive levels of androgens (male hormones) in the body, primarily testosterone.
2. Hyperandrogenism is caused exclusively by genetic factors and is not linked to any medical conditions.

Which of the above statements is correct?
(a) Only statement 1
(b) Only statement 2
(c) Both statements 1 and 2
(d) Neither statement 1 nor 2

Ans: a

Sol:
- **Statement 1** is correct: Hyperandrogenism is characterized by elevated androgen levels, commonly testosterone, which can affect both males and females.
- **Statement 2** is incorrect: Hyperandrogenism can result from various medical conditions, including polycystic ovary syndrome (PCOS), adrenal hyperplasia, or certain tumors, and is not solely due to genetic factors.

Q471. Which of the following is a unique characteristic of the X chromosome compared to the Y chromosome?
(a) The X chromosome contains genes that determine only female characteristics.
(b) The X chromosome is smaller in size and carries fewer genes than the Y chromosome.
(c) The X chromosome carries many genes unrelated to sex determination, unlike the Y chromosome.
(d) The X chromosome is only present in females.

Ans: c

Sol: The X chromosome is larger and carries a variety of genes, many of which are unrelated to sex determination, such as those involved in blood clotting and colour vision. In contrast, the Y chromosome is smaller and primarily carries genes related to male sex determination.

Topic 158

158. Axiom Mission

- Axiom Mission 4 (or Ax-4) is a **private spaceflight** to the **International Space Station**.
- It is operated by **Axiom Space**.
- **Axiom Space** collaborates with **NASA** and other **space agencies like ISRO** to leverage with International Space Station (ISS).
- Axiom Mission 1, Axiom Mission 2 and Axiom Mission 3 have been already sent in the past.

Current news?

- India has selected **Group Captains Shubhanshu Shukla** and **Prasanth Balakrishnan Nair** for the upcoming **Axiom-4 mission.**
- **Group Captain Shukla** will serve as the **prime mission pilot,** with Group Captain Nair as the backup.

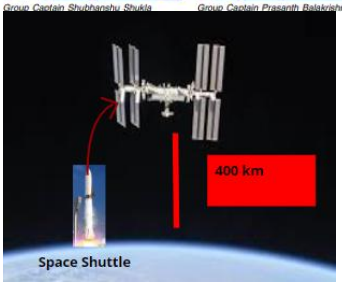
International Space Station

- **habitable satellite** -Low Earth Orbit **(about 400 km)**
- **Built by 5 space agencies- NASA(US), ROSCOSMOS(Russia), JAXA(Japan), European Space Agency (Europe), Canadian Space Agency (Canada).**
- It is always inhabited by **6 Astronauts-** to collect **information from the Universe.**
- **Space Shuttle** takes Astronauts from **Earth to Space and bring them back.**

Negative impact on their health because of two factors-

1. **Microgravity- causing loss of muscles**
2. **Solar Radiations**

Indo-US mission to Space Station



- **ISS** will **cease** operations in **2031**
- It **will fall out of orbit and plunge** into the waters of the **South Pacific Ocean- at Point Nemo**

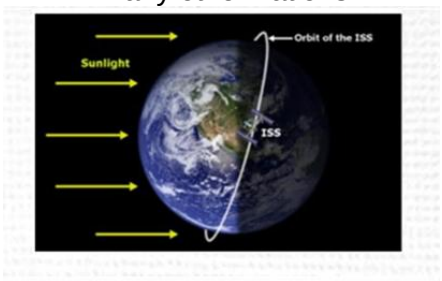
Point Nemo

- **sort of space cemetery,** where **decommissioned space debris**

- **Additional information about ISS**
  It circles the Earth in **roughly 93 minutes, completing 15.5 orbits per day.**
- Currently, the ISS has **eight solar arrays** generating about **160 kilowatts of power total.**

The station is divided into two sections:

- The **Russian Orbital Segment (ROS)** – Operated by Russia,
- The **United States Orbital Segment (USOS)** – Operated by the US as well as many other nations.



Q472. Which of the following statements accurately describes a significant aspect of Axiom Mission 4 (Ax-4)?

(a) Ax-4 will be the first mission to transport tourists to the Moon.
(b) Ax-4 includes crew members from India, Poland, and Hungary, marking each nation's first mission to the International Space Station.
(c) Ax-4 is scheduled to deploy a new space telescope into orbit.
(d) Ax-4 will be the first mission to test a reusable lunar lander.

Ans: b

Sol: Axiom Mission 4 (Ax-4) features crew members from India, Poland, and Hungary, marking each nation's first mission to the International Space Station and their second government-sponsored human spaceflight mission in over 40 years.

Q473. Evaluate the following statements:

1. The International Space Station (ISS) is a joint project involving NASA, Roscosmos, ESA, JAXA, and CSA.
2. The ISS orbits the Earth at an average altitude of approximately 400 kilometers.
3. The primary mission of the ISS is to serve as a platform for deep-space exploration beyond the Moon.

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

Ans: b

Sol:

- **Statement 1** is correct: The ISS is an international collaboration involving five major space agencies: NASA (USA), Roscosmos (Russia), ESA (Europe), JAXA (Japan), and CSA (Canada).
- **Statement 2** is correct: The ISS orbits the Earth at an altitude of approximately 400 kilometers (about 250 miles).
- **Statement 3** is incorrect: The ISS's primary mission is to conduct scientific research and technology development in low Earth orbit, not as a platform for deep-space exploration.

Deep-space missions are separate initiatives, such as NASA's Artemis program.

Q474. Evaluate the following statements:
1. Prolonged exposure to microgravity on the ISS can lead to muscle atrophy and bone density loss in astronauts.
2. Astronauts on the ISS are affected by radiation despite some protection due to the Earth's magnetic field.

Which of the above statements is correct?
(a) Only statement 1
(b) Only statement 2
(c) Both statements 1 and 2
(d) Neither statement 1 nor 2

Ans: c

Sol:
- **Statement 1** Correct-Prolonged microgravity causes muscle atrophy and bone density loss as the body adjusts to the lack of weight-bearing activities, making it essential for astronauts to exercise regularly.
- **Statement 2** Correct-While the Earth's magnetic field offers partial protection, astronauts on the ISS are still exposed to higher levels of radiation compared to those on the Earth's surface. This radiation can have cumulative health effects over time.

Topic 159

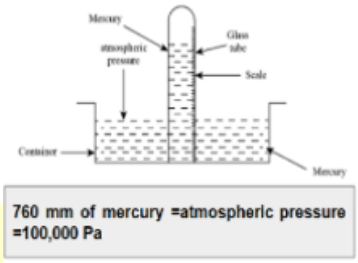
159. Physics of Pressure

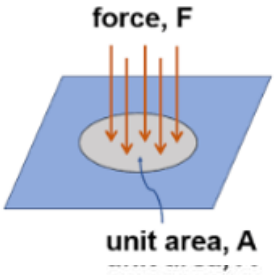
- Pressure is the **average force** spread over any **area(F/A).**
- **Unit** of pressure is **pascal (Pa)**
- All the air, on top of our heads, right up to space, exerts a **atmospheric pressure** of **100,000 Pa.**

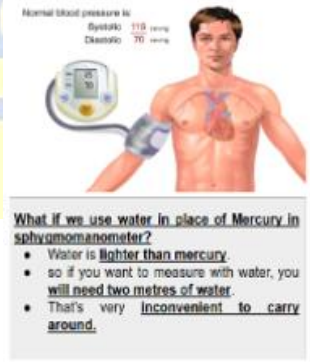
How atmospheric pressure is measured with mercury barometer?
- The glass tube is **initially filled with mercury**, and then **inverted into the container** also filled with mercury.
- This ensures that **no air is trapped** inside the tube.
- In this way **Pressure** is calculated in **millimeters (mm).**

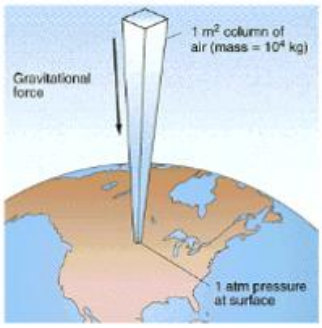
Blood pressure measurement
- **Equipment-sphygmomanometer**
- **It measures-pressure of the blood flowing in our arteries**
- The pressure in our blood is about **one-sixth** that of atmospheric pressure.
- And the **120/80** doctors say is actually 1**20 mm or 80 mm of mercury**: the former is the pressure when your **heart beats** and the latter, when your **heart rests** between beats.

Pressure cooker
- Since the **steam cannot escape** (except through the pressure regulator valve), pressure inside the cooker increases.
- The **boiling point of water rises** above its normal boiling point of **100°C (212°F) under pressure.**
- This helps in **cooking food in lesser time.**









Atmospheric pressure is the **pressure exerted** by the **weight** of the atmosphere

Q475. Evaluate the following statements:
1. Mercury is preferred over water in pressure measurement devices because its higher density allows for more compact instruments.
2. Water is more commonly used than mercury in barometers because it is safer and less toxic.

Which of the above statements is correct?

(a) Only statement 1
(b) Only statement 2
(c) Both statements 1 and 2
(d) Neither statement 1 nor 2

Ans: a

Sol:

- Statement 1 is correct: Mercury's high density (approximately 13.6 times that of water) enables pressure measurements to be conducted with much shorter columns, making the instruments more compact.
- Statement 2 is incorrect: Water is rarely used in barometers due to its lower density, which would require extremely tall columns to measure the same pressure as mercury. Additionally, mercury is commonly used despite its toxicity because it does not evaporate easily and provides precise readings.

Q476. Evaluate the following statements:
1. A sphygmomanometer measures both systolic and diastolic blood pressure.
2. The inflatable cuff in a sphygmomanometer restricts blood flow in the vein to facilitate measurement.

Which of the above statements is correct?
(a) Only statement 1
(b) Only statement 2
(c) Both statements 1 and 2
(d) Neither statement 1 nor 2

Ans: a

Sol:

- **Statement 1** is correct: The sphygmomanometer measures both systolic and diastolic blood pressure, which are critical parameters in assessing cardiovascular health.
- **Statement 2** is incorrect: The inflatable cuff restricts blood flow in the artery, not the vein, to measure the pressure exerted by the blood as the heart beats and relaxes.

Q477. Evaluate the following statements:
1. A pressure cooker increases the boiling point of water by trapping steam, which allows food to cook slower.
2. The pressure cooker works by decreasing the internal pressure, which reduces cooking time.

Which of the above statements is correct?
(a) Only statement 1
(b) Only statement 2
(c) Both statements 1 and 2
(d) Neither statement 1 nor 2

Ans: d

Sol:

- Statement 1 is incorrect: While a pressure cooker increases the boiling point of water, it does so by increasing steam pressure. This leads to higher cooking temperatures and faster cooking.
- Statement 2 is incorrect: The pressure cooker works by increasing internal pressure, not decreasing it, to raise the boiling point and reduce cooking time.

Topic 160

160. Sucralose as a Sugar Substitute

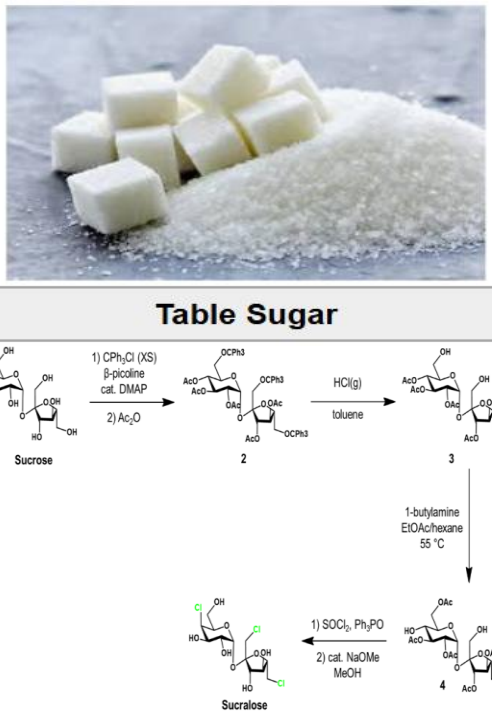
What is Sucralose?

- A **zero-calorie** artificial sweetener
- Used as a **sugar substitute** in a variety of food and beverage products.
- It is about **600 times sweeter** than sucrose (table sugar).
- Chemically, sucralose is **derived from sucrose**.
- It remains exceptionally **stable under heat** and across a **range of pH levels**.
- This allows it to be **used** in both **cooking** and **baking** **without losing its sweetness**.
- World Health Organization **(WHO)** have deemed it **safe for consumption**.

Concerns

- Some research has raised concerns about **potential effects** on **gut health and metabolism.**

Sucralose



What is sucrose?

- Sucrose, commonly known as **table sugar.**
- It is a **naturally occurring carbohydrate** found in many plants.
- **Sucralose can be derived** from **Sucrose** through **chain of chemical reactions.**

Q478. Here is sucralose commonly used?
(a) As a flavor enhancer in savory foods
(b) In medicines as a thickening agent
(c) In sugar-free beverages and baked goods
(d) As a stabilizer in dairy products

Ans: c

Sol: Sucralose is widely used in sugar-free products like beverages, baked goods, and candies due to its intense sweetness, zero-calorie nature, and stability under heat.

Q479. Evaluate the following statements:
1. Sucrose is a natural sugar, while sucralose is an artificial sweetener derived from sucrose.
2. Both sucrose and sucralose provide the same amount of calories per gram when consumed.

Which of the above statements is correct?
(a) Only statement 1
(b) Only statement 2
(c) Both statements 1 and 2
(d) Neither statement 1 nor 2

Ans: a

Sol:

- **Statement 1** is correct: Sucrose is a naturally occurring sugar found in plants like sugarcane and sugar beets, while sucralose is an artificial sweetener chemically modified from sucrose to enhance sweetness and eliminate calorie contribution.
- **Statement 2** is incorrect: Sucrose provides 4 calories per gram, while sucralose is non-caloric because it is not metabolized by the body.

Q480. Evaluate the following statements about sucrose:
1. Sucrose is a disaccharide composed of glucose and fructose.
2. Sucrose is naturally found in plants such as sugarcane and sugar beets.
3. Sucrose is used as a low-calorie sweetener in sugar-free products.

How many of the above statements are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

Ans: b

Sol:

- **Statement 1** is correct: Sucrose is a disaccharide made up of one molecule of glucose and one molecule of fructose linked by a glycosidic bond.
- **Statement 2** is correct: Sucrose is naturally occurring and is extracted from plants like sugarcane and sugar beets for commercial use.
- **Statement 3** is incorrect: Sucrose is a high-calorie sweetener and is not used in sugar-free products. Artificial sweeteners like sucralose or stevia are used for sugar-free options.

Day 17

Topic 161

161. Rashtriya Vigyan Puraskar

- A **newly instituted** set of **national awards** in India.
- **First** announced in **2024.**

The awards are categorized into four main types:

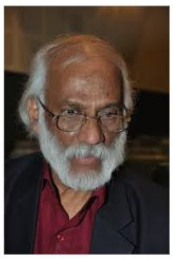
1. **Vigyan Ratna**
- Recognizing lifetime achievements in science and technology.

2. Vigyan Shri
- Acknowledging distinguished contributions in science and technology.Upto 25 awards a year.

3. **Vigyan Yuva**
- Encouraging young scientists under the age of 45 for exceptional contributions.Upto 25 awards a year.

4. Vigyan Team
- Awarding teams of three or more scientists or innovators for their collaborative work.

Rashtriya Vigyan Puraskar 2024
- **Vigyan Ratna Puraskar-Dr. Govindarajan Padmanabhan(**biochemist)
- **Vigyan Team** -team behind the **Chandrayaan-3**
- **18 Vigyan Yuva Puraskars(**Important-**Dr. Roxy Mathew Koll** for Climate Science/**Prof. Vivek Polshettiwar**-carbon capture technologies)
- **13 Vigyan Shri** (**Prof. Naba Kumar Mondal** for his contributions to particle physics/**Prof. Annapurni Subramaniam** for her work in astrophysics)



Dr. Govindarajan Padmanabhan

Massive effort: Some members of the jubilant Chandrayaan-3 team with ISRO Chairman S. Somanath. FILE PHOTO

- The awards will be presented on **National Space Day.**

National Space Day
- National Space Day is celebrated annually on **August 23**.
- The day commemorates the **successful landing of the Chandrayaan-3 mission.**

Q481. Consider the following statements regarding the Categories of Rashtriya Vigyan Puraskar:
1. Vigyan Ratna recognizes lifetime achievements in science and technology.
2. Vigyan Shri awards are limited to five recipients per year.
3. Vigyan Yuva is awarded to scientists under the age of 45 for exceptional contributions.
4. Vigyan Team is awarded to groups of three or more for collaborative scientific work.
How many of the above statements are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: Vigyan Ratna is awarded for lifetime achievements in science and technology.
Statement 2 is incorrect: Vigyan Shri is awarded to up to 25 recipients per year, not limited to five.
Statement 3 is correct: Vigyan Yuva is specifically aimed at encouraging young scientists under 45 for their contributions.
Statement 4 is correct: Vigyan Team is awarded to groups of three or more scientists or innovators for collaborative efforts.
Thus, three statements are correct.

Q482. Which of the following statements about the Rashtriya Vigyan Puraskar 2024 awardees is/are correct?
1. Dr. Govindarajan Padmanabhan, a biochemist, was the recipient of the Vigyan Ratna Puraskar.
2. The team behind Chandrayaan-3 was awarded the Vigyan Team Puraskar.
3. Dr. Roxy Mathew Koll and Prof. Vivek Polshettiwar received the Vigyan Shri Puraskar.
4. Prof. Annapurni Subramaniam was recognized for her work in astrophysics under the Vigyan Yuva Puraskar category.
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2 and 4 only
(d) 1, 3, and 4 only

Ans: a

Sol: Statement 1 is correct: Dr. Govindarajan Padmanabhan received the Vigyan Ratna Puraskar for his lifetime contributions in biochemistry.

Statement 2 is correct: The team behind Chandrayaan-3 was awarded the Vigyan Team Puraskar.
Statement 3 is incorrect: Dr. Roxy Mathew Koll and Prof. Vivek Polshettiwar received the Vigyan Yuva Puraskar, not Vigyan Shri.
Statement 4 is incorrect: Prof. Annapurni Subramaniam was awarded the Vigyan Shri Puraskar for her work in astrophysics, not the Vigyan Yuva Puraskar.
Thus, only statements 1 and 2 are correct.

Q483. Consider the following statements about the Vigyan Yuva Puraskar:
1. It is aimed at recognizing contributions from young scientists under the age of 45.
2. In 2024, exactly 25 Vigyan Yuva Puraskars were awarded.
3. The award encourages contributions in emerging fields like climate science and carbon capture technologies.
4. It can be awarded to teams of scientists under the age of 45.
Which of the statements given above are correct?
(a) 1 and 3 only
(b) 1, 2, and 3 only
(c) 1, 3, and 4 only
(d) All four

Ans: a

Sol: Statement 1 is correct: Vigyan Yuva Puraskar recognizes exceptional contributions from scientists below 45 years of age.
Statement 2 is incorrect: In 2024, 18 Vigyan Yuva Puraskars were awarded, not 25.
Statement 3 is correct: Recipients in 2024 included Dr. Roxy Mathew Koll for climate science and Prof. Vivek Polshettiwar for carbon capture technologies, showcasing the focus on emerging fields.
Statement 4 is incorrect: The Vigyan Yuva Puraskar is awarded to individual scientists, not teams.
Thus, statements 1 and 3 are correct.

Topic 162

162. BPal

- **Tuberculosis (TB)**-caused by a bacterium-**Mycobacterium**
- **mainly affects lungs.**
- **DoTS** programme is run by government-**free medicine** is provided to **TB patients.**
- **National TB elimination Programme is to eliminate TB by 2025.**

(Read it in line with topic 18 of Day 2)

- Bacillus Calmette-Guérin **(BCG) Vaccine-currently only licensed TB vaccine**.
- India has the **world's largest tuberculosis cases.**

Current news?

- India is preparing to **introduce a new treatment** regimen called **BPaL** for **multi-drug-resistant tuberculosis (MDR-TB)** and extensively drug-resistant tuberculosis **(XDR-TB)** patients.

BPal

- **B** for **bedaquiline,**
- **Pa** for **Pretomanid**
- **L** for **Linezolid.**
- **6-month oral regimen** (compared to **older regimens** that took **18–24 months)**
- developed by **TB Alliance**- (a not-for-profit product development partnership).
- BPaL is **endorsed** by the World Health Organization **(WHO)**

Q484. Consider the following statements regarding Tuberculosis (TB):
1. TB is caused by a bacterium called Mycobacterium tuberculosis and mainly affects the lungs.
2. India has the highest burden of tuberculosis cases in the world.
3. The Bacillus Calmette-Guérin (BCG) vaccine is currently the only licensed vaccine for TB.
4. The National TB Elimination Programme aims to eradicate TB globally by 2025.
How many of the statements given above are correct?

(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: TB is caused by Mycobacterium tuberculosis and primarily affects the lungs, though it can affect other parts of the body.
Statement 2 is correct: India indeed has the world's largest number of TB cases.
Statement 3 is correct: The BCG vaccine is the only licensed vaccine currently available for TB.
Statement 4 is incorrect: The National TB Elimination Programme aims to eliminate TB in India by 2025, not globally.
Thus, three statements are correct.

Q485. Which of the following statements about the BPaL regimen is/are correct?
1. The regimen is designed for treating both multi-drug-resistant (MDR-TB) and extensively drug-resistant (XDR-TB) tuberculosis patients.
2. BPaL includes bedaquiline, pretomanid, and linezolid and is administered over six months.
3. BPaL is developed by the TB Alliance and is endorsed by the World Health Organization (WHO).
4. Unlike older regimens, BPaL involves injectable medicines.
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2 and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: The BPaL regimen is designed for treating MDR-TB and XDR-TB patients.
Statement 2 is correct: BPaL comprises bedaquiline (B), pretomanid (Pa), and linezolid (L) and is a six-month oral regimen.
Statement 3 is correct: The regimen was developed by the TB Alliance, a not-for-profit partnership, and has WHO endorsement.
Statement 4 is incorrect: BPaL is an oral regimen, unlike older injectable regimens.
Thus, statements 1, 2, and 3 are correct.

Q486. Consider the following statements regarding TB control programmes in India:
1. The DoTS programme provides free medicine to TB patients in India.
2. India is preparing to introduce the BPaL regimen as a replacement for the BCG vaccine.
3. The National TB Elimination Programme aims to eliminate TB in India by 2025.
Which of the statements given above is/are correct?
(a) 1 and 3 only
(b) 1 and 2 only
(c) 2 and 3 only
(d) All three

Ans: a

Sol: Statement 1 is correct: The Directly Observed Treatment, Short-course (DoTS) programme provides free medicine to TB patients in India.
Statement 2 is incorrect: The BPaL regimen is a treatment for drug-resistant TB and does not replace the BCG vaccine, which is for TB prevention.
Statement 3 is correct: The National TB Elimination Programme aims to eliminate TB in India by 2025 as part of its national health goals.
Thus, statements 1 and 3 are correct.

Topic 163

163. Wolbachia method for Dengue control

Dengue

- caused by the **dengue virus (DENV).**
- transmitted to **humans** through the **bites of infected female Aedes aegypti mosquitoes.**
- **Cause-**dengue **hemorrhagic fever**
- **common** in **tropical and subtropical climates.**
- There is **no specific treatment for dengue**. (low fatality rate if symptoms are managed well).
- **Brazil** is the country with the **highest number of dengue cases**.

wMel strategy for Dengue control

- In the **wMel strategy**, **Aedes aegypti mosquitoes are deliberately infected** with **wMel strain** of **Bacteria Wolbachia**.

- This bacterium **affects the mosquitoes' ability** to **transmit viruses** causing **dengue or other disease**.
- The wMel strategy has been **successfully applied in Singapore.**

Wolbachia Bacterium

- A **naturally occurring** bacterium that is **found** in many **insect species** but **not** originally **in the Aedes aegypti mosquito** (primary vector for dengue, chikungunya, Zika).

Q487. Consider the following statements about Dengue:
1. Dengue is caused by a virus and transmitted to humans by female Aedes aegypti mosquitoes.
2. Dengue hemorrhagic fever is a severe form of the disease commonly found in temperate climates.
3. There is no specific treatment for dengue, but proper management of symptoms can significantly lower fatality rates.
4. Brazil is the country with the highest number of dengue cases globally.
How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: Dengue is caused by the dengue virus (DENV) and transmitted by infected female Aedes aegypti mosquitoes.
Statement 2 is incorrect: Dengue haemorrhagic fever is common in tropical and subtropical climates, not temperate regions.
Statement 3 is correct: There is no specific antiviral treatment for dengue, but managing symptoms can significantly reduce fatalities.
Statement 4 is correct: Brazil has the highest number of dengue cases globally.
Thus, three statements are correct.

Q488. Which of the following statements about the wMel strategy for dengue control is/are correct?
1. The wMel strategy involves infecting Aedes aegypti mosquitoes with the wMel strain of the Wolbachia bacterium.
2. The Wolbachia bacterium enhances the mosquitoes' ability to transmit the dengue virus.
3. The wMel strategy has been successfully applied in Singapore.
4. Wolbachia bacteria naturally occur in Aedes aegypti mosquitoes.
(a) 1 and 3 only
(b) 1, 2, and 3 only
(c) 2 and 4 only
(d) 1, 3, and 4 only

Ans: a

Sol: Statement 1 is correct: The wMel strategy involves infecting Aedes aegypti mosquitoes with

the wMel strain of Wolbachia bacterium, reducing their ability to transmit dengue.
Statement 2 is incorrect: Wolbachia bacteria reduce the mosquitoes' ability to transmit viruses, including dengue, not enhance it.
Statement 3 is correct: The wMel strategy has been successfully implemented in Singapore for dengue control.
Statement 4 is incorrect: Wolbachia bacteria are not naturally present in Aedes aegypti mosquitoes; they must be deliberately introduced.
Thus, statements 1 and 3 are correct.

Q489. Consider the following statements about Wolbachia bacterium:
1. Wolbachia is a naturally occurring bacterium found in many insect species.
2. The bacterium is not naturally present in Aedes aegypti mosquitoes, the primary vector of dengue.
3. Wolbachia affects Aedes aegypti mosquitoes' ability to transmit viruses such as dengue, chikungunya, and Zika.
4. Wolbachia is directly lethal to mosquitoes, reducing their population.
Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: Wolbachia is a naturally occurring bacterium found in many insect species, though not in Aedes aegypti.
Statement 2 is correct: Wolbachia is not naturally present in Aedes aegypti mosquitoes and must be introduced deliberately.
Statement 3 is correct: Wolbachia infection affects the mosquito's ability to transmit viruses like dengue, chikungunya, and Zika.
Statement 4 is incorrect: Wolbachia does not directly kill mosquitoes but interferes with their ability to transmit viruses.
Thus, statements 1, 2, and 3 are correct.

Topic 164

164. Small Satellite Launch Vehicle

- India's **indigenous satellite launch vehicle program** was initiated by **Dr. Vikram Sarabhai** in the **1960s.**
- **Dr Sarabhai** was instrumental in establishment **of INCOSPAR** in **1962,** which became **ISRO in 1969.**
- **In 1967** ISRO (then INCOSPAR) launched its **first Sounding Rocket RH-75.**
- Sounding rockets are **suborbital rockets** designed to **carry scientific instruments** and experiments **into the upper atmosphere** or near space (100 km from Earth's surface- Known as **Karman line**)
- In **1980, first indigenous satellite** launch vehicle, **SLV-3**, successfully launched the **Rohini Satellite (RS-1)** into **orbit** of Earth.

Small Satellite Launch Vehicle

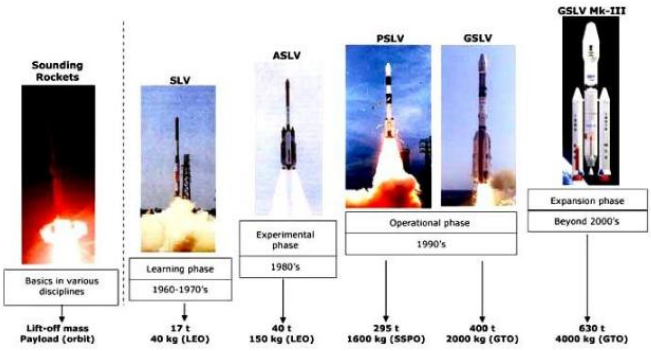
- A **compact launch vehicle** developed by the Indian Space Research Organisation **(ISRO)**.
- It is designed to carry **small payloads** into low Earth orbit **(LEO).**
- It is a **three-stage vehicle**, with all stages being **solid propulsion-based.**

Benefits

1. **Commercial contracts for ISRO**
2. **Strategic-border defence and intelligence purposes**

Current news?

- ISRO successfully launched the **third and final developmental test flight** of the **Small Satellite Launch Vehicle (SSLV).**
- **NewSpace India Limited (NSIL),** ISRO's commercial arm, and India's private space industry can now produce SSLVs for **commercial missions.**



Evolution of Launch Vehicles of India

1. **Augmented Satellite Launch Vehicle**
2. **Polar Satellite Launch Vehicle (PSLV)**
3. **Geosynchronous Satellite Launch Vehicle (GSLV)**
4. **Small Satellite Launch Vehicle (SSLV)-recent**
5. **Reusable Launch Vehicle-recent**

Q490. Consider the following statements about India's space program:
1. Dr. Vikram Sarabhai was instrumental in establishing INCOSPAR, which later became ISRO in 1969.
2. The first indigenous satellite launch vehicle, SLV-3, launched the Rohini Satellite into orbit in 1980.
3. Sounding rockets like RH-75 are orbital rockets designed to place satellites into Earth's orbit.
Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) All three

Ans: a

Sol: Statement 1 is correct: Dr. Vikram Sarabhai established INCOSPAR in 1962, which became ISRO in 1969.
Statement 2 is correct: The SLV-3 successfully launched the Rohini Satellite (RS-1) into orbit in 1980, marking a milestone in India's space program.
Statement 3 is incorrect: Sounding rockets like RH-75 are suborbital rockets designed to carry scientific instruments into the upper atmosphere or near space, not to place satellites into orbit.
Thus, statements 1 and 2 are correct.

Q491. Which of the following statements about the Small Satellite Launch Vehicle (SSLV) is/are correct?
1. The SSLV is a compact, three-stage vehicle, with all stages being solid propulsion-based.
2. The SSLV is designed to carry small payloads into low Earth orbit (LEO).
3. It enables India's private space industry to participate in commercial satellite launches.
4. The SSLV has replaced the PSLV for all of ISRO's commercial missions.
(a) 1, 2, and 3 only
(b) 1 and 2 only
(c) 3 and 4 only
(d) All four

Ans: a

Sol: Statement 1 is correct: The SSLV is a three-stage vehicle with all stages using solid propulsion.
Statement 2 is correct: It is designed to carry small payloads into low Earth orbit (LEO), making it suitable for commercial and strategic applications.
Statement 3 is correct: New Space India Limited (NSIL) and private space companies can now produce SSLVs for commercial missions, expanding India's private space industry.
Statement 4 is incorrect: The SSLV has not replaced the PSLV; the PSLV continues to be used for launching medium-sized payloads and specialized missions.
Thus, statements 1, 2, and 3 are correct.

Q492. Consider the following statements regarding the evolution of launch vehicles in India:
1. The Polar Satellite Launch Vehicle (PSLV) was developed after the Augmented Satellite Launch Vehicle (ASLV).
2. The Geosynchronous Satellite Launch Vehicle (GSLV) is primarily used for launching payloads into geostationary orbit.
3. The Reusable Launch Vehicle (RLV) is an older program and was replaced by the SSLV.
4. The SSLV is the latest addition to ISRO's operational launch vehicles.
How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

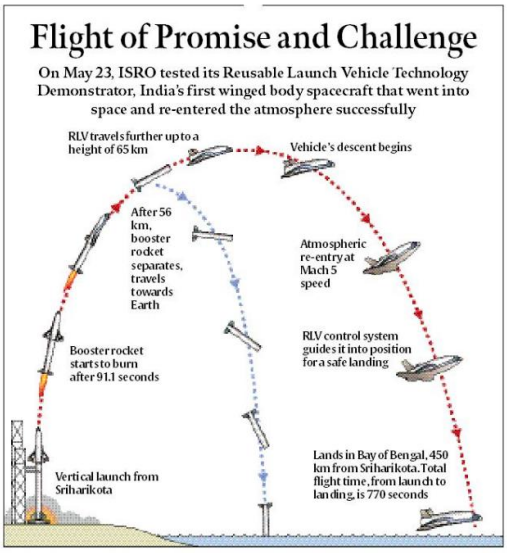
Ans: b

Sol: Statement 1 is correct: The PSLV was developed after the ASLV in the timeline of India's launch vehicle evolution.
Statement 2 is correct: The GSLV is used for placing payloads into geostationary orbit, as indicated by its name.
Statement 3 is incorrect: The Reusable Launch Vehicle (RLV) is a recent program, not replaced by the SSLV. It aims to create a cost-effective, reusable launch system.
Statement 4 is incorrect: While the SSLV is recent, it is not the latest addition as the Reusable Launch Vehicle (RLV) program is still under development.
Thus, two statements (1 and 2) are correct.

Topic 165

165. Reusable launch vehicle (RLV)

- Reusable launch vehicle (RLV) means a launch vehicle that is **designed to return** to Earth after **launching satellite.**
- Currently RLV of ISRO is in **test mode.**
- **Hence it is known as RLV-TD** (Reusable launch vehicle-Technology Demonstrator).
- **In June 2024** third and final test in the series of landing experiment (LEX-03) was conducted in Chitradurga, Karnataka.



Third and final test of RLV TD

- The **winged vehicle, named 'Pushpak',** was released from an Indian Air Force Chinook Helicopter at an **altitude** of **4.5 km** "from a release point **4.5 km away from the runway.**

Q493. Consider the following statements about Reusable Launch Vehicles (RLVs):
1. RLVs use two stages for propulsion, with the first stage being reusable after maintenance.
2. The aerodynamic lift-to-drag (L/D) ratio of RLVs is higher than that of conventional rockets.
3. RLVs can reduce launch costs by nearly 80% compared to conventional launch vehicles.
4. They serve as a foundation for technologies such as air-breathing propulsion and hypersonic flight.
How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: ISRO's RLV uses two stages for propulsion, with the first stage capable of re-entering the atmosphere, landing autonomously, and being reused after maintenance.
Statement 2 is incorrect: RLVs have a low lift-to-drag (L/D) ratio, which means they generate less lift relative to aerodynamic drag.
Statement 3 is correct: RLVs can reduce launch costs by nearly 80%, making space launches significantly more cost-effective.
Statement 4 is correct: RLVs lay the foundation for advanced technologies like hypersonic flight, air-breathing propulsion, and autonomous landing systems.
Thus, three statements are correct.

Q494. Which of the following statements regarding ISRO's RLV development is/are correct?
1. ISRO began working on winged reusable rockets in 2010, aiming to achieve a two-stage-to-orbit (TSTO) system.
2. The first successful autonomous landing of an RLV occurred in 2016 in the Bay of Bengal.
3. The Orbital Re-entry Experiment (ORE) aims to test autonomous runway landings for an RLV equipped with landing gear.
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) All three

Ans: b

Sol: Statement 1 is correct: ISRO began developing winged reusable rockets in 2010 as part of its two-stage-to-orbit (TSTO) system initiative.

Statement 2 is incorrect: While ISRO successfully conducted hypersonic flight tests in 2016, the first autonomous landing test of an RLV was completed in 2023 during the RLV LEX mission.
Statement 3 is correct: The Orbital Re-entry Experiment (ORE) involves testing a runway landing for an RLV equipped with landing gear after its return from orbit.
Thus, statements 1 and 3 are correct.

Q495. Consider the following statements about ISRO's RLV Landing Experiment (LEX) missions:
1. The RLV LEX-03 mission simulated high-speed landing conditions for a vehicle returning from space.
2. The LEX missions were accomplished through collaboration between the Vikram Sarabhai Space Centre (VSSC) and the Indian Institute of Space Science and Technology (IIST).
3. RLV LEX-03 reaffirmed ISRO's expertise in autonomous landing technologies under challenging conditions.
4. The RLV LEX-03 mission was conducted at the Aeronautical Test Range (ATR) in Chitradurga, Karnataka.
Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 3, and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: The RLV LEX-03 mission successfully simulated high-speed landing conditions for a vehicle returning from space.
Statement 2 is incorrect: The LEX missions were accomplished through collaboration between the Vikram Sarabhai Space Centre (VSSC), Liquid Propulsion System Centre (LPSC), and ISRO Inertial Systems Unit (IISU), not IIST.
Statement 3 is correct: The RLV LEX-03 mission demonstrated ISRO's expertise in autonomous landing technologies under challenging release conditions.
Statement 4 is correct: The RLV LEX-03 mission was conducted at the Aeronautical Test Range (ATR) in Chitradurga, Karnataka.
Thus, statements 1, 3, and 4 are correct.

Topic 166

166. Aditya L1

- **First Indian space mission** to **observe the Sun** and the **solar corona, photosphere, chromosphere, solar emissions, solar winds and flares,** and **Coronal Mass Ejections (CMEs).**
- it will **make observations** of the Sun for the **next five years.**

Lagrange Point

- **Aditya L1 mission** is placed at **Lagrange point L1.**
- **Lagrange points,** are locations in space where objects can **stay** in position **relative to another, larger body** since gravitational forces **counteract over each other.**

Important payloads

1. ASPEX payload

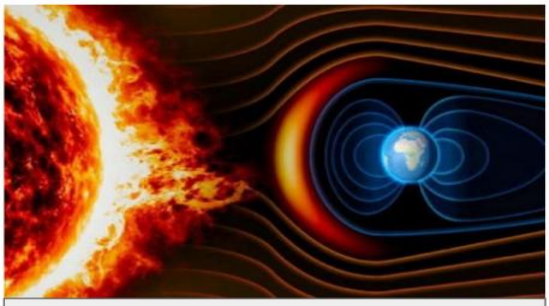
- ASPEX payload of Aditya-L1 spacecraft recorded high-speed solar wind, high-temperature plasma, and energetic ion flux.

2. SoLEXS and HEL1OS payload

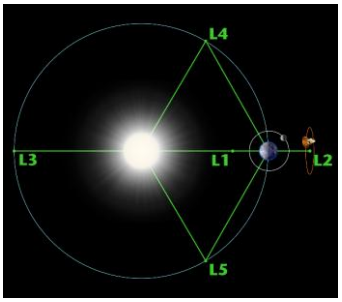
- These are X-ray instruments on-board Aditya-L1.
- captured the powerful X-ray flares.

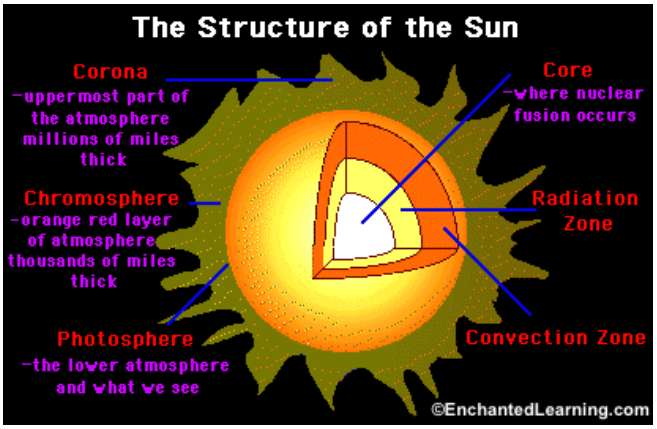
Other payloads

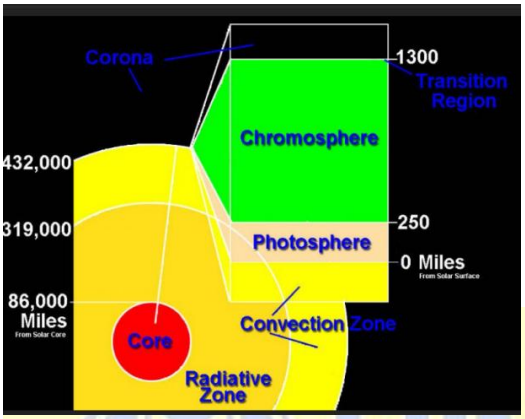
- **Visible Emission Line Coronagraph** (VELC),
- **Solar Ultraviolet Imaging Telescope (SUIT),**
- **X-ray Spectrometer (XSM),**
- **Plasma Analyser Package for Aditya (PAPA)**



Solar storms are **magnetic plasma(ionised gas) ejected** at great speed from the **solar surface.**







Sun's atmosphere

- Photosphere
- Chromosphere
- Corona-The corona region of Sun mainly contains-Plasma (an electrically charged gas)

Q496. Consider the following statements about the Aditya-L1 mission:
1. Aditya-L1 is India's first space-based solar observatory.
2. The mission aims to study the Sun's photosphere, chromosphere, and corona.
3. Aditya-L1 was launched into a Low Earth Orbit (LEO).
Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: a

Sol: Statements 1 and 2 are correct. Aditya-L1 is indeed India's first space-based solar observatory, and it aims to study the Sun's photosphere, chromosphere, and corona. Statement 3 is incorrect because Aditya-L1 was not launched into a Low Earth Orbit; instead, it was placed in a halo orbit around the Sun-Earth Lagrange point 1 (L1), approximately 1.5 million kilometers from Earth.

Q497. Which of the following instruments are part of the Aditya-L1 payload?
1. Visible Emission Line Coronagraph (VELC)
2. Solar Ultraviolet Imaging Telescope (SUIT)
3. X-ray Spectrometer (XSM)
4. Plasma Analyser Package for Aditya (PAPA)
Select the correct answer using the codes given below:
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 1, 2, and 4 only
(d) 1, 2, 3, and 4

Ans: d

Sol: All four instruments listed are part of the Aditya-L1 payload. The Visible Emission Line Coronagraph (VELC) is designed to study the solar corona. The Solar Ultraviolet Imaging Telescope (SUIT) will observe the Sun's photosphere and chromosphere in the ultraviolet spectrum. The X-ray Spectrometer (XSM) will measure the X-ray emissions from the Sun. The Plasma Analyser Package for Aditya (PAPA) is intended to study the solar wind and its composition.

Q498. Which of the following objectives are associated with the Aditya-L1 mission?
1. To study coronal mass ejections (CMEs) and their origins.
2. To observe the dynamics of the Sun's chromosphere and corona.
3. To analyze the impact of solar activities on Earth's climate.
4. To explore the surface of Mars.
Select the correct answer using the codes given below:
(a) 1, 2, and 3 only
(b) 2 and 4 only
(c) 1 and 4 only
(d) 1, 2, 3, and 4

Ans: a

Sol: Objectives 1, 2, and 3 are associated with the Aditya-L1 mission. The mission aims to study

coronal mass ejections (CMEs) and their origins, observe the dynamics of the Sun's chromosphere and corona, and analyze the impact of solar activities on Earth's climate. Objective 4 is incorrect because exploring the surface of Mars is not within the scope of the Aditya-L1 mission; such exploration is conducted by missions like the Mars Orbiter Mission (Mangalyaan).

Topic 167

167. Gaganyaan TV-D1

- **Gaganyaan mission human space flight** programme, called the **Orbital Module** will have **4 Indian astronauts.**
- It will circle Earth at a **low-earth-orbit at an altitude of 300-400 km** from earth for **5-7 days.**
- First Gaganyaan **Test Vehicle (TV) Demonstration** was successfully conducted in **October 2023.**
- With the success of this mission, **India will become the 4th country** to send humans to space after the **USA, Russia, and China.**
- ISRO's **Gaganyaan mission in 2025** will be **preceded by an uncrewed mission** carrying a **female humanoid named Vyommitra.**

Humanoid Definition

- Humanoids are **robotic systems** designed to **resemble humans** in form and function, with the **ability to operate autonomously** in space.

Four astronauts-designate for Gaganyaan-

1. Group Captain Prasanth Balakrishnan Nair
2. Group Captain Ajit Krishnan
3. Group Captain Angad Pratap,
4. Wing Commander Shubhanshu Shukla

First Indian in Space

- In **1984,** Wing Commander **Rakesh Sharma** became the **first Indian in space** when he flew to the **Salyut 7 space station** on a **Soviet spacecraft.**

Prime Minister Narendra Modi with astronauts-designate (from left) Group Captains Prasanth Balakrishnan Nair, Ajit Krishnan, Angad Pratap and Wing Commander Shubhanshu Shukla at the Vikram Sarabhai Space Centre in Thiruvananthapuram on Tuesday. PTI

Q499. Who among the following is not one of the four astronauts designated for the Gaganyaan mission?
(a) Group Captain Prasanth Balakrishnan Nair
(b) Group Captain Ajit Krishnan
(c) Wing Commander Shubhanshu Shukla
(d) Group Captain Rajesh Sharma

Ans: d

Sol: The four astronauts designated for the Gaganyaan mission are:
1. Group Captain Prasanth Balakrishnan Nair
2. Group Captain Ajit Krishnan
3. Group Captain Angad Pratap
4. Wing Commander Shubhanshu Shukla
"Group Captain Rajesh Sharma" is not listed among the designated astronauts.

Q500. Consider the following statements regarding Vyommitra, the humanoid for ISRO's Gaganyaan mission:
1. Vyommitra is a female humanoid designed to simulate human functions in space.
2. It is capable of monitoring module parameters and sending alerts to the ground.
3. Vyommitra will participate in the crewed Gaganyaan mission in 2025.
Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: a

Sol: Statement 1 is correct: Vyommitra is a female humanoid designed to simulate human-like functions in space.
Statement 2 is correct: Vyommitra can monitor various module parameters, send alerts, and perform specific tasks autonomously.

Statement 3 is incorrect: Vyommitra will be part of the uncrewed Gaganyaan mission preceding the crewed mission in 2025, not the crewed mission itself.

Q501. Who was the first Indian to travel to space, and when did the mission take place?
(a) Rakesh Sharma, 1984
(b) Kalpana Chawla, 1997
(c) Sunita Williams, 2006
(d) Vikram Sarabhai, 1975

Ans: a

Sol: Rakesh Sharma was the first Indian to travel to space as part of the Soviet Union's Soyuz T-11 mission on April 3, 1984. He spent 7 days, 21 hours, and 40 minutes aboard the Salyut 7 space station. His iconic response to the then Prime Minister Indira Gandhi's question, "How does India look from space?" was, "Saare Jahan Se Achha", highlighting his pride in the country.

Topic 168

168. XPoSat

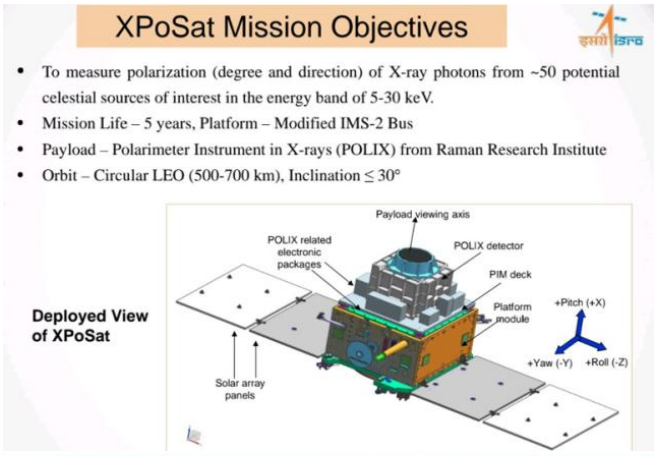
- A **space-based observation** platform
- To study **polarised X-Ray** from **bright cosmic sources**

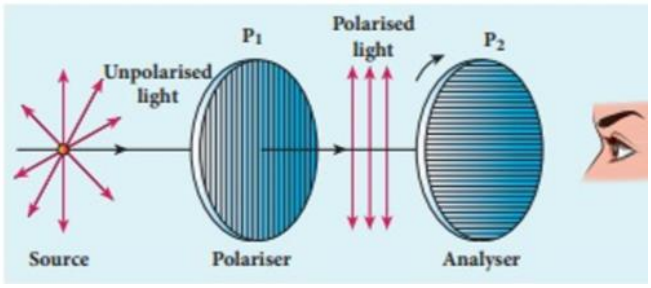
Polarisation of light:

- Light travels in the form of **transverse electromagnetic waves.**
- The light emitted by sources like the **sun, bulb, candle etc.** has vibrations in **several planes** (oscillates in all directions), and it is called **unpolarised light.**
- **Polarisation** is the phenomenon of **restricting the vibration of light** waves to **one specific direction/plane.**

Launch

- **XPoSAT** was successfully launched aboard **PSLV-C58 on 1 January 2024.**
- Following the launch, the final **4th stage** of the **PSLV dropped** to a **350 km orbit to facilitate** it's use as **PSLV Orbital Experimental Module (POEM).**





Q502. Consider the following statements regarding X-ray polarization:
1. X-ray polarization refers to the orientation of the electric field vector of X-ray photons in a specific direction.
2. The study of X-ray polarization helps in understanding the magnetic fields and emission mechanisms of high-energy astrophysical sources like black holes and neutron stars.
Which of the above statements is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: c

Sol: Statement 1 is correct: X-ray polarization measures the direction in which the electric field of an X-ray photon oscillates, providing insights into the behaviour of these photons.
Statement 2 is correct: X-ray polarization is critical for understanding the properties of high-energy sources such as black holes, neutron stars, and pulsars, as it reveals information about magnetic fields, emission mechanisms, and the geometry of the emitting regions.

Q503. Which of the following statements about XPoSat is/are correct?
1. XPoSat is India's first dedicated mission to study the polarization of X-rays from celestial sources.
2. It was launched by ISRO on January 1, 2024.
3. The mission aims to observe X-rays in the energy range of 0.1 to 10 keV.
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: a

Sol: Statements 1 and 2 are correct. XPoSat is indeed India's first dedicated mission to study the polarization of X-rays from celestial sources, and it was launched by ISRO on January 1, 2024.
Statement 3 is incorrect because XPoSat is designed to observe X-rays in the energy range of 5 to 30 keV, not 0.1 to 10 keV.

Q504. What are the primary scientific payloads onboard XPoSat?
(a) POLIX and XSPECT
(b) SUIT and VELC
(c) XSM and SXT
(d) LAXPC and CZTI

Ans: a

Sol: XPoSat carries two primary scientific payloads:
- POLIX (Polarimeter Instrument in X-rays): Designed to measure the degree and angle of polarization of X-rays in the energy range of 8 to 30 keV.
- XSPECT (X-ray Spectroscopy and Timing): Designed to provide spectroscopic information in the energy range of 0.8 to 15 keV.

Topic 169

169. Mpox a Public Health Emergency

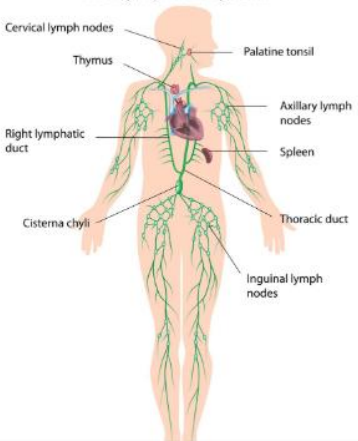
Mpox (Monkeypox)
- **viral zoonotic disease**
- **pox-like disease among monkeys** hence it is named Monkeypox.
- It is endemic to **Nigeria.**

Sources of Monkeypox virus
- **monkeys and apes, a variety of rodents (**including **rats, mice, squirrels and prairie dogs**) and rabbits.
- The disease has been reported in **mainly West and Central African countries.**

Monkeypox typically has the following symptoms:
- Fever
- Rash and swollen lymph nodes
- Headaches and nausea

How is it different from smallpox?
- Smallpox-no swelling of Lymph Nodes
- Monkeypox-swelling of Lymph Nodes

Current news
- The **World Health Organisation**, declared mpox as a **Public Health Emergency of International Concern.**



What are Lymph nodes?
- A small bean-shaped structure that is part of the body's immune system.

Q505. Which of the following animals are known sources of the Mpox virus?
1. Monkeys and apes
2. Rodents such as rats, squirrels, and prairie dogs

3. Rabbits
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: d

Sol: The Mpox virus is zoonotic and can spread from multiple animal sources, including:
- Monkeys and apes
- Rodents such as rats, mice, squirrels, and prairie dogs
- Rabbits

This highlights the broad range of potential reservoirs for the Mpox virus.

Q506. Which of the following is a key difference between Mpox (Monkeypox) and Smallpox?
(a) Mpox causes a rash, whereas Smallpox does not.
(b) Mpox is a viral disease, while Smallpox is bacterial.
(c) Mpox causes swelling of lymph nodes, whereas Smallpox does not.
(d) Mpox is more severe and has a higher fatality rate compared to Smallpox.

Ans: c

Sol: Mpox (Monkeypox) and Smallpox are both viral diseases, but a key differentiating feature is that Mpox causes swelling of lymph nodes (lymphadenopathy), which does not occur in Smallpox.
Both diseases cause a rash, and Smallpox historically had a higher fatality rate compared to Mpox.
Smallpox was eradicated in 1980, whereas Mpox continues to be reported in various regions.

Q507. Consider the following statements regarding Mpox (Monkeypox):
1. Mpox is a viral zoonotic disease primarily reported in West and Central African countries.
2. Swelling of lymph nodes is a distinguishing symptom of Mpox that differentiates it from Smallpox.
3. The World Health Organization has declared Mpox a Public Health Emergency of International Concern.
Which of the above statements is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans: d

Sol: Statement 1 is correct: Mpox is a viral zoonotic disease reported primarily in West and Central African countries.
Statement 2 is correct: Swelling of lymph nodes (lymphadenopathy) is a distinguishing feature of Mpox, whereas Smallpox does not cause lymph node swelling.
Statement 3 is correct: The World Health Organization (WHO) declared Mpox a Public Health Emergency of International Concern (PHEIC) due to its rapid spread and potential health impact.

Topic 170

170. Hayflick limit

- Hayflick limit is considered as **maximum possible human lifespan**.
- It is due to **number of times a normal human cell can divide** before it stops due to aging (**cell division** process is **known as Mitosis**).
- It is considered around **125 years.**
- Beyond this no amount of **diet, exercise, or even genetic tweaking** against diseases **can extend** the human lifespan.

Basis for Hayflick limit?
- **Maximum number** of **times a Somatic cell (non reproductive) can divide.**
- It's named after scientist **Leonard Hayflick,** who discovered this phenomenon.

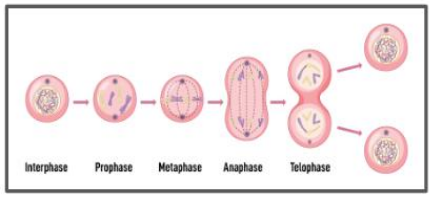
Significance of Hayflick limit?
- **Rejects** the possibility of **immortality.**
- Subsequent research further showed that the limit is **caused by telomeres,** the terminal **ends of chromosomes.**

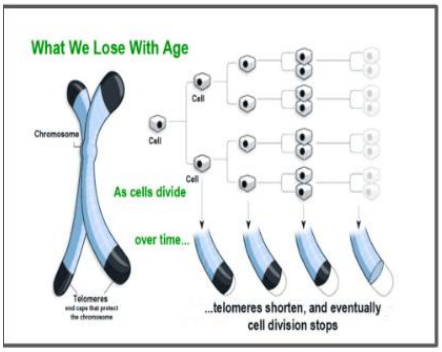
Telomeres
- Main job of **telomeres** is to **protect the DNA sequences** inside each **chromosome.**
- It has **impact** over the mitosis process due to **telomere shortening.**
- **Telomeres shorten** with each **cell division**, leading to **cellular aging.**

Current news?

- Biomedical researcher **Leonard Hayflick**, who developed **Hayflick limit**, **died** at the age of 98.

Mitosis





Q508. What does the Hayflick Limit refer to?

(a) The maximum size a cell can grow before it divides.
(b) The number of times a normal human cell can divide before it stops due to aging.
(c) The point at which a cell becomes cancerous due to mutations.
(d) The limit to which stem cells can regenerate in the human body.

Ans: b

Sol: The Hayflick Limit is the maximum number of times a normal human cell can divide (approximately 40-60 times) before reaching senescence due to the shortening of telomeres at the ends of chromosomes.

Q509. Which of the following cells can bypass the Hayflick Limit?

(a) Normal human skin cells
(b) Cancer cells
(c) Muscle cells
(d) Liver cells

Ans: b

Sol: Cancer cells bypass the Hayflick Limit by activating the telomerase enzyme, which prevents telomere shortening. This allows them to divide indefinitely, unlike normal somatic cells that are limited by telomere attrition.

Q510. Which of the following statements about telomeres is correct?

(a) Telomeres are the coding regions of DNA at the ends of chromosomes.
(b) Telomeres shorten with each cell division, leading to cellular aging.
(c) Telomeres are enzymes that repair damaged DNA sequences.
(d) Telomeres remain unchanged in all cells regardless of age or division.

Ans: b

Sol: Telomeres are non-coding, repetitive DNA sequences at the ends of chromosomes that protect them from damage.

- With each round of cell division, telomeres shorten due to the inability of DNA polymerase to completely replicate the ends of linear chromosomes.
- This shortening eventually leads to cellular aging (senescence).

Day 18

Topic 171

171. Mars Insight Lander

- **Scientists have discovered a reservoir** of **liquid water** on **Mars.**
- The liquid water is believed to exist beneath the **polar ice caps of Mars.**
- It remains in a **liquid state** due to the presence of **salts like perchlorates,** which **lower the water's freezing point.**

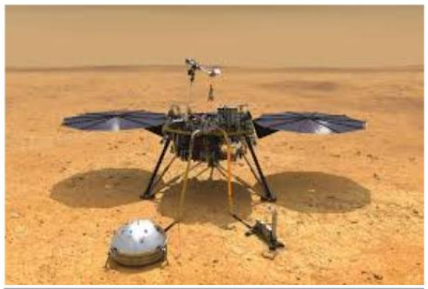
Source of this knowledge-

- **data** from **NASA's Mars Insight Lander.**

Mars Insight Lander

- Mars **lander mission** by **NASA.**
- **touched down** on the planet back in **2018** and **retired** in **December 2022**

- The lander was **equipped with a seismometer,** which recorded more than **1,300 seismic waves** — created by **Marsquakes** and **meteorite impacts.**
- **By analysing seismic waves,** scientists have concluded **presence of liquid water on Mars.**



Mars Insight Lander

Q511. Consider the following statements about the discovery of liquid water on Mars:
1. Liquid water on Mars is believed to exist beneath the polar ice caps.
2. The water remains in a liquid state due to the presence of salts like perchlorates.
3. The discovery was made using data from NASA's Mars Insight Lander.
4. Marsquakes have no role in the discovery of liquid water on Mars.

How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: Scientists have discovered liquid water beneath the polar ice caps of Mars.
Statement 2 is correct: The presence of salts like perchlorates lowers the freezing point of water, allowing it to remain in a liquid state.
Statement 3 is correct: The discovery was made using data collected by NASA's Mars Insight Lander.
Statement 4 is incorrect: Marsquakes, recorded by the Insight Lander's seismometer, were critical in analyzing seismic waves to deduce the presence of liquid water.
Thus, three statements are correct.

Q512. Which of the following statements about the Mars Insight Lander are correct?
1. The Mars Insight Lander was launched by NASA in 2018.
2. It retired in December 2022 after completing its mission.
3. The lander was equipped with a seismometer that recorded over 1,300 seismic events.
4. It was specifically designed to explore the polar regions of Mars to find evidence of liquid water.

(a) 1 and 3 only
(b) 1, 2, and 3 only
(c) 2 and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: NASA launched the Mars Insight Lander in 2018.
Statement 2 is correct: The mission concluded, and the lander retired in December 2022.
Statement 3 is correct: The lander recorded more than 1,300 seismic events, including Marsquakes and meteorite impacts, using its seismometer.
Statement 4 is incorrect: The Mars Insight Lander was not specifically designed to explore the polar regions; its focus was on understanding the interior structure and seismic activity of Mars.
Thus, statements 1, 2, and 3 are correct.

Q513. Consider the following statements regarding the use of seismic data in the discovery of liquid water on Mars:
1. The Mars Insight Lander recorded seismic waves created by Marsquakes and meteorite impacts.
2. Scientists used seismic wave analysis to infer the presence of liquid water beneath the surface of Mars.
3. The seismometer aboard the lander detected variations in wave speed and energy that hinted at subsurface water reservoirs.
4. The seismic data conclusively proved the existence of freshwater lakes on Mars.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 2, 3, and 4 only
(c) 1, 2, and 3 only
(d) All four

Ans: c

Sol: Statement 1 is correct: The Mars Insight Lander recorded seismic waves from Marsquakes and meteorite impacts, which provided critical data.
Statement 2 is correct: The presence of liquid water beneath the surface was inferred through the analysis of seismic waves.
Statement 3 is correct: Variations in seismic wave speed and energy suggested the presence of liquid water reservoirs beneath the polar ice caps.
Statement 4 is incorrect: The seismic data did not conclusively prove the existence of freshwater lakes; it pointed to brine reservoirs containing salts like perchlorates.
Thus, statements 1, 2, and 3 are correct.

Topic 172

172. 'Impact Magma Ocean' (IMO) theory

- **ISRO's Lunar mission Chandrayaan 3** successfully landed on the **South pole of Moon's surface** on **August 23,2023**.
- Chandrayaan-3 had **Lander named Vikram** and **Rover named Pragyan**.

Payloads of Chandrayaan 3-

1. **Lander Vikram**
- **RAMBHA**-study **property of ions**
- **ChaSTE**-study **thermal properties of Lunar surface**

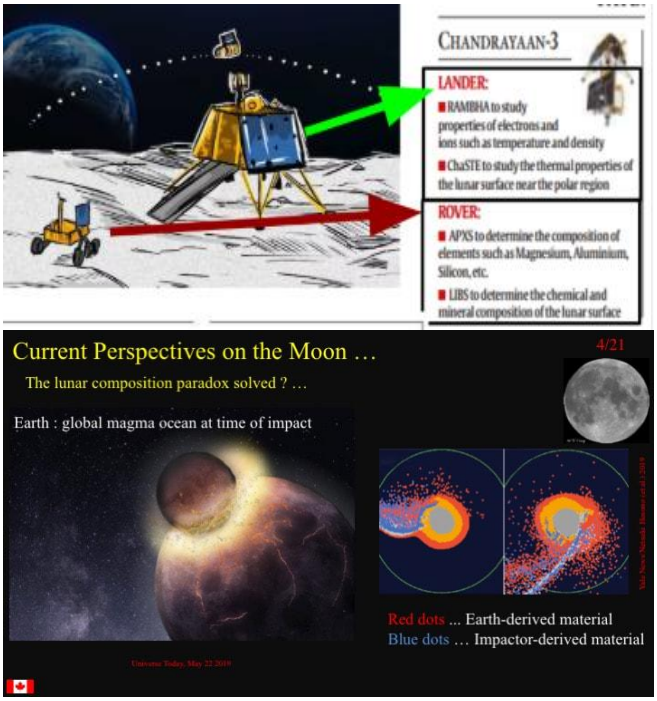
2. **Rover Pragyan**
- **APXS**-determine **composition of elements such as Magnesium,Aluminium,Silicon etc**
- **LIBS-Chemical and mineral composition** of **Lunar surface**

Current news?

- **Chandrayaan 3's APXS** results have **confirmed the presence** of magnesium-rich **magma layer** (molten rock and minerals) **within the Moon**, **in its earliest days.**
- The findings is a **strong evidence** of **'Impact Magma Ocean' (IMO)** theory about **Moon formation.**

'Impact Magma Ocean' theory of Moon formation

- According to this theory,a **large asteroid** or **planetesimal collided with the Earth,** leading to the **formation of the Moon**.
- Because of the collision the Moon's **outer layers were once fully molten,** forming what is referred to as a **"magma ocean."**
- **Later** on the Moon's surface **solidified.**



Computer Generated image to show **'Impact Magma Ocean' (IMO) theory**

Q514. Consider the following statements about Chandrayaan-3:
1. Chandrayaan-3 consisted of a lander named Vikram and a rover named Pragyan.
2. The APXS payload on Pragyan confirmed the presence of magnesium-rich magma on the Moon's surface.
3. ChaSTE is a payload on Vikram designed to study the thermal properties of the Lunar surface.
4. Chandrayaan-3 landed on the North Pole of the Moon on August 23, 2023.

How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: Chandrayaan-3 included the Vikram lander and Pragyan rover.
Statement 2 is correct: The APXS payload on Pragyan detected magnesium-rich magma, supporting the Impact Magma Ocean theory.
Statement 3 is correct: The ChaSTE payload on Vikram was designed to study the Moon's thermal properties.

Statement 4 is incorrect: Chandrayaan-3 landed on the South Pole of the Moon, not the North Pole.
Thus, three statements are correct.

Q515. Which of the following statements about the payloads of Chandrayaan-3 are correct?
1. RAMBHA, a payload on Vikram, studied the properties of ions on the Lunar surface.
2. The APXS payload on Pragyan studied the thermal properties of the Moon's surface.
3. LIBS on Pragyan determined the chemical and mineral composition of the Lunar surface.
4. ChaSTE on Vikram detected the presence of magnesium-rich magma on the Moon.

(a) 1 and 3 only
(b) 2 and 4 only
(c) 1, 2, and 3 only
(d) All four

Ans: a

Sol: Statement 1 is correct: RAMBHA on Vikram was tasked with studying the ion properties on the Moon's surface.
Statement 2 is incorrect: APXS on Pragyan determined the elemental composition (e.g., magnesium, silicon) rather than thermal properties.
Statement 3 is correct: LIBS on Pragyan analysed the chemical and mineral composition of the Moon's surface.
Statement 4 is incorrect: The presence of magnesium-rich magma was confirmed by APXS, not ChaSTE.
Thus, statements 1 and 3 are correct.

Q516. Consider the following statements regarding the 'Impact Magma Ocean' (IMO) theory:
1. The theory suggests the Moon was formed when a large asteroid or planetesimal collided with the Earth.
2. This collision caused the Moon's outer layers to become fully molten, forming a magma ocean.
3. The IMO theory is supported by Chandrayaan-3's APXS findings of magnesium-rich magma.
4. The Moon's entire surface remains molten today as evidence of the IMO theory.

Which of the statements given above are correct?

(a) 1, 2, and 3 only
(b) 1 and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: a

Sol: Statement 1 is correct: The 'Impact Magma Ocean' theory proposes that the Moon was formed after a collision between Earth and a large celestial body.
Statement 2 is correct: The impact led to the formation of a fully molten outer layer, known as a magma ocean, which later solidified.
Statement 3 is correct: Chandrayaan-3's APXS findings of magnesium-rich magma support the IMO theory.
Statement 4 is incorrect: The Moon's surface does not remain molten today; it has solidified over time.
Thus, statements 1, 2, and 3 are correct.

Topic 173

173. Fixed Dose Combination

What are Fixed Dose Combinations?

- **combinations** of **two or more** known **drugs.Example-anti-allergic medicines** with nasal decongestants.

Benefits of FDCs

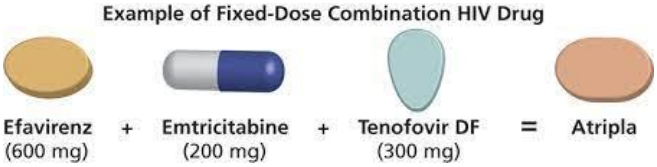
- FDCs **reduce the number of pills** to be **taken** and hence **can improve patient compliance.**
- This eventually leads to **enhanced treatment outcomes.**

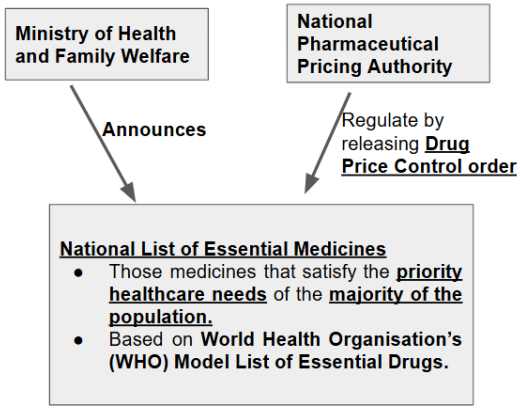
Issues with FDCs

1. **Escape Drug Price Control Order**
2. **Reduces Efficacy of Drugs**
3. **Higher Costs of Drugs**
4. **Nonsensical combination**
5. **May lead to antimicrobial resistance (AMR)**

Current news?

- The **Union Health Ministry** has **banned 156 "irrational" fixed dose combination (FDC)** drugs with immediate effect on grounds of **health risks to patients**.





Q517. Consider the following statements about Fixed Dose Combinations (FDCs):
1. FDCs combine two or more known drugs into a single formulation.
2. FDCs are commonly used to improve patient compliance by reducing the number of pills to be taken.
3. All FDCs are approved globally as they enhance treatment outcomes.
4. An example of an FDC is a combination of anti-allergic medicines with nasal decongestants.

How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: FDCs are formulations that combine two or more known drugs.
Statement 2 is correct: FDCs reduce the number of pills, improving patient compliance and enhancing treatment outcomes.
Statement 3 is incorrect: Not all FDCs are globally approved; some are banned due to health risks or irrational combinations.
Statement 4 is correct: A combination of anti-allergic medicines with nasal decongestants is an example of an FDC.
Thus, three statements are correct.

Q518. Which of the following statements about issues associated with FDCs is/are correct?
1. FDCs can reduce the efficacy of drugs when nonsensical combinations are used.
2. Some FDCs may escape the Drug Price Control Order, leading to higher costs.
3. The use of irrational FDCs can contribute to the problem of antimicrobial resistance (AMR).
4. All FDCs enhance treatment outcomes without any health risks.

(a) 1, 2, and 3 only
(b) 2 and 4 only
(c) 1 and 3 only
(d) All four

Ans: a

Sol: Statement 1 is correct: Nonsensical combinations in FDCs can reduce the efficacy of drugs.
Statement 2 is correct: Some FDCs escape the Drug Price Control Order, leading to increased costs.
Statement 3 is correct: The use of irrational FDCs can lead to antimicrobial resistance (AMR), a major global health concern.
Statement 4 is incorrect: Not all FDCs enhance treatment outcomes; some are deemed irrational and pose health risks.
Thus, statements 1, 2, and 3 are correct.

Q519. Consider the following statements about the recent developments in Fixed Dose Combination (FDC) regulation in India:
1. The Union Health Ministry recently banned 156 irrational FDC drugs.
2. These bans were implemented to mitigate health risks to patients.
3. The banned FDCs included combinations proven to enhance antimicrobial resistance.
4. The ban applies only to over-the-counter (OTC) FDC drugs and not prescription FDCs.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: The Union Health Ministry banned 156 irrational FDC drugs.
Statement 2 is correct: The ban was imposed due to the health risks posed by these drugs.

Statement 3 is correct: Some of the banned FDCs contribute to antimicrobial resistance (AMR), which is a growing concern.
Statement 4 is incorrect: The ban applies to both prescription and over-the-counter (OTC) FDCs, as irrational combinations can pose health risks regardless of their mode of sale.
Thus, statements 1, 2, and 3 are correct.

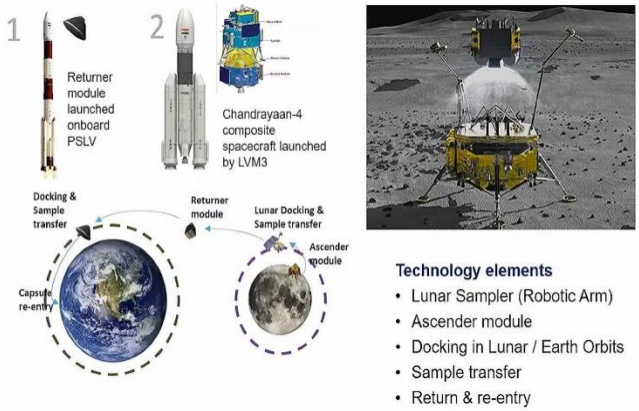
Topic 174

174. Chandrayaan 4

- **Mission goal:** To **bring back rock** and **soil samples** from the Moon to Earth.
- **Design**:The spacecraft will have **five separate modules.**
- **Two modules** will **detach** from the **main spacecraft** after landing on the Moon.
- They will **collect samples** which will be **transferred to an Earth-return vehicle,** which will be launched **separately.**
- The **Earth-return vehicle** will be a **re-entry vehicle** will bring the samples back to Earth.
- **expected launch in 2027**.
- **Chandrayaan-4** will involve a **complex docking** and **sample return mission**.
- **ISRO** will **demonstrate docking** of spacecraft in **lunar orbit for the first time**.

What is docking of spacecraft in lunar orbit?

- The docking of spacecraft in lunar orbit refers to the process of **two spacecraft meeting** and **joining together** while both are **orbiting the Moon.**



Launch vehicles-

- Composite Spacecraft-LVM3
- Returner module on PSLV

Q520. Consider the following statements about Chandrayaan-4:

1. The mission aims to return rock and soil samples from the Moon to Earth.
2. The Earth-return vehicle will detach from the main spacecraft and return samples to Earth.
3. Chandrayaan-4 will demonstrate docking of spacecraft in lunar orbit for the first time.
4. The mission is scheduled for launch in 2025.

How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: Chandrayaan-4's primary goal is to collect and return Moon rock and soil samples to Earth.
Statement 2 is correct: The Earth-return vehicle will detach from the spacecraft, carrying collected samples back to Earth.
Statement 3 is correct: Chandrayaan-4 will be ISRO's first mission to demonstrate docking of spacecraft in lunar orbit.
Statement 4 is incorrect: Chandrayaan-4 is scheduled for launch in 2027, not 2025.
Thus, three statements are correct.

Q521. Which of the following statements regarding Chandrayaan-4's spacecraft design and docking are correct?

1. The spacecraft will consist of five separate modules.
2. Two modules will detach after landing on the Moon to collect rock and soil samples.
3. Docking of spacecraft refers to the joining of two spacecraft while both are in orbit around the Moon.
4. Chandrayaan-4's docking will occur between the main spacecraft and Earth-return vehicle in Earth's orbit.

(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: Chandrayaan-4 will feature a five-module spacecraft design for its complex mission.

Statement 2 is correct: After landing, two modules will detach to collect samples from the Moon.
Statement 3 is correct: Docking refers to the joining of two spacecraft while orbiting the Moon, an essential part of this mission.
Statement 4 is incorrect: The docking will occur in lunar orbit, not Earth's orbit.
Thus, statements 1, 2, and 3 are correct.

Q522. Consider the following statements about the launch vehicles used in Chandrayaan-4:
1. The composite spacecraft will be launched using the LVM3 rocket.
2. The Earth-return module will be launched separately using the PSLV rocket.
3. Chandrayaan-4 will reuse components of Chandrayaan-3's Vikram lander and Pragyan rover for cost optimization.
4. LVM3 is a reusable rocket developed by ISRO for manned and unmanned space missions.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1, 2, and 4 only
(d) All four

Ans: a

Sol: Statement 1 is correct: The composite spacecraft of Chandrayaan-4 will be launched using the LVM3 launch vehicle.
Statement 2 is correct: The Earth-return module will be launched separately on the PSLV rocket.
Statement 3 is incorrect: Chandrayaan-4 is a distinct mission and does not reuse components of Chandrayaan-3.
Statement 4 is incorrect: While LVM3 is a versatile rocket, it is not reusable in its current design.
Thus, statements 1 and 2 are correct.

Topic 175

175. Debris-Free Space by 2030

- **ISRO** has committed to making all space missions **debris-free by 2030.**

Space Debris

- Space **Junk or debris** is human made **defunct objects** in space.
- It may be **discarded satellite, spent rocket parts, broken space crafts.**

Challenges due to Space Debris

- Space debris **destroys spacecraft and rockets** sent in the space.
- This overall leads to **increase in the cost of space missions.**

Project NETRA of ISRO

- Initiative by the Indian Space Research Organisation **(ISRO)** which is an early warning system in space to **detect debris and hazards to the Indian satellites.**
- The radar under **project NETRA** is planned at the **defunct thermal power plant site** at **Chandrapur near Guwahati.**

Kessler Syndrome or Kessler Effect

- A **theoretical scenario** proposed by NASA scientist **Donald J. Kessler.**
- A cascading **chain reaction** of **collisions of satellites** in **Earth's orbit** that could create a **dense cloud of space debris.**
- It will make **certain orbits** around Earth **unusable for satellites.**

Q523. Consider the following statements about space debris:
1. Space debris consists of defunct objects such as discarded satellites, spent rocket parts, and broken spacecraft.
2. Space debris poses significant risks to spacecraft and rockets, increasing the cost of space missions.

3. Space debris is harmless and does not pose any threat to future satellite launches.
4. The presence of space debris can lead to cascading chain reactions of collisions, as described by the Kessler Syndrome.

How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: Space debris consists of defunct human-made objects in space, including satellites and rocket parts.
Statement 2 is correct: Space debris can destroy spacecraft and rockets, increasing the costs of space missions.
Statement 3 is incorrect: Space debris poses a significant threat to satellite launches and space operations.
Statement 4 is correct: The Kessler Syndrome predicts a cascading chain reaction of satellite collisions, creating a dense cloud of space debris.
Thus, three statements are correct.

Q524. Which of the following statements about ISRO's efforts to address space debris are correct?
1. ISRO has committed to making all its space missions debris-free by 2030.
2. Project NETRA is an early warning system to detect space debris and potential hazards to Indian satellites.
3. The radar under Project NETRA is planned at a site in Chandrapur near Guwahati.
4. ISRO's Project NETRA is primarily focused on mitigating the effects of Kessler Syndrome.

(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: ISRO aims to ensure all its space missions are debris-free by 2030.
Statement 2 is correct: Project NETRA is an early warning system to monitor space debris and protect Indian satellites.
Statement 3 is correct: The radar under Project NETRA is planned at Chandrapur near Guwahati.
Statement 4 is incorrect: While Project NETRA addresses space debris, it is not specifically focused on mitigating the Kessler Syndrome but rather on detecting hazards.
Thus, statements 1, 2, and 3 are correct.

Q525. Consider the following statements about the Kessler Syndrome:
1. The Kessler Syndrome predicts a cascading chain reaction of collisions of satellites in Earth's orbit.
2. It could create a dense cloud of space debris, rendering certain orbits around Earth unusable.
3. The Kessler Effect was first proposed by NASA scientist Donald J. Kessler.
4. The Kessler Syndrome has already occurred, making several orbital paths unusable for satellite operations.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 3 and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: The Kessler Syndrome predicts a chain reaction of satellite collisions in Earth's orbit.
Statement 2 is correct: This scenario would create a dense cloud of debris, making certain orbits unusable.
Statement 3 is correct: The Kessler Effect was proposed by Donald J. Kessler, a NASA scientist.
Statement 4 is incorrect: The Kessler Syndrome is a theoretical scenario and has not yet occurred in Earth's orbit.
Thus, statements 1, 2, and 3 are correct.

Topic 176

176. Polaris Dawn Mission

- Part of the **Polaris Program led by SpaceX** and **Jared Isaacman** (billionaire entrepreneur and space enthusiast).

Objective of the mission-

1. One of the **highest human Earthorbit**
- One of the **highest Earth orbits** ever achieved by **humans** (about 700 kilometers).

2. **Spacewalk**

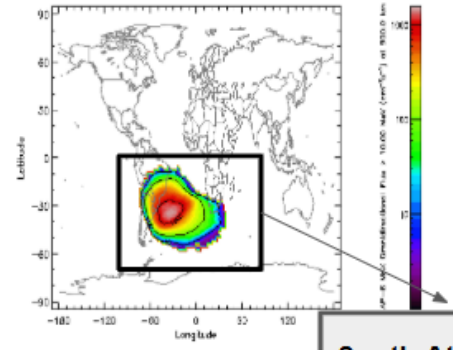
- first-ever **commercial spacewalk**
- crew members will exit the SpaceX Dragon spacecraft in **specially designed spacesuits**.

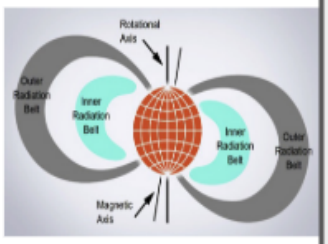
The Space walk will be **through** regions of a **highly-charged belt** of radiation known as **"Van Allen Belts"**.

- A Van Allen radiation belt is a zone of **energetic charged particles from Sun.**
- They are captured by and **held around Earth** by that **Earth's magnetic field.**

Van Allen Radiation belt can impact our life-

1. May cause **loss of contact with satellites**
2. can **hit operations of space-dependent services** like global positioning systems **(GPS), radio, and satellite communications**.
3. **Aircraft flights, power grids, and space exploration programmes** are vulnerable.





South Atlantic Anomaly

- a region where **Earth's magnetic field** is **weaker**
- Allows **charged particles** from the **Van Allen belts** to **penetrate closer** to **Earth's surface**

Q526. Consider the following statements about the Polaris Dawn Mission:

1. It is part of the Polaris Program led by SpaceX and Jared Isaacman.
2. The mission aims to achieve one of the highest human Earth orbits, approximately 700 kilometres above the surface.
3. The crew will perform the first-ever commercial spacewalk in spacesuits designed for high radiation zones.
4. The mission will focus on studying the effects of solar flares on Mars' atmosphere.

How many of the statements given above are correct?

(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: Polaris Dawn is part of the Polaris Program led by SpaceX and Jared Isaacman.
Statement 2 is correct: The mission aims to achieve a human Earth orbit of approximately 700 kilometers, one of the highest ever.
Statement 3 is correct: The crew will perform the first-ever commercial spacewalk in spacesuits designed for high-radiation environments like the Van Allen Belts.
Statement 4 is incorrect: The mission does not study solar flares' effects on Mars' atmosphere; this is not part of its objectives.
Thus, three statements are correct.

Q527. Which of the following statements about the Van Allen Belts are correct?

1. The Van Allen Belts are zones of energetic charged particles held around Earth by its magnetic field.
2. Charged particles in the belts originate from solar radiation.
3. The Van Allen Belts can disrupt satellite communications, GPS services, and power grids.
4. The Van Allen Belts primarily protect Earth from cosmic rays and meteorite impacts.

(a) 1 and 3 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: The Van Allen Belts are zones of charged particles captured by Earth's magnetic field.
Statement 2 is correct: The charged particles in the belts are mostly derived from solar radiation.
Statement 3 is correct: The belts can disrupt satellite communications, GPS services, and power grids, making them a significant concern for space missions.
Statement 4 is incorrect: While the magnetic field protects Earth, the Van Allen Belts do not directly protect against cosmic rays or meteorite impacts.
Thus, statements 1, 2, and 3 are correct.

Q528. Consider the following statements about the South Atlantic Anomaly (SAA):
1. The SAA is a region where Earth's magnetic field is weaker, allowing charged particles from the Van Allen Belts to penetrate closer to Earth's surface.
2. The SAA can disrupt satellite operations and increase radiation exposure for spacecraft passing through this region.
3. The SAA is caused by the weakening of Earth's gravitational field over the Atlantic Ocean.
4. The SAA poses challenges to space missions, especially during low Earth orbit manoeuvres.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: The South Atlantic Anomaly (SAA) is a region where Earth's magnetic field is weaker, allowing charged particles from the Van Allen Belts to come closer to the surface.
Statement 2 is correct: The SAA can disrupt satellite operations and increase radiation exposure for spacecraft passing through it.
Statement 3 is incorrect: The SAA is caused by irregularities in Earth's magnetic field, not its gravitational field.
Statement 4 is correct: The SAA poses significant challenges during low Earth orbit maneuvers, requiring careful mission planning.
Thus, statements 1, 2, and 4 are correct.

Topic 177

177. National Deworming Day

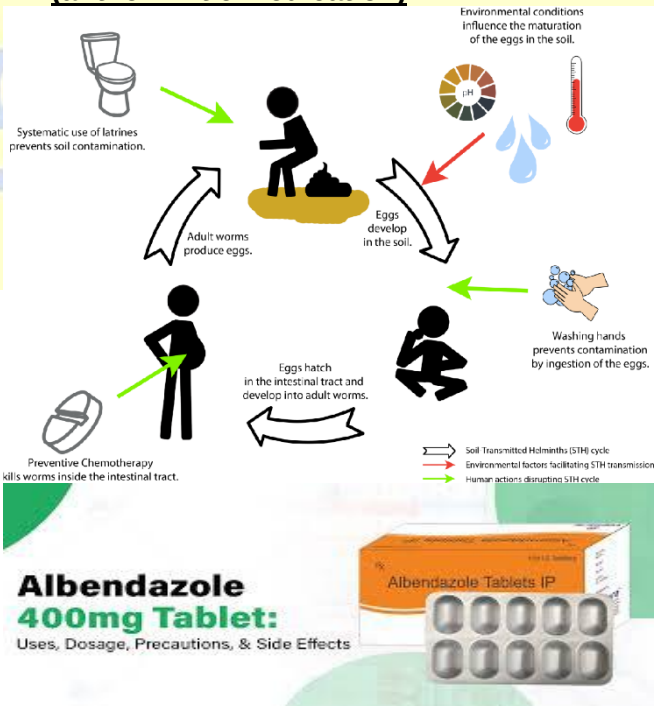
- Intestinal worms are **parasites that live in the human intestines** and **consume nutrients and vitamins** that a **child consumes.**
- There are **three main types of STH (Soil-Transmitted Helminths)** that infect people-

1. **Roundworm** (Ascaris lumbricoides),
2. **Whipworm (**Trichuris trichiura) and
3. **Hookworms (**Necator americanus and Ancylostoma duodenale).

- STH transmits through soil because of **Open defecation.**

National Deworming campaign

- By Ministry of **Health And Family Welfare**
- **Children and adolescents** below age **19 years** are given **medicine Albendazole.**
- Albendazole is **deworming medicine (anthelmintic medication).**



Q529. Consider the following statements about Soil-Transmitted Helminths (STH):
1. STH are intestinal parasites that consume the nutrients and vitamins from the host's body.
2. Roundworm, whipworm, and hookworms are the three main types of STH that infect humans.

3. STH transmission is facilitated by open defecation practices.
4. STH are viruses that infect human intestines and spread through contaminated water.

How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: STH are intestinal parasites that feed on nutrients and vitamins consumed by the host.
Statement 2 is correct: Roundworm (Ascaris lumbricoides), whipworm (Trichuris trichiura), and hookworms (Necator americanus and Ancylostoma duodenale) are the primary STH species infecting humans.
Statement 3 is correct: Open defecation is a major cause of STH transmission, as the eggs are transmitted through contaminated soil.
Statement 4 is incorrect: STH are parasitic worms, not viruses, and they spread through contaminated soil rather than water.
Thus, three statements are correct.

Q530. Which of the following statements about the National Deworming Campaign are correct?
1. The campaign is organized by the Ministry of Health and Family Welfare.
2. Albendazole, an anthelmintic medicine, is administered to children and adolescents below the age of 19 years.
3. The campaign primarily targets school-going children and adolescents.
4. Albendazole is an antiviral medication used to treat soil-transmitted helminths.

(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: The National Deworming Campaign is run by the Ministry of Health and Family Welfare.
Statement 2 is correct: Albendazole, an anthelmintic drug, is provided to children and adolescents under 19 years to deworm them.
Statement 3 is correct: The campaign primarily targets school-going children and adolescents, who are most at risk of STH infections.
Statement 4 is incorrect: Albendazole is an anthelmintic, not an antiviral, medication.
Thus, statements 1, 2, and 3 are correct.

Q531. Consider the following statements about STH transmission and its impacts:
1. STH infections lead to malnutrition in children by depriving them of essential nutrients and vitamins.
2. Open defecation contributes significantly to the spread of STH by contaminating soil with parasite eggs.
3. STH infections are limited to rural areas with poor sanitation and do not occur in urban settings.
4. Albendazole medication effectively treats STH infections and is safe for mass administration.

Which of the statements given above are correct?
(a) 1, 2, and 4 only
(b) 1 and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: a

Sol: Statement 1 is correct: STH infections can cause malnutrition by robbing children of the nutrients they consume.
Statement 2 is correct: Open defecation is a key factor in the spread of STH infections, as the eggs contaminate soil.
Statement 3 is incorrect: STH infections can occur in both rural and urban settings, especially where sanitation is inadequate.
Statement 4 is correct: Albendazole is a safe and effective medication for deworming and is used in mass campaigns.
Thus, statements 1, 2, and 4 are correct.

Topic 178

178. Planetary Defence Mission

- **Asteroid Day**-**June 30**
- On this day **an asteroid** flattened **2,200 sq km** of forest in **Siberia,Russia**
- On the occasion of World Asteroid Day ISRO Chairman S Somanath said ISRO is looking

forward to **study** the **asteroid Apophis** when it is close to **Earth in 2029.**
- This will help in **developing planetary defense system** against any **possible collision of Asteroid** with Earth in future.

Asteroid Apophis
- **discovered in 2004**
- named after the **ancient Egyptian god of chaos**
- measures **340 metres cross sectionally.**
- Once considered a **threat for Earth for possible collision**
- **Later-**NASA-**ruled out the possibility-for the next 100 years.**
- Apophis will **flyby Earth in 2029.**
- **ISRO** wants to **study Apophis** when it **flybys** to **develop a Planetary Defence Mission.**

Q532. Consider the following statements about Asteroid Apophis:
1. Apophis was discovered in 2004 and named after an ancient Egyptian god.
2. It measures approximately 340 meters in cross-section.
3. NASA has ruled out the possibility of Apophis colliding with Earth for the next 50 years.
4. Apophis will have a close flyby with Earth in 2029.

How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: Asteroid Apophis was discovered in 2004 and named after the ancient Egyptian god of chaos.
Statement 2 is correct: It measures approximately 340 meters cross-sectionally.
Statement 3 is incorrect: NASA ruled out the possibility of collision with Earth for the next 100 years, not 50.
Statement 4 is correct: Apophis will have a close flyby with Earth in 2029.
Thus, three statements are correct.

Q533. Which of the following statements about ISRO's objectives in studying Asteroid Apophis are correct?
1. ISRO aims to develop a planetary defence system to mitigate potential asteroid collisions with Earth.
2. Studying Apophis during its flyby in 2029 will provide insights into asteroid deflection techniques.
3. ISRO plans to launch a spacecraft to redirect Apophis away from Earth during its 2029 flyby.
4. The study of Apophis is part of World Asteroid Day initiatives announced by ISRO.

(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: ISRO plans to develop a planetary defence system against possible asteroid collisions with Earth.
Statement 2 is correct: Studying Apophis during its 2029 flyby will contribute to understanding asteroid deflection techniques.
Statement 3 is incorrect: ISRO is not planning to redirect Apophis during its flyby; the mission is focused on observation and study.
Statement 4 is correct: The study of Apophis aligns with ISRO's initiatives related to World Asteroid Day.
Thus, statements 1, 2, and 4 are correct.

Q534. Consider the following statements about Asteroid Day:
1. Asteroid Day is observed annually on June 30 to commemorate an asteroid impact event in Siberia, Russia.
2. The 2029 flyby of Apophis is the primary reason for observing Asteroid Day worldwide.
3. The event commemorates the 1908 Tunguska explosion, which flattened a vast area of Siberian Forest.

4. The day emphasizes global cooperation for planetary defence and asteroid awareness.

Which of the statements given above are correct?
(a) 1, 3, and 4 only
(b) 1 and 3 only
(c) 2 and 4 only
(d) All four

Ans: a

Sol: Statement 1 is correct: Asteroid Day is observed on June 30 to mark the significance of asteroid impacts.
Statement 2 is incorrect: Asteroid Day does not directly commemorate the 2029 flyby of Apophis; it is focused on general asteroid awareness.
Statement 3 is correct: The day commemorates the 1908 Tunguska explosion, which flattened 2,200 sq. km of Siberian Forest.
Statement 4 is correct: Asteroid Day emphasizes global cooperation in developing planetary defence systems.
Thus, statements 1, 3, and 4 are correct.

Topic 179

179. DART Mission

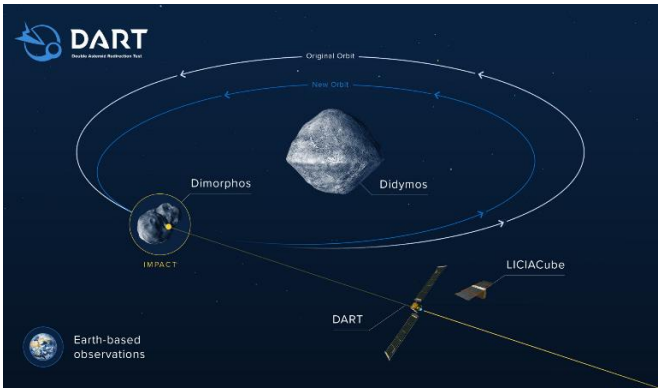
- **NASA's** mission
- Named- Double Asteroid Redirection Test
- The **main aim of the mission** is to **test** the newly developed technology that would **allow a spacecraft to crash** into an **asteroid** and **change its course.**
- It is a **suicide mission** and the spacecraft will be completely destroyed.
- The **target** of the spacecraft is a **small moonlet** called **Dimorphous** (Greek for "two forms").
- **Dimorphous orbits a larger asteroid** named **Didymos** (Greek for "twin") which has a diameter of 780 metres.

Why such mission?

- To **protect the Earth** from possible conflict of **Near Earth Asteroid** with Earth.

Launch date

- Mission was **successfully launched** on **November 24, 2021**, and it achieved its primary objective.



Q535. Consider the following statements about NASA's DART Mission:
1. The mission aimed to test technology that could redirect an asteroid's path by crashing a spacecraft into it.
2. The DART Mission targeted a small moonlet named Dimorphous, which orbits a larger asteroid called Didymos.
3. The spacecraft used in the DART Mission is reusable for future planetary defence missions.
4. The mission was successfully launched on November 24, 2021, and achieved its primary objective.

How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol: Statement 1 is correct: The DART Mission's primary goal was to test technology that could alter an asteroid's trajectory by colliding a spacecraft with it.
Statement 2 is correct: The target of the DART Mission was Dimorphous, a moonlet orbiting the larger asteroid Didymos.
Statement 3 is incorrect: The spacecraft used in the DART Mission was not reusable; it was a suicide mission where the spacecraft was completely destroyed.
Statement 4 is correct: The mission was launched on November 24, 2021, and successfully met its objective.
Thus, three statements are correct.

Q536. Which of the following statements about Dimorphous and Didymos are correct?
1. Dimorphous, meaning "two forms," is a small moonlet orbiting the larger asteroid Didymos.
2. Didymos, meaning "twin," has a diameter of approximately 780 meters.
3. Both Dimorphous and Didymos are part of the Near-Earth Asteroid (NEA) group.
4. The DART Mission targeted Didymos to directly change its trajectory.

(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol: Statement 1 is correct: Dimorphous is a small moonlet that orbits Didymos and translates to "two forms."
Statement 2 is correct: Didymos, meaning "twin," has a diameter of approximately 780 meters.
Statement 3 is correct: Both Dimorphous and Didymos are Near Earth Asteroids (NEAs), which are closely monitored for planetary defence.
Statement 4 is incorrect: The DART Mission targeted Dimorphous, not Didymos, to test asteroid deflection technology.
Thus, statements 1, 2, and 3 are correct.

Q537. Consider the following statements regarding the importance of the DART Mission:
1. The mission demonstrates the ability to protect Earth from potential asteroid collisions.
2. It marks the first successful test of asteroid deflection using kinetic impact technology.
3. The mission achieved its goal of permanently altering the trajectory of a Near Earth Asteroid.
4. DART Mission provided critical data for future reusable spacecraft technologies.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2 and 4 only
(d) All four

Ans: a

Sol: Statement 1 is correct: The DART Mission was a step toward demonstrating the capability to protect Earth from potential asteroid threats.
Statement 2 is correct: The mission successfully tested kinetic impact technology to alter an asteroid's path.
Statement 3 is incorrect: The DART Mission altered Dimorphous's trajectory, but it was a temporary test and not aimed at permanent deflection.
Statement 4 is incorrect: The DART spacecraft was destroyed, and the mission did not involve testing for reusable technologies.
Thus, statements 1 and 2 are correct.

Topic 180

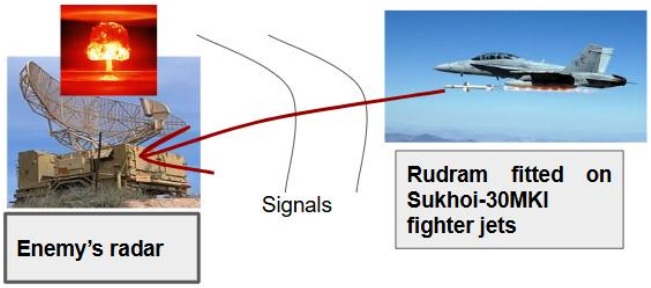
180. Rudram-1

Current news?

- India has successfully flight tested **Rudram-1 anti-radiation missile.**

Rudram anti-radiation missile

- It is a **air to surface missile.**
- Developed by **DRDO for Indian Air Force.**
- Anti-radiation missiles are **designed to detect, track and neutralise** the adversary's **radar, communication assets** and other **radio frequency sources.**
- It is capable of striking accurately **even if the radiation source switches off** in between.
- It has an **operational range** of more than **250 km.**
- **Speed: Up to Mach 2**



Q538. Which of the following statements about the Rudram-1 missile is/are correct?
1. It is an air-to-surface missile.
2. It has been developed by the Indian Army for anti-tank operations.

3. It can strike targets with precision even if the radiation source is switched off.
4. Its operational range is more than 250 km.

(a) Only 1 and 3 are correct
(b) Only 1, 3, and 4 are correct
(c) Only 2 and 4 are correct
(d) All statements are correct

Ans: b

Sol: Statement 1 is correct: Rudram-1 is an air-to-surface missile.
Statement 2 is incorrect: It has been developed by DRDO for the Indian Air Force, not the Indian Army or for anti-tank purposes.
Statement 3 is correct: Rudram-1 can strike accurately even if the radiation source switches off.
Statement 4 is correct: It has an operational range of more than 250 km.

Q539. Consider the following features of Rudra-1 and determine which statements are correct:
1. It is designed to neutralize adversary radar and communication assets.
2. It is a surface-to-air missile.
3. Its maximum speed is Mach 2.
4. It was developed by DRDO for naval operations.

(a) Only 1 and 3 are correct
(b) Only 1, 3, and 4 are correct
(c) Only 2 and 4 are correct
(d) All statements are correct

Ans: a

Sol: Statement 1 is correct: Rudram-1 is specifically designed to detect, track, and neutralize adversary radar, communication systems, and other radio frequency sources.
Statement 2 is incorrect: It is an air-to-surface missile, not a surface-to-air missile.
Statement 3 is correct: Rudram-1 has a speed of up to Mach 2.
Statement 4 is incorrect: It was developed for the Indian Air Force, not for naval operations.

Q540. How many of the following statements about the Rudram-1 missile are incorrect?
1. Rudram-1 is an air-to-surface missile developed by DRDO.
2. It is designed to target tanks and armored vehicles.
3. It can neutralize radar systems, even if they stop emitting radiation during the strike.
4. Its speed exceeds Mach 3.

(a) None are incorrect
(b) Only 1 is incorrect
(c) Only 2 are incorrect
(d) Only 2 and 4 are incorrect

Ans: d

Sol: Statement 1 is correct: Rudram-1 is an air-to-surface missile developed by DRDO.
Statement 2 is incorrect: Rudram-1 is not designed for targeting tanks or armoured vehicles; it targets radar, communication, and radio frequency sources.
Statement 3 is correct: Rudram-1 can neutralize radar systems even if they stop emitting radiation.
Statement 4 is incorrect: Rudram-1's speed is up to Mach 2, not exceeding Mach 3.

Day 19

Topic 181

181. Li-Fi technology

- Li-Fi, which stands for **Light Fidelity.**
- It is a **mobile wireless communications technology** that **uses light** to **transmit data.**
- Li-Fi uses special **LED (light-emitting diode) bulbs** for the transmission of data.
- **High-speed** and **bidirectional**.
- deliver data through **visible, infrared, or ultraviolet light.**
- **100 times faster** than **Wi-Fi routers** because **light has a larger bandwidth than radio waves.**

Current news?

- Telecom **startup Velmenni** recently received a **grant** from the **Ministry of Defence (MoD)** under the **Innovations for Defence Excellence (iDEX)** initiative for its innovative **Li-Fi (Light Fidelity) technology.**
- The Technology **may be used** for upgrading technological base for **Indian Navy.**

Innovations for Defence Excellence (iDEX) Framework

- By **Ministry of Defence**
- To **promote innovation** in **defence manufacturing**
- Provides **financial grant to Start ups.**

Aspect	LiFi (Light Fidelity)	WiFi (Wireless Fidelity)
Medium of Communication	Uses visible light, ultraviolet, or infrared light to transmit data.	Uses radio waves for data transmission.
Speed	Potentially faster with speeds up to 224 Gbps (under ideal conditions).	Standard speeds typically range from 100 Mbps to 10 Gbps in modern networks.
Coverage	Limited to the line of sight; cannot penetrate walls.	Wide coverage; can penetrate walls and obstacles.
Interference	Immune to electromagnetic interference (e.g., from electronic devices).	Susceptible to electromagnetic interference from devices like microwaves.
Applications	Ideal for environments needing high security (e.g., hospitals, aircraft, and research labs).	Widely used in homes, offices, and public areas for general-purpose networking.

Q541. Which of the following statements about Li-Fi technology is/are correct?

1. Li-Fi stands for Light Fidelity and uses light for data transmission.
2. It can deliver data through visible, infrared, or ultraviolet light.
3. It uses standard LED bulbs found in homes for transmitting data.
4. Li-Fi is 100 times faster than Wi-Fi because light has a larger bandwidth than radio waves.

(a) Only 1, 2, and 4 are correct
(b) Only 1 and 3 are correct
(c) Only 2 and 4 are correct
(d) All statements are correct

Ans: a

Sol:

- Statement 1 is correct: Li-Fi stands for Light Fidelity and uses light for data transmission.
- Statement 2 is correct: Li-Fi can deliver data through visible, infrared, or ultraviolet light.
- Statement 3 is incorrect: Li-Fi uses special LED bulbs, not standard LED bulbs.
- Statement 4 is correct: Li-Fi is 100 times faster than Wi-Fi because light has a larger bandwidth than radio waves.

Q542. Consider the following features of Li-Fi technology and identify the correct statements:

1. It is a wireless communication technology that uses light instead of radio waves.
2. It is unidirectional, transmitting data in one direction only.
3. The Ministry of Defence supports Li-Fi development under the iDEX initiative.
4. The technology may enhance the technological capabilities of the Indian Navy.

(a) Only 1, 3, and 4 are correct
(b) Only 1 and 4 are correct
(c) Only 2 and 3 are correct
(d) All statements are correct

Ans: a

Sol:

- Statement 1 is correct: Li-Fi uses light for wireless communication, replacing radio waves.
- Statement 2 is incorrect: Li-Fi is bidirectional, allowing data transmission in both directions.
- Statement 3 is correct: The Ministry of Defence supports Li-Fi under the Innovations for Defence Excellence (iDEX) initiative.
- Statement 4 is correct: The technology may be used to upgrade the technological base for the Indian Navy.

Q543. How many of the following statements about the Innovations for Defence Excellence (iDEX) framework are correct?

1. It is an initiative of the Ministry of Defence to promote innovation in defence manufacturing.
2. It provides grants exclusively to government-owned organizations.
3. It aims to enhance India's defence capabilities by supporting startups.
4. Velmenni, a telecom startup, received a grant under iDEX for its work on Li-Fi technology.

(a) Only 1 and 3 are correct
(b) Only 2 and 4 are correct
(c) Only 1, 3, and 4 are correct
(d) All statements are correct

Ans: c

Sol:

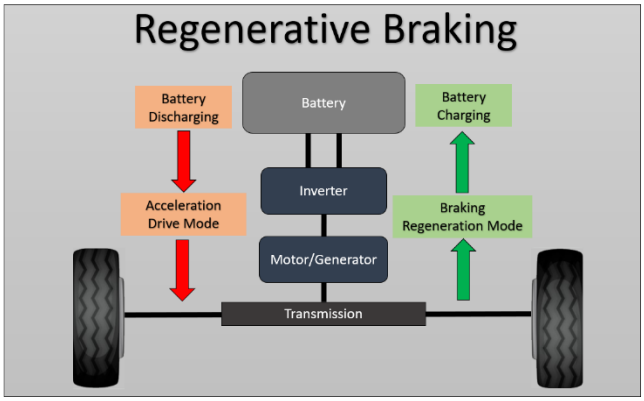
- Statement 1 is correct: iDEX is an initiative of the Ministry of Defence to promote innovation in defence manufacturing.

- Statement 2 is incorrect: iDEX provides grants to startups, not exclusively to government-owned organizations.
- Statement 3 is correct: iDEX aims to enhance defence capabilities by supporting innovation from startups.
- Statement 4 is correct: Velmenni, a telecom startup, received a grant under iDEX for its Li-Fi technology work.

Topic 182

182. Regenerative Braking

- This mechanism is found on most **hybrid** and **full-electric vehicles**.
- It **captures the kinetic energy** from **braking** and **converts** it into the **electrical power** that charges the vehicle's **high-voltage battery.**
- It also provides a **better braking system** as compared to **traditional brakes**.
- It can **improve fuel efficiency.**
- Reduced braking load, **reduces the wear** and **tear of braking pads.**



Q544. Which of the following statements about regenerative braking is/are correct?
1. It is commonly used in hybrid and full-electric vehicles.
2. It converts kinetic energy from braking into electrical energy to charge the battery.
3. It is primarily designed to reduce the weight of vehicles.
4. It improves fuel efficiency and reduces wear and tear on braking pads.

(a) Only 1, 2, and 4 are correct
(b) Only 1 and 3 are correct
(c) Only 2 and 3 are correct
(d) All statements are correct

Ans: a

Sol:
- Statement 1 is correct: Regenerative braking is a feature of most hybrid and full-electric vehicles.
- Statement 2 is correct: It captures kinetic energy during braking and converts it into electrical energy.
- Statement 3 is incorrect: Regenerative braking is not designed to reduce vehicle weight but to improve energy efficiency.
- Statement 4 is correct: It improves fuel efficiency and reduces the wear and tear on braking pads.

Q545. Consider the following statements regarding regenerative braking:
1. It enhances braking performance compared to traditional braking systems.
2. It completely eliminates the need for traditional brakes.
3. It reduces the wear and tear of braking pads.
4. It improves fuel efficiency in vehicles.

(a) Only 1, 3, and 4 are correct
(b) Only 1 and 4 are correct
(c) Only 2 and 3 are correct
(d) All statements are correct

Ans: a

Sol:
- Statement 1 is correct: Regenerative braking provides a better braking system compared to traditional brakes.
- Statement 2 is incorrect: While it reduces reliance on traditional brakes, it does not eliminate their need entirely.
- Statement 3 is correct: By reducing braking load, it minimizes the wear and tear on braking pads.
- Statement 4 is correct: Regenerative braking improves fuel efficiency by recapturing energy.

Q546. How many of the following statements about regenerative braking are incorrect?
1. It is only found in full-electric vehicles.
2. It captures kinetic energy during braking and stores it in the vehicle's battery.
3. It reduces the wear and tear of braking pads.
4. It increases the load on traditional brakes.

(a) None are incorrect
(b) Only 1 and 4 are incorrect

(c) Only 2 and 3 are incorrect
(d) Only 1, 3, and 4 are incorrect

Ans: b

Sol:

- Statement 1 is incorrect: Regenerative braking is found in both hybrid and full-electric vehicles, not just full-electric ones.
- Statement 2 is correct: It captures kinetic energy and converts it into electrical energy to charge the battery.
- Statement 3 is correct: It reduces the wear and tear of braking pads.
- Statement 4 is incorrect: Regenerative braking reduces, not increases, the load on traditional brakes.

Topic 183

183. Lidar technology for flood forecast

- LiDAR, or light detection and ranging, is a **remote sensing method** used for measuring the **exact distance** of an **object on the earth's surface.**
- LiDAR follows a simple principle — **throw laser light** at an object on the earth surface and **calculate the time it takes to return to the LiDAR source.**

The formula

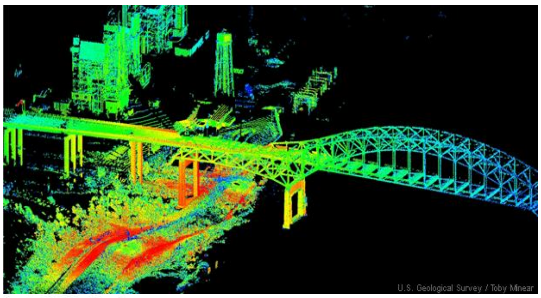
- **The distance of the object=(Speed of Light x Time of Flight)/ 2**

Application of LiDAR survey

1. Measure **depth of ocean's surface**
2. **calculating phytoplankton density** and biomass
3. **Terrain elevations-**construction of roads, large buildings and bridges-**3D representation of elevation.**

Current news?

- A **LiDAR survey** has started in **Guwahati as** part of a project to build a hyper-resolution **real time flood impact forecasting system for the city.**



Aspect	LiDAR (Light Detection and Ranging)	Radar (Radio Detection and Ranging)
Principle	Uses laser light pulses to measure distances and create 3D models of the environment.	Uses radio waves to detect objects and measure their distance and velocity.
Accuracy	Offers higher precision and detailed resolution, especially for smaller objects.	Less precise compared to LiDAR, particularly for small or close-range objects.
Range	Effective over short to medium ranges (a few meters to a few kilometers).	Capable of long-range detection (up to hundreds of kilometers).
Weather Sensitivity	Performance can be affected by adverse weather conditions like fog, rain, or dust.	Works well in most weather conditions, including rain and fog.
Applications	Used in **autonomous vehicles**, 3D mapping, surveying, and forestry management.	Widely used in **aviation, meteorology**, military, and air traffic control.

Q547. Which of the following statements about LiDAR technology is/are correct?

1. LiDAR stands for Light Detection and Ranging.
2. It calculates the distance of an object by measuring the time it takes for laser light to return to its source.
3. The formula used in LiDAR calculations is: Distance = (Speed of Light × Time of Flight).
4. LiDAR can measure the depth of oceans and represent terrain elevations in 3D.

(a) Only 1, 2, and 4 are correct
(b) Only 1 and 3 are correct
(c) Only 2 and 4 are correct
(d) All statements are correct

Ans: a

Sol:

- Statement 1 is correct: LiDAR stands for Light Detection and Ranging.
- Statement 2 is correct: LiDAR works by measuring the time laser light takes to return to its source.
- Statement 3 is incorrect: The correct formula is Distance = (Speed of Light × Time of Flight) / 2.
- Statement 4 is correct: LiDAR is used to measure ocean depths and represent terrain elevations in 3D.

Q548. Consider the following statements regarding LiDAR applications:

1. LiDAR is used to calculate phytoplankton density and biomass.
2. It is utilized for constructing 3D models of terrain elevations.
3. A LiDAR survey is being used in Guwahati for a flood impact forecasting system.

4. It is primarily designed for use in space exploration.

(a) All statements are correct
(b) Only 1 and 3 are correct
(c) Only 2 and 4 are correct
(d) Only 1, 2, and 3 are correct

Ans: d

Sol:

- Statement 1 is correct: LiDAR is used for calculating phytoplankton density and biomass.
- Statement 2 is correct: It is applied in constructing 3D models of terrain elevations for roads, buildings, and bridges.
- Statement 3 is correct: A LiDAR survey is being conducted in Guwahati for a hyper-resolution flood forecasting system.
- Statement 4 is incorrect: While LiDAR can be used in space exploration, its primary applications are terrestrial, including environmental monitoring and infrastructure planning.

Q549. How many of the following statements about LiDAR technology are incorrect?

1. LiDAR is a remote sensing method used to measure distances on the Earth's surface.
2. It measures the time of flight of laser light but does not use the speed of light in its calculations.
3. LiDAR applications include ocean depth measurement and terrain elevation mapping.
4. It can help forecast flood impacts in real-time.

(a) None are incorrect
(b) Only 1 and 3 are incorrect
(c) Only 2 is incorrect
(d) Only 2 and 4 are incorrect

Ans: c

Sol:

- Statement 1 is correct: LiDAR is a remote sensing method used to measure distances.
- Statement 2 is incorrect: LiDAR explicitly uses the speed of light in its distance calculation formula.
- Statement 3 is correct: LiDAR applications include measuring ocean depths and creating 3D terrain maps.
- Statement 4 is correct: LiDAR is being used for real-time flood impact forecasting in Guwahati.

Topic 184

184. National Quantum Mission

Classical computers

- employ a stream of **electrical impulses (1 and 0)** in a **binary manner.**
- This **restricts** their **processing speed.**
- make **calculations in sequence.**

Quantum computers

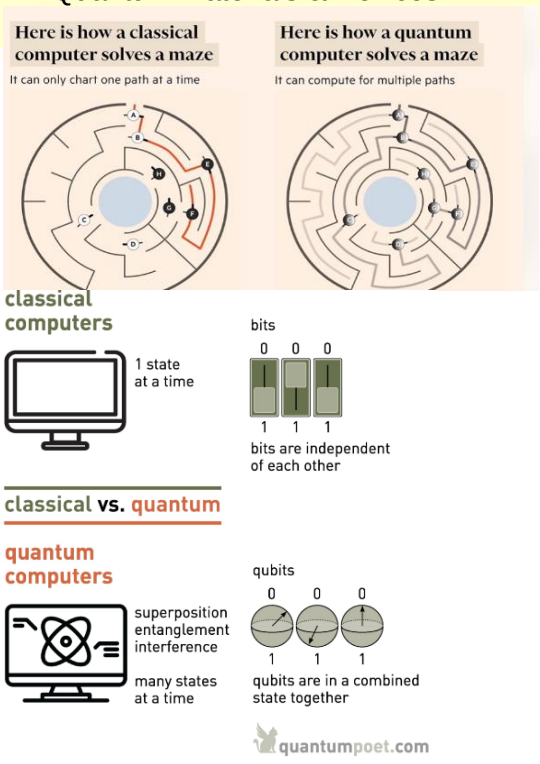
- **uses subatomic particles**, such as **electrons or photons known as Qubits.**
- **Quantum bits**, or qubits, allow these particles to exist in **more than one state** (i.e., 1 and 0) at the **same time.**
- This allows-**parallel calculations**-hence **processing speed is high.**
- Quantum computers are **faster than Supercomputers** (use classical computing).

National Quantum Mission

- Approved by GoI- **₹6,003 crore (2023-24 to 2030-31)**

4 themes under the mission

1. Quantum computation
2. Quantum communication
3. Quantum Sensing & Metrology
4. Quantum Materials & Devices



Q550. Which of the following statements about classical and quantum computers is/are correct?
1. Classical computers perform calculations in sequence using binary electrical impulses.
2. Quantum computers use qubits, which can exist in multiple states (1 and 0) simultaneously.
3. Supercomputers employ quantum bits for their high-speed calculations.
4. Quantum computers can perform parallel calculations, making them faster than classical computers.

(a) Only 1 and 3 are correct
(b) Only 1, 2, and 4 are correct
(c) Only 2 and 4 are correct
(d) All statements are correct

Ans: b

Sol:
- Statement 1 is correct: Classical computers rely on binary electrical impulses to process calculations sequentially.
- Statement 2 is correct: Quantum computers use qubits, which allow particles to exist in more than one state at a time.
- Statement 3 is incorrect: Supercomputers use classical computing, not quantum bits.
- Statement 4 is correct: Quantum computers can perform parallel calculations, enhancing their processing speed.

Q551. Consider the following statements regarding the National Quantum Mission:
1. It was approved by the Government of India with a budget of ₹6,003 crore.
2. The mission is planned for the period 2023-24 to 2030-31.
3. Quantum sensing and metrology is one of the key focus areas of the mission.
4. It aims to develop quantum applications exclusively for defense and space exploration.

(a) Only 1, 2, and 3 are correct
(b) Only 1 and 4 are correct
(c) Only 2 and 3 are correct
(d) All statements are correct

Ans: a

Sol:
- Statement 1 is correct: The National Quantum Mission has been approved with a budget of ₹6,003 crore.
- Statement 2 is correct: The mission is scheduled from 2023-24 to 2030-31.
- Statement 3 is correct: Quantum sensing and metrology is one of the four focus themes under the mission.
- Statement 4 is incorrect: The mission is not exclusively for defence and space exploration but also focuses on broader quantum advancements.

Q552. How many of the following statements about quantum computing and the National Quantum Mission are incorrect?
1. Qubits enable quantum computers to perform sequential calculations faster than classical computers.
2. Quantum communication is one of the four focus areas of the National Quantum Mission.
3. The mission aims to enhance India's capabilities in quantum materials and devices.
4. Quantum computers are slower than supercomputers for large-scale computations.

(a) None are incorrect
(b) Only 1 and 4 are incorrect
(c) Only 2 and 3 are incorrect
(d) Only 1, 3, and 4 are incorrect

Ans: b

Sol:
- Statement 1 is incorrect: Quantum computers perform parallel, not sequential, calculations, which makes them faster than classical computers.
- Statement 2 is correct: Quantum communication is indeed one of the four themes under the National Quantum Mission.
- Statement 3 is correct: Enhancing capabilities in quantum materials and devices is a key focus of the mission.
- Statement 4 is incorrect: Quantum computers are faster than supercomputers for large-scale computations due to their parallel processing ability.

Topic 185

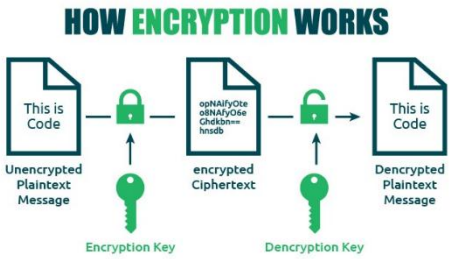
185. QUANTUM Cryptography

What is encryption?

- It means **protection from breach.**
- Currently, **messaging technology** like **Whatsapp** relies on **cryptographic, methods** of protection, known as **end-to-end encryption.**

How encryption works?

- Encryption works by **scrambling data** or text into what appears to be **nonsense** by using an algorithm.
- A **key** that only the **sender and recipient** can use is created to **unlock the data.**
- **Supercomputers** will also take **many years** to break encryption due to **complex mathematical equations involved.**
- But **Quantum Computing** can **easily break encryption** (future risk of Quantum computing).
- Fearing that **quantum computers** will **render encryption obsolete** someday (called as **Q day**), scientists are proposing **new technologies** to protect **sensitive communications.**
- The new method is **"quantum cryptography"**



How "quantum cryptography" will work?

- **Information** being encoded into **individual light particles** and then **transmitted.**
- When the **information is intercepted,** the **light** particles **change their characteristics.**
- Thus **attempt to intercept** is **detected.**

Issues with "quantum cryptography"

- amount of information-**not very large or very fast**

Q553. Which of the following statements about encryption and its current limitations is/are correct?

1. Encryption protects data from unauthorized access by scrambling it into unreadable text.
2. Current encryption methods rely on algorithms that supercomputers can easily break.
3. End-to-end encryption is widely used in messaging applications like WhatsApp.
4. Quantum computing poses a future risk by potentially breaking existing encryption methods.

(a) Only 1, 3, and 4 are correct
(b) Only 1 and 3 are correct
(c) Only 2 and 4 are correct
(d) All statements are correct

Ans: a

Sol:

- Statement 1 is correct: Encryption works by scrambling data using algorithms to make it unreadable without the decryption key.
- Statement 2 is incorrect: Supercomputers require many years to break encryption due to the complex mathematical equations involved.
- Statement 3 is correct: End-to-end encryption is commonly used in messaging apps like WhatsApp.
- Statement 4 is correct: Quantum computing could potentially break encryption methods in the future, posing a significant risk.

Q554. Consider the following statements regarding quantum cryptography:

1. Quantum cryptography encodes information into individual light particles.
2. An interception attempt alters the characteristics of light particles, allowing detection.
3. Quantum cryptography enables the transfer of large amounts of information at very high speeds.
4. Quantum cryptography is being developed to counter the potential risks posed by quantum computing.

(a) Only 1, 2, and 4 are correct
(b) Only 1 and 3 are correct
(c) Only 2 and 4 are correct
(d) All statements are correct

Ans: a

Sol:

- Statement 1 is correct: Quantum cryptography encodes information into individual light particles for transmission.
- Statement 2 is correct: If the light particles are intercepted, their characteristics change, making interception attempts detectable.
- Statement 3 is incorrect: Quantum cryptography has limitations in transferring large amounts of information quickly.
- Statement 4 is correct: Quantum cryptography is being developed as a safeguard against quantum computing's ability to break encryption.

Q555. How many of the following statements about quantum cryptography are incorrect?

1. Quantum cryptography eliminates the need for keys in the encryption process.
2. Interception of quantum-encrypted data changes the characteristics of the transmitted particles.
3. Quantum cryptography can transmit sensitive information at very high speeds.
4. The development of quantum cryptography is driven by concerns over "Q Day."

(a) None are incorrect
(b) Only 1 and 3 are incorrect
(c) Only 2 and 4 are incorrect
(d) Only 1, 2, and 3 are incorrect

Ans: b

Sol:

- Statement 1 is incorrect: Quantum cryptography does not eliminate the need for keys; it ensures secure transmission of the key.
- Statement 2 is correct: Interception changes the characteristics of light particles, alerting to an attempted breach.
- Statement 3 is incorrect: Quantum cryptography is not yet capable of transmitting large volumes of information quickly.
- Statement 4 is correct: Concerns over "Q Day," when quantum computers might render traditional encryption obsolete, are driving the development of quantum cryptography.

Topic 186

186. India AI Mission

- **Union Cabinet approved** the **IndiaAI Mission** with an outlay of **Rs 10,372 crore** for the **next five years.**

7 Key Features of India AI Mission-

1. **India AI Compute Capacity**
   - Build a high-end scalable AI computing ecosystem to cater to the increasing demands from India's rapidly expanding AI startups.
2. **IndiaAI Innovation Centre**
3. **IndiaAI Datasets Platform**
   - This will streamline access to quality non-personal datasets for AI Innovation.
4. **IndiaAI Application Development Initiative**
   - This will promote AI applications in critical sectors for the problem statements sourced from Central Ministries, State Departments, etc.
5. **IndiaAI FutureSkills**
   - Increase AI courses in undergraduate, Masters level, and Ph.D. programmes.
6. **IndiaAI Startup Financing**
7. **Safe & Trusted AI**

One of the earliest step under India AI Mission-

- IT Ministry will procure between **300 to 500 graphics processing units (GPUs)** to help the **private sector** build domestic computing capacity for **artificial intelligence (AI) systems**

AI impact on global warming

- A simple **AI query,** like the ones **posted to OpenAI's chatbot ChatGPT,** could be using between **10 to 33 times more energy** than a **regular Google search.**

Why?

- AI models typically **work much more** than a **simple Google search** even when the **same question** is addressed to both.
- More work means a **greater number of electrical signals** are required.

Q556. Consider the following statements about the India AI Mission:
1. The mission has an approved budget of Rs 10,372 crore for the next five years.
2. The IndiaAI Compute Capacity initiative aims to develop a scalable AI computing ecosystem for startups.
3. IndiaAI Datasets Platform will provide access to non-personal datasets to foster AI innovation.
4. The mission exclusively focuses on promoting AI in the private sector.

How many of the statements given above are correct?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Ans: c

Sol:
- Statement 1 is correct: The Union Cabinet approved the India AI Mission with an outlay of Rs 10,372 crore for five years.
- Statement 2 is correct: The IndiaAI Compute Capacity initiative focuses on creating a high-end, scalable AI ecosystem for startups.
- Statement 3 is correct: The IndiaAI Datasets Platform will facilitate access to quality non-personal datasets to promote AI innovation.
- Statement 4 is incorrect: The mission targets both the public and private sectors by sourcing problem statements from Central Ministries, State Departments, and others.

Thus, three statements are correct.

Q557. Which of the following statements about the India AI Mission are correct?
1. The IndiaAI FutureSkills initiative aims to increase the availability of AI courses at undergraduate and doctoral levels.
2. IndiaAI Application Development Initiative will promote AI applications in critical sectors based on challenges sourced from Central and State government entities.
3. One of the earliest steps under the mission includes procuring 300 to 500 GPUs to enhance domestic AI computing capacity.
4. The mission seeks to replace all foreign AI models in India with domestically developed ones within its first five years.

(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol:
- Statement 1 is correct: The IndiaAI FutureSkills initiative focuses on increasing AI courses in undergraduate, Masters, and Ph.D. programs.
- Statement 2 is correct: The IndiaAI Application Development Initiative promotes AI solutions in critical sectors by leveraging problem statements from Central Ministries and State Departments.
- Statement 3 is correct: The mission includes procuring 300 to 500 GPUs as an early step to bolster domestic AI computing capacity.
- Statement 4 is incorrect: The mission does not explicitly aim to replace all foreign AI models but seeks to strengthen domestic capabilities.

Thus, statements 1, 2, and 3 are correct.

Q558. Consider the following statements about the environmental impact of artificial intelligence (AI):
1. An AI query can consume 10 to 33 times more energy than a regular Google search.
2. AI models require significantly higher electrical signals due to the complexity of their tasks compared to a simple search engine query.
3. AI systems inherently consume less energy as they process data more efficiently.
4. The India AI Mission includes measures to address the environmental impact of AI systems.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: a

Sol:
- Statement 1 is correct: AI queries, such as those made to ChatGPT, use 10 to 33 times more energy than regular Google searches.

- Statement 2 is correct: AI models require more electrical signals due to their complexity and computation-intensive tasks, leading to higher energy usage.
- Statement 3 is incorrect: AI systems consume more energy, not less, due to their extensive computational requirements.
- Statement 4 is incorrect: There is no specific mention of measures within the India AI Mission to address the environmental impact of AI systems.

Thus, statements 1 and 2 are correct.

Topic 187

187. Dark Oxygen

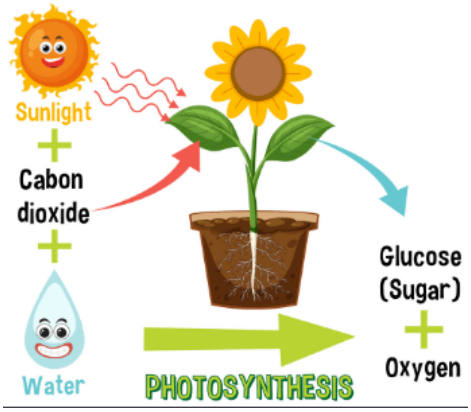
- Scientists have recently discovered a **strange phenomenon**, dubbed as **"dark oxygen"** in the **deep sea.**

What is Dark Oxygen?

- Oxygen that is being **produced in complete darkness.**
- Thousands of feet **below the ocean surface.**
- The oxygen discovery was made in the **Clarion-Clipperton Zone**

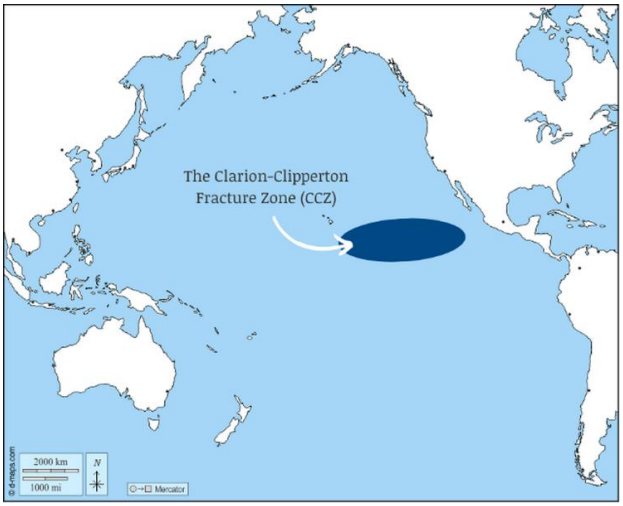
How Dark Oxygen is produced?

- The oxygen comes out of **Polymetallic nodules.**
- These nodules, made up of **metals like manganese, iron, cobalt, nickel, copper, and lithium**, can **generate oxygen** through **electrochemical activity** even in the **absence of light.**
- They are **splitting H2O molecules** into **Hydrogen and Oxygen.**



Photosynthesis

- Until now, it was thought that **oxygen was created** only through **photosynthesis**, a process that requires sunlight.



Clarion-Clipperton Zone

- **Vast abyssal plain** in the **North Pacific Ocean.**
- Located between **Hawaii and Mexico.**
- Rich in **polymetallic nodules**

Q559. Consider the following statements about Dark Oxygen:

1. Dark oxygen is oxygen produced through electrochemical activity in complete darkness.
2. The discovery of dark oxygen was made in the Clarion-Clipperton Zone, located in the North Atlantic Ocean.
3. Polymetallic nodules are responsible for the production of dark oxygen by splitting H_2O molecules into hydrogen and oxygen.
4. The phenomenon of dark oxygen is driven by sunlight penetrating the deep sea.

Which one of the statements given above is correct?

(a) 1 only
(b) 2 only
(c) 3 only
(d) 4 only

Ans: a

Sol:

- Statement 1 is correct: Dark oxygen is produced through electrochemical activity by polymetallic nodules in complete darkness.
- Statement 2 is incorrect: The Clarion-Clipperton Zone is located in the North Pacific Ocean, not the North Atlantic.
- Statement 3 is incorrect: While polymetallic nodules produce dark oxygen, the mechanism involves splitting H_2O, not sunlight.

- Statement 4 is incorrect: Dark oxygen production occurs without sunlight, deep below the ocean surface.

Thus, statement 1 is correct.

Q560. Which of the following statements about polymetallic nodules are correct?

1. Polymetallic nodules contain metals like manganese, cobalt, and lithium.
2. These nodules generate oxygen through photosynthesis in deep-sea environments.
3. They are found abundantly in the Clarion-Clipperton Zone of the North Pacific Ocean.
4. Polymetallic nodules facilitate the electrochemical splitting of water molecules to produce oxygen in darkness.

(a) 1 and 3 only
(b) 1, 3, and 4 only
(c) 2 and 3 only
(d) All four

Ans: b

Sol:

- Statement 1 is correct: Polymetallic nodules contain metals like manganese, cobalt, nickel, copper, and lithium.
- Statement 2 is incorrect: Oxygen generation by polymetallic nodules is due to electrochemical activity, not photosynthesis.
- Statement 3 is correct: The Clarion-Clipperton Zone in the North Pacific Ocean is rich in polymetallic nodules.
- Statement 4 is correct: These nodules produce oxygen by splitting H_2O molecules without the need for light.

Thus, statements 1, 3, and 4 are correct.

Q561. Consider the following statements about the Clarion-Clipperton Zone:

1. It is a vast abyssal plain located in the North Pacific Ocean between Hawaii and Mexico.
2. The zone is rich in polymetallic nodules, which are known to generate oxygen through electrochemical reactions.
3. The Clarion-Clipperton Zone has been identified as a critical region for deep-sea mining due to its resource richness.
4. Dark oxygen production in this zone is driven by thermal energy from hydrothermal vents.

Which one of the statements given above is correct?

(a) 1 only
(b) 2 only
(c) 3 only
(d) 4 only

Ans: a

Sol:

- Statement 1 is correct: The Clarion-Clipperton Zone is a vast abyssal plain located in the North Pacific Ocean between Hawaii and Mexico.
- Statement 2 is incorrect: Although the zone is rich in polymetallic nodules, oxygen production is not the primary focus of its mining activities.
- Statement 3 is incorrect: While the region is targeted for deep-sea mining, this statement does not address oxygen production directly.
- Statement 4 is incorrect: Dark oxygen production is due to electrochemical activity of polymetallic nodules, not hydrothermal vents.

Thus, statement 1 is correct.

Topic 188

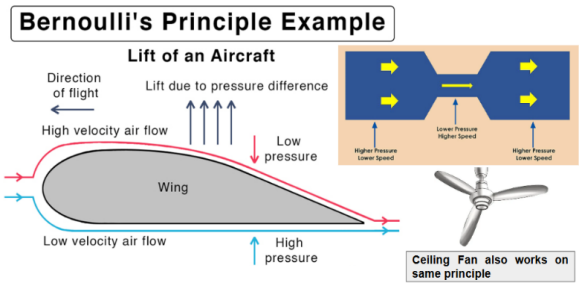
188. Science behind aircraft lift

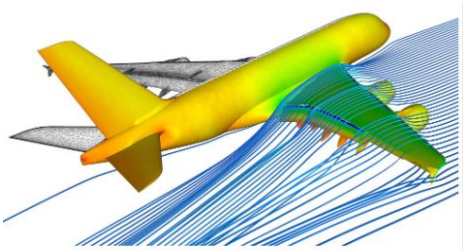
How do aircraft fly?

- Aircraft wings are shaped such that their **top is slightly more curved** than the bottom.
- So, when an aircraft begins to move, the **air over the top** of the **wings moves faster** than that under the bottom.
- This faster-moving air then creates a **lower pressure above the wing** (as per **Bernoulli's principle)**, when compared to the pressure under it.
- This difference in the pressure **generates a force (called lift)** underneath the wings that helps the **aircraft take off.**

Why flights get cancelled in high altitude region very frequently eg Ladakh?

- **Thin air** (low air density) **doesn't create enough thrust** for the plane to fly.





Flight aerodynamics

Q562. Consider the following statements about the role of wing shape in generating lift:
1. Aircraft wings are designed with a curved top and a flat bottom to generate lift.
2. The air over the top of the wing moves slower than the air under the wing.
3. Bernoulli's principle explains how faster-moving air creates lower pressure above the wing.
4. The pressure difference between the top and bottom of the wing generates a force that lifts the aircraft.

Which of the statements given above are correct?
(a) 1 and 3 only
(b) 1, 3, and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol:
- Statement 1 is correct: Aircraft wings are designed with a curved top to facilitate lift.
- Statement 2 is incorrect: The air over the top of the wing moves faster, not slower, than the air under the wing.
- Statement 3 is correct: Bernoulli's principle explains that faster-moving air results in lower pressure.
- Statement 4 is correct: The pressure difference creates a force called lift, which allows the aircraft to take off.

Thus, statements 1, 3, and 4 are correct.

Q563. Which of the following statements about flight operations in high-altitude regions are correct?
1. Low air density reduces the thrust generated by the aircraft engines.
2. Low air density decreases the lift generated by the wings.
3. Aircraft require longer runways to take off in high-altitude regions due to thinner air.
4. Flights are rarely canceled in high-altitude regions because modern engines compensate for thin air.

(a) 1 and 3 only
(b) 1, 2, and 3 only
(c) 2 and 4 only
(d) All four

Ans: b

Sol:
- Statement 1 is correct: Low air density reduces engine thrust and makes it harder to accelerate.
- Statement 2 is correct: Low air density also reduces the lift generated by the wings, making takeoff difficult.
- Statement 3 is correct: Aircraft require longer runways to achieve sufficient speed for lift in thin air.
- Statement 4 is incorrect: Flights are often canceled in high-altitude regions due to challenges posed by low air density.

Thus, statements 1, 2, and 3 are correct.

Q564. Consider the following statements about Bernoulli's principle and aircraft lift:
1. Bernoulli's principle explains that faster-moving air creates higher pressure.
2. The difference in air pressure between the top and bottom of the wing generates lift.
3. Faster airflow over the top of the wing creates a force called drag, which opposes motion.
4. Aircraft lift is primarily achieved by adjusting the angle of the wing to the wind.

Which one of the statements given above is correct?
(a) 1 only
(b) 2 only
(c) 3 only
(d) 4 only

Ans: b

Sol:
- Statement 1 is incorrect: Bernoulli's principle states that faster-moving air creates lower pressure, not higher pressure.
- Statement 2 is correct: The pressure difference between the top and bottom of the wing generates lift.

- Statement 3 is incorrect: The force created by faster airflow is lift, not drag. Drag opposes motion but is unrelated to Bernoulli's principle.
- Statement 4 is incorrect: Lift is primarily generated by the wing shape and airflow, not just by adjusting the angle.

Thus, statement 2 is correct.

Topic 189

189. Chang'e-6 mission

Near side of the Moon

- It refers to the portion of the moon that is **visible from Earth.**
- It is about **60%** of the **Moon's surface.**
- **This side** of the Moon **always faces the Earth**.

Far Side of the Moon

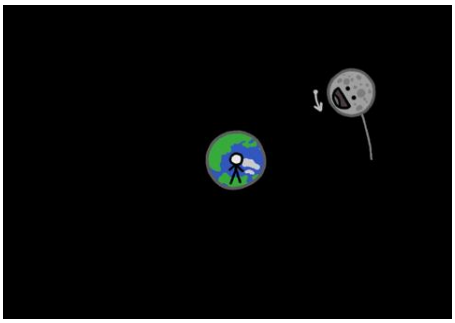
- The Moon's far side is often called the **dark side** because it **cannot be seen from Earth**.
- This **does not mean** it **never gets sunlight**.

Current news?

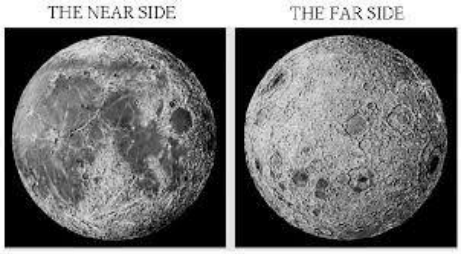
- A **Chinese spacecraft Chang'e-6 mission** landed on the **far side of the moon** to **collect soil and rock samples.**
- China has **successfully soft-landed** on the **far side** of the Moon **twice**, when **no other country** has **done it once.**
- **Chandrayaan 3** landen on **near side.**

Past Chang'e missions

- **Chang'e-4 mission-Soft landed on far side of Moon in 2019.**
- **Chang'e-5 mission-**collected **samples** from the **near side** of the moon in 2020.



- The **Moon** is **tidally locked** with **Earth.**
- Tidal locking means **orbital period matches its rotational period.**
- The **moon takes 28 days** to go around the Earth and **28 days to rotate once around it's axis**.
- This results in the **same face of the Moon always facing the Earth.**



The **Moon's near side,** always **facing Earth**, has **visible dark and light patches** known as **"maria."**

Q565. Consider the following statements:

1. The Moon's near side always faces Earth due to tidal locking.
2. The far side of the Moon is called the "dark side" because it never receives sunlight.
3. The Moon's orbital period matches its rotational period, resulting in the same face always facing Earth.
4. The near side of the Moon has visible dark patches called maria.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 1, 3, and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol:

- Statement 1 is correct: Tidal locking ensures that the near side of the Moon always faces Earth.
- Statement 2 is incorrect: The far side is called the "dark side" because it cannot be seen from Earth, but it does receive sunlight.
- Statement 3 is correct: The Moon's orbital period and rotational period are both approximately 28 days, causing the same side to always face Earth.
- Statement 4 is correct: The near side has visible dark patches called maria, which are large, basaltic plains.

Thus, statements 1, 3, and 4 are correct.

Q566. Which of the following statements about China's Chang'e Moon missions are correct?
1. The Chang'e-6 mission aims to collect soil and rock samples from the far side of the Moon.
2. The Chang'e-4 mission was the first to soft-land on the far side of the Moon in 2019.
3. The Chang'e-5 mission collected samples from the Moon's near side in 2020.
4. China is the only country to have successfully soft-landed on the Moon's near side.

(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol:
- Statement 1 is correct: The Chang'e-6 mission is focused on collecting soil and rock samples from the far side of the Moon.
- Statement 2 is correct: The Chang'e-4 mission made history by soft-landing on the far side of the Moon in 2019.
- Statement 3 is correct: The Chang'e-5 mission collected samples from the Moon's near side in 2020.
- Statement 4 is incorrect: Other countries, including India with Chandrayaan-3, have successfully landed on the near side of the Moon.

Thus, statements 1, 2, and 3 are correct.

Q567. Consider the following statements about the Moon's tidal locking and its effects:
1. The Moon's tidal locking means it takes 28 days to orbit Earth and 28 days to rotate once around its axis.
2. Tidal locking causes the far side of the Moon to remain permanently dark.
3. The near side of the Moon always facing Earth shows features like maria due to tidal locking.
4. The far side of the Moon is completely smooth compared to the near side.

Which one of the statements given above is correct?
(a) 1 only
(b) 2 only
(c) 3 only
(d) 4 only

Ans: a

Sol:
- Statement 1 is correct: Tidal locking ensures that the Moon takes 28 days to orbit Earth and 28 days to rotate once, causing the same side to face Earth.
- Statement 2 is incorrect: The far side is not permanently dark; it receives sunlight during the Moon's orbit.
- Statement 3 is incorrect: While the near side shows maria, this is due to volcanic activity, not directly caused by tidal locking.
- Statement 4 is incorrect: The far side of the Moon is not completely smooth; it has more craters and rugged terrain than the near side.

Thus, statement 1 is correct.

Topic 190

190. Agnibaan Rocket

- A private space company, **Agnikul Cosmos**, carried out the **first successful launch** of its **indigenously-built rocket** named **Agniban.**
- **Agnibaan** was powered by the **world's first 3-D printed engine,** and was launched from **Agnikul's own launchpad,** built at **ISRO's Sriharikota** launch facility.

Indian private company had flown a rocket from Indian soil for first time-
- In November **2022**, **Skyroot Aerospace**, a space start-up successfully launched a rocket which it has named **Vikram**, after **Vikram Sarabhai,** the legendary space leader credited with building **ISRO (earlier INCOSPAR).**

3D printing
- "making objects from 3D data, usually **layer upon layer" (additive manufacturing).**
- the physical object to be built is **first designed in software**
- design is **fed to computerised machines**, which build that **object layer by layer**

Current
- **Ministry of Electronics & IT** released a **"National Strategy on Additive Manufacturing"**

Aims -
1. **India's share** in **global additive manufacturing** to **5 per cent**
2. **100 startups in 3D printing by 2025**

Production-worldwide
US is market leader-35% of market share

China- Biggest player in Asia (50% market share in Asia)

The 3D-printed post office in Bengaluru. PTI

Cost **30-40 per cent less** than **conventional buildings** because of the **technological intervention**

Note- Recently ISRO made fourth stage liquid engine of PSLV through 3D printing.

Q568. Consider the following statements about the Agnibaan rocket:
1. It was developed by Agnikul Cosmos, a private Indian space company.
2. Agnibaan was powered by the world's first 3D-printed engine.
3. The rocket was launched from a launchpad located in ISRO's Sriharikota facility.
4. It is the first rocket launched by an Indian private company from Indian soil.

How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol: Statements 1, 2, and 3 are correct:
- Agnibaan was developed by Agnikul Cosmos.
- It was powered by the world's first 3D-printed engine.
- The rocket was launched from Agnikul's launchpad at ISRO's Sriharikota facility.

Statement 4 is incorrect:
- The first rocket launched by an Indian private company from Indian soil was Vikram, developed by Skyroot Aerospace in November 2022.

Q569. Consider the following statements about 3D printing in India:
1. The Ministry of Electronics & IT has released a "National Strategy on Additive Manufacturing."
2. The strategy aims to establish 100 startups in 3D printing by 2025.
3. The strategy seeks to achieve a 5% share of India in the global additive manufacturing market.
4. China is the leading player in the global 3D printing market with 35% market share.

Which of the above statements are correct?
(a) Only 1 and 2
(b) Only 1, 2, and 3
(c) Only 2, 3, and 4
(d) All 4

Ans: b

Sol: Statements 1, 2, and 3 are correct:
- The Ministry of Electronics & IT has released a strategy aiming for 100 startups in 3D printing by 2025 and a 5% share in the global additive manufacturing market.

Statement 4 is incorrect:
- The United States, not China, is the market leader with 35% of the global share. China is the largest player in Asia with 50% of the market share in the region.

Q570. Consider the following statements:
1. Agnikul Cosmos is the first private Indian company to launch a rocket.
2. Skyroot Aerospace's Vikram rocket is named after Vikram Sarabhai, the pioneer of India's space program.
3. Agnikul Cosmos used its own launchpad at ISRO's Sriharikota facility for the Agnibaan rocket.
4. Skyroot Aerospace launched its Vikram rocket in November 2022.

How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol: Statements 2, 3, and 4 are correct:

- Skyroot Aerospace's Vikram rocket is named after Vikram Sarabhai.
- Agnikul Cosmos used its own launchpad at ISRO's Sriharikota facility.
- Skyroot Aerospace launched the Vikram rocket in November 2022.

Statement 1 is incorrect:

- Skyroot Aerospace, not Agnikul Cosmos, was the first private Indian company to launch a rocket (Vikram).

Day 20

Topic 191

191. Uranium Enrichment

- Uranium is a **fissile material** (means can undergo **fission reaction** and release energy inform of heat).

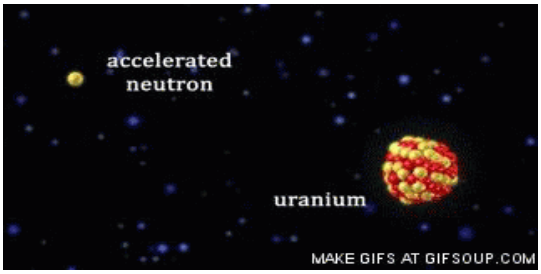
Can be used for **dual purpose-**

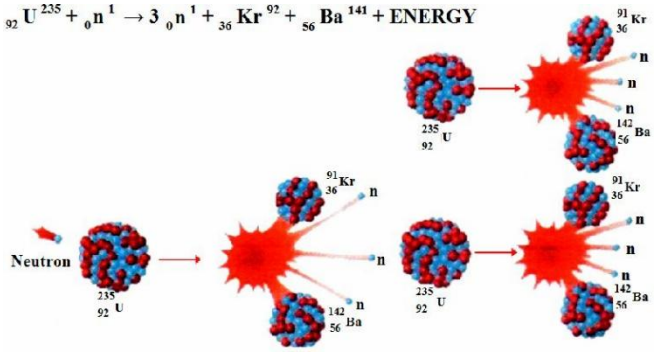
1. **Peaceful use- Eg Nuclear Power generation.**
2. **Destructive use- Eg Nuclear bombs.**

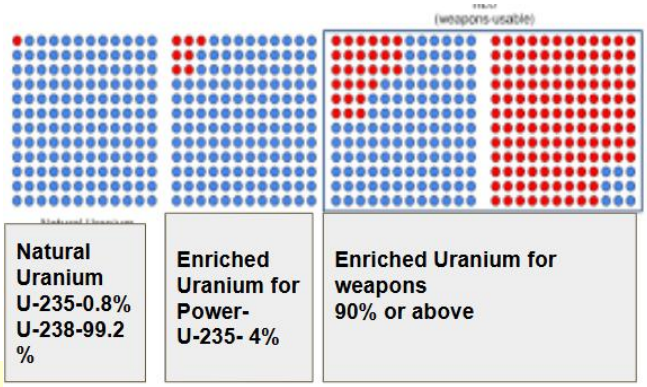
- **Uranium naturally** is found in mixture of **two isotope- U-235** and **U-238.**
- Natural Uranium- **U-235 (only 0.7%) U-238(99.3%).**
- Only **U-235 is fissile** (U-238 is fertile).

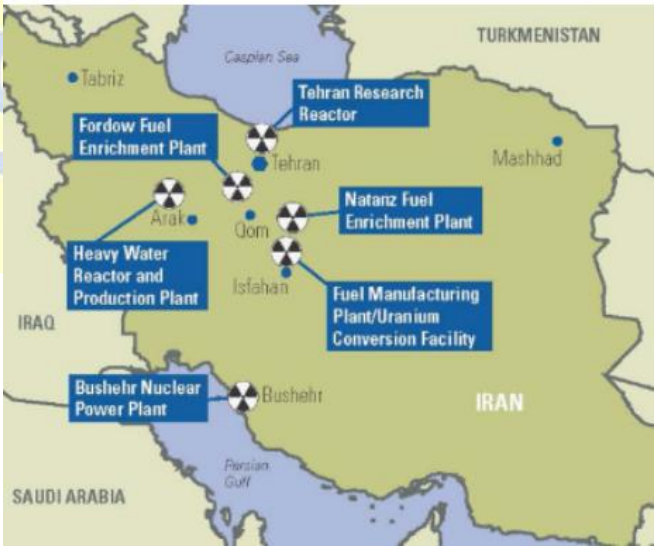
Uranium enrichment

- **Uranium enrichment** means **increasing the concentration** of **U-235** to use for power **generation or making bomb.**
- For **Nuclear bomb** the Uranium must be **enriched more than 90%.**
- While for **peaceful purpose Uranium enrichment** required is only **4%.**









Current news?

- **Iran** has started **uranium enrichment** upto level of **weapon grade** (more than 90%).
- Important **Nuclear sites of Iran**-
  a. Bushehr (Persian Gulf)
  b. Natanz
  c. Fordow

Q571. Consider the following statements about uranium:
1. Uranium is a fissile material that can release energy through fission reactions.

2. Natural uranium primarily consists of U-235, with a concentration of 99.3%.
3. U-235 is the fissile isotope, while U-238 is fertile.
4. Uranium can be used for both peaceful purposes, such as nuclear power generation, and destructive purposes, such as nuclear bombs.

How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol: Statements 1, 3, and 4 are correct:
- Uranium is fissile and can release energy through fission (Statement 1).
- U-235 is the fissile isotope, and U-238 is fertile (Statement 3).
- Uranium has dual-use applications: peaceful (nuclear power) and destructive (nuclear weapons) (Statement 4).

Statement 2 is incorrect:
- Natural uranium contains only 0.7% U-235, while U-238 makes up 99.3%.

Q572. Consider the following statements about uranium enrichment:
1. Uranium enrichment involves increasing the concentration of U-235 in natural uranium.
2. For nuclear power generation, uranium must be enriched to at least 90%.
3. For nuclear weapons, uranium enrichment must exceed 90%.
4. Iran has recently started enriching uranium to weapon-grade levels.

Which of the above statements are correct?
(a) Only 1 and 3
(b) Only 1, 3, and 4
(c) Only 2, 3, and 4
(d) All 4

Ans: b

Sol: Statements 1, 3, and 4 are correct:
- Uranium enrichment increases the concentration of U-235 (Statement 1).
- For nuclear weapons, uranium must be enriched to over 90% (Statement 3).
- Iran has recently started enriching uranium to weapon-grade levels (Statement 4).

Statement 2 is incorrect:
- For nuclear power generation, uranium needs to be enriched to only about 4%, not 90%.

Q573. Consider the following statements about Iran's nuclear program:
1. Iran's Bushehr nuclear site is located on the Persian Gulf.
2. The Natanz nuclear site is associated with uranium enrichment activities.
3. Fordow is one of Iran's major nuclear facilities.
4. Iran's uranium enrichment has reached a level required for peaceful nuclear power generation.

Which of the above statements are correct?
(a) Only 1 and 2
(b) Only 1, 2, and 3
(c) Only 2, 3, and 4
(d) All 4

Ans: b

Sol: Statements 1, 2, and 3 are correct:
- Bushehr is located on the Persian Gulf (Statement 1).
- Natanz is associated with uranium enrichment (Statement 2).
- Fordow is a key nuclear facility in Iran (Statement 3).

Statement 4 is incorrect:
- Iran's uranium enrichment has exceeded 90%, which is beyond the level required for peaceful purposes (4% for nuclear power).

Topic 192

192. Nuclear Power Strategy of India

3 stage Nuclear programme
- Formulated by **Dr. Homi Bhabha** in the **1950's.**
- It was developed **keeping in mind** that India is **rich in Thorium** (Monazite sand of Kerala).

1st stage-Pressurised Heavy Water Reactor
- Input-Natural Uranium (U-235 and U-238)
- Output-Plutonium & Energy

2nd stage-Fast Breeder Reactor

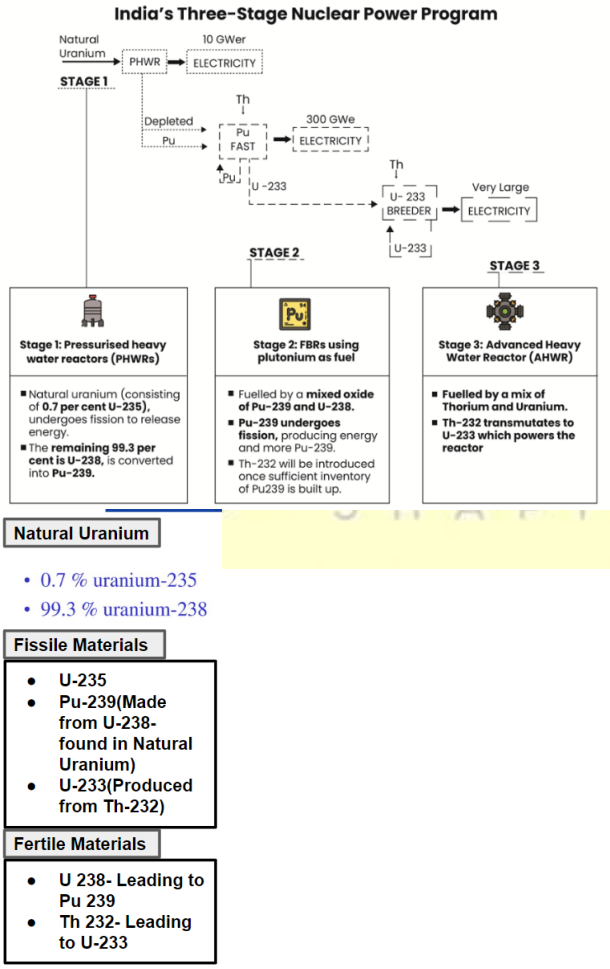
- Input-Plutonium (produced from stage 1) and Thorium (from Monazite sand)
- Output-U 233 & Energy

3rd Stage-Advanced Heavy Water Reactor

- Input-Thorium (from Monazite sand) + U233(from stage 2)
- Output-Energy

Note-

- India holds only about **2-3%** of the world's **uranium reserves,** but it possesses **25% of world's thorium reserves**.
- Thorium is found **Kerala, Tamil Nadu, Odisha**, Andhra Pradesh, West Bengal, Jharkhand etc.



Natural Uranium

- 0.7 % uranium-235
- 99.3 % uranium-238

Fissile Materials

- U-235
- Pu-239(Made from U-238- found in Natural Uranium)
- U-233(Produced from Th-232)

Fertile Materials

- U 238- Leading to Pu 239
- Th 232- Leading to U-233

Current status

- India is **planning** to **start 2nd Stage reactor.**
- India's **first Fast Breeder reactor** is being developed in **Kalpakkam, TN.**
- Soon, a **prototype of 500MW Fast Breeder reactor** will be critical.
- **Designed** and constructed indigenously by **Bharatiya Nabhikiya Vidyut Nigam Ltd or BHAVINI**

Note-Uranium Ore is known as **Yellow Cake** due to its color.

Q574. Consider the following statements about India's three-stage nuclear programme:

1. It was formulated by Dr. Homi Bhabha in the 1950s.
2. The first stage uses natural uranium as input and produces plutonium and energy.
3. The second stage involves fast breeder reactors using plutonium and thorium as input.
4. The third stage uses U-233 and plutonium to produce energy.

How many of the above statements are correct?
(a) Only 2
(b) Only 3
(c) All 4
(d) None

Ans: b

Sol: Statements 1, 2, and 3 are correct:

- The programme was formulated by Dr. Homi Bhabha in the 1950s (Statement 1).
- Stage 1 uses natural uranium as input and produces plutonium and energy (Statement 2).
- Stage 2 involves fast breeder reactors using plutonium and thorium as input (Statement 3).

Statement 4 is incorrect:

- The third stage uses U-233 (from stage 2) and thorium (not plutonium) as input to produce energy.

Q575. Consider the following statements:

1. India holds about 25% of the world's thorium reserves.
2. India possesses 2-3% of the world's uranium reserves.
3. Thorium is primarily found in the monazite sands of Kerala, Tamil Nadu, and Odisha.
4. Yellow cake refers to refined thorium ore due to its colour.

Which of the above statements are correct?
(a) Only 1 and 3
(b) Only 1, 2, and 3
(c) Only 2, 3, and 4
(d) All 4

Ans: b

Sol: Statements 1, 2, and 3 are correct:

- India holds 25% of the world's thorium reserves (Statement 1).
- It possesses 2-3% of the world's uranium reserves (Statement 2).
- Thorium is found in the monazite sands of Kerala, Tamil Nadu, Odisha, Andhra Pradesh, West Bengal, and Jharkhand (Statement 3).

Statement 4 is incorrect:

- Yellow cake refers to refined uranium ore, not thorium ore.

Q576. Consider the following statements about India's fast breeder reactor programme:

1. India is planning to start its second-stage nuclear reactors, which are fast breeder reactors.
2. India's first fast breeder reactor is being developed in Kalpakkam, Tamil Nadu.
3. The prototype of a 500 MW fast breeder reactor is being designed and constructed by BHAVINI.
4. The second stage uses natural uranium and thorium as inputs to produce U-233 and energy.

How many of the above statements are correct?

(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol: Statements 1, 2, and 3 are correct:

- India is planning to start its second-stage nuclear programme (Statement 1).
- The first fast breeder reactor is being developed in Kalpakkam, Tamil Nadu (Statement 2).
- BHAVINI is designing and constructing a 500 MW prototype fast breeder reactor (Statement 3).

Statement 4 is incorrect:

- The second stage uses plutonium (produced in stage 1) and thorium as inputs, not natural uranium and thorium.

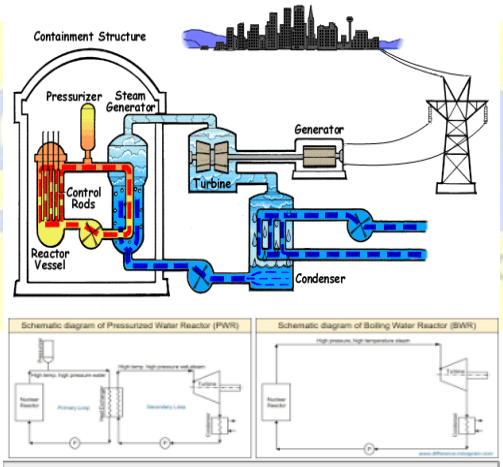
Topic 193

193. Nuclear Power production in India

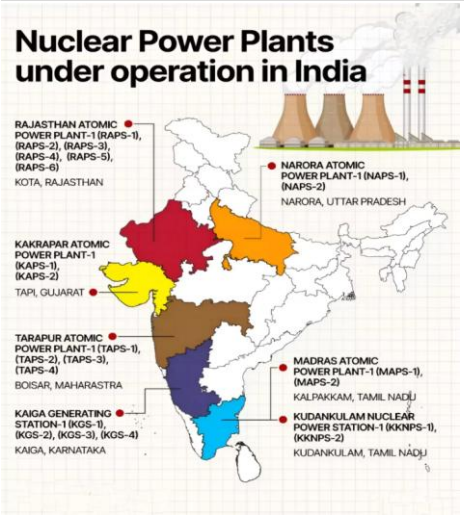
- **Installed nuclear power capacity** -**7.5 GW**
- **Share of nuclear power** -**3%**(of total power produced)
- India aims to **achieve tripling nuclear power** generation **capacity by 2030**.
- India currently has comprising of **23 nuclear power reactors.** (**19 Pressurised Heavy Water Reactor (PHWR)**, 2 Boiling Water Reactors (BWR) and 2 Pressurised Water Reactors (PWRs)).
- Recently added at the **Kakrapar Atomic Power Plant in Gujarat.**

PHWR v/s BWR v/s PWRs

- On the basis of use of **coolant and Moderator.**
- **PWR and BWR** use **same** coolant and moderator ie **Water.**
- A **PWR generates steam indirectly**: heat is transferred from the primary reactor coolant into secondary circuit.
- A **BWR produces steam directly** by boiling the water coolant.



Above diagram shows difference between PWR and BWR



Feature	Pressurized Heavy Water Reactor (PHWR)	Boiling Water Reactor (BWR)	Pressurized Water Reactor (PWR)
Moderator	Heavy water (D2O)	Light water (H2O)	Light water (H2O)
Coolant	Heavy water (D2O)	Light water (H2O)	Light water (H2O)
Fuel	Natural uranium	Enriched uranium	Enriched uranium

Q577. Consider the following statements about nuclear power production in India:
1. India's installed nuclear power capacity is 7.5 GW.
2. Nuclear power accounts for 3% of the total power produced in India.
3. India has 25 operational nuclear reactors, including PHWRs, BWRs, and PWRs.
4. India aims to triple its nuclear power generation capacity by 2030.

How many of the above statements are correct?
(a) Only 2
(b) Only 3
(c) Only 1
(d) All 4

Ans: b

Sol: Statements 1, 2, and 4 are correct:
- India's installed nuclear power capacity is 7.5 GW (Statement 1).
- Nuclear power contributes 3% of the total power production (Statement 2).
- India aims to triple its nuclear power generation capacity by 2030 (Statement 4).

Statement 3 is incorrect:
- India currently has 23 nuclear reactors, not 25.

Q578. Consider the following statements about nuclear reactors in India:
1. India's nuclear power reactors include Pressurised Heavy Water Reactors (PHWR), Boiling Water Reactors (BWR), and Pressurised Water Reactors (PWRs).
2. PHWRs make up the majority of India's nuclear reactors.
3. Recently, a PWR was added to the Kakrapar Atomic Power Plant in Gujarat.
4. BWRs and PWRs use water as both coolant and moderator.

Which of the above statements are correct?
(a) Only 1 and 2
(b) Only 1, 2, and 4
(c) Only 2, 3, and 4
(d) All 4

Ans: b

Sol: Statements 1, 2, and 4 are correct:
- India's nuclear reactors include PHWRs, BWRs, and PWRs (Statement 1).
- PHWRs are the majority, with 19 out of 23 reactors (Statement 2).
- Both BWRs and PWRs use water as coolant and moderator (Statement 4).

Statement 3 is incorrect:
- The reactor recently added to the Kakrapar Atomic Power Plant is a PHWR, not a PWR.

Q579. Consider the following statements about Pressurised Water Reactors (PWRs) and Boiling Water Reactors (BWRs):
1. Both PWRs and BWRs use water as the coolant and moderator.
2. A PWR generates steam indirectly through a secondary circuit.
3. A BWR produces steam directly by boiling the water coolant.
4. PWRs are more commonly used than BWRs in India's nuclear power plants.

Which of the above statements are correct?
(a) Only 1, 2, and 3
(b) Only 1 and 4
(c) Only 2, 3, and 4
(d) All 4

Ans: a

Sol: Statements 1, 2, and 3 are correct:
- Both PWRs and BWRs use water as coolant and moderator (Statement 1).
- A PWR generates steam indirectly via a secondary circuit (Statement 2).
- A BWR produces steam directly by boiling the water coolant (Statement 3).

Statement 4 is incorrect:
- PHWRs, not PWRs or BWRs, are more commonly used in India's nuclear power plants.

Topic 194

194. Tokamak

Nuclear Fission vs Fusion Reaction

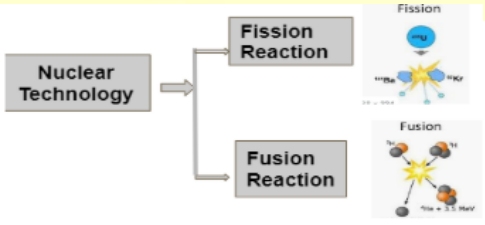
- While **fission** is an **easier process** to carry out, it **generates far more nuclear waste.**
- **Fission** also gives **GHG unlike Fusion.**
- **Fusion** considered a **safer process** with **lower risk of accidents** and **produces more energy** but **difficult to conduct.**

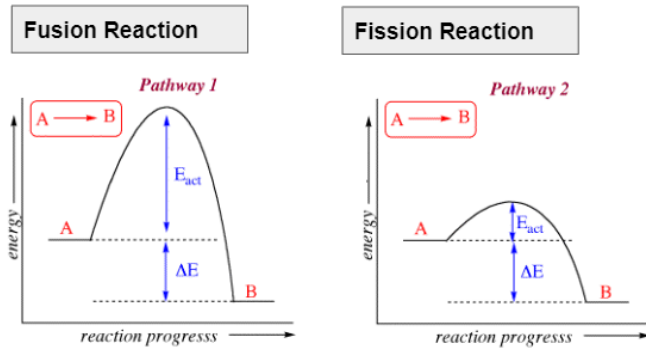
Tokamak

- A type of **nuclear fusion reactor.**
- **Mimic the fusion processes** that power the sun, thus **known as "artificial sun."**

Important Tokamaks being developed worldwide-

1. **ITER (International Thermonuclear Experimental Reactor)**
   - Location: Cadarache, France
   - A global **collaboration involving 35 countries** (European Union, USA, **China**, **India,** Russia, Japan, and South Korea).
2. **EAST (Experimental Advanced Superconducting Tokamak)**
   - Location: Hefei, China/Nickname: "Artificial Sun"
3. **ADITYA & ADITYA-U**
   - Location: Institute for Plasma Research (IPR), **Gandhinagar, India.**
   - **India's first Tokamak** focusing on plasma behavior studies.





Q580. Consider the following statements about nuclear fission and fusion reactions:
1. Fission generates more greenhouse gases (GHGs) compared to fusion.
2. Fusion produces significantly less nuclear waste than fission.
3. Fission is easier to carry out than fusion but produces less energy.
4. Fusion is considered safer with a lower risk of accidents compared to fission.

How many of the above statements are correct?
(a) Only two
(b) Only three
(c) Only one
(d) All four

Ans: d

Sol: • **Statements 1, 2, and 4 are correct:** Fission generates GHGs, while fusion does not **(Statement 1).**
• Fusion produces less nuclear waste than fission **(Statement 2).**
Fission is easier to carry out than fusion but produces less energy.
• **Statement 3 Correct.** Fission is a well-established technology and can be controlled with current technology. Fusion is much harder to achieve due to the extreme temperature and pressure conditions required. Fusion does have the potential to produce significantly more energy per reaction.
• Fusion is considered safer with lower accident risks **(Statement 4).**

Q581. Consider the following statements about major Tokamak projects:
1. ITER is a collaborative project involving 35 countries and is located in France.
2. EAST, nicknamed the "Artificial Sun," is being developed in China.
3. ADITYA-U is India's first Tokamak focusing on plasma behavior studies.
4. Tokamaks aim to replicate the fusion process that powers the Sun.

Which of the above statements are correct?
(a) Only 1 and 2
(b) Only 1, 2, and 4
(c) Only 2, 3, and 4
(d) All 4

Ans: d

Sol: All statements are correct:

- ITER is located in Cadarache, France, and involves 35 countries, including India (Statement 1).
- EAST is nicknamed the "Artificial Sun" and is being developed in Hefei, China (Statement 2).
- ADITYA-U is India's first Tokamak and focuses on plasma behavior studies (Statement 3).
- Tokamaks aim to replicate the Sun's fusion process (Statement 4).

Q582. Consider the following statements about Tokamak technology:
1. Tokamaks are nuclear fission reactors designed to produce energy with minimal GHG emissions.
2. The fusion process in Tokamaks mimics the energy generation process of the Sun.
3. ADITYA and ADITYA-U are Tokamaks developed in India to study plasma behavior.
4. Tokamaks produce significantly more energy than fission reactors but are harder to operate.

Which of the above statements are incorrect?
(a) Only 1 and 4
(b) Only 1 and 2
(c) Only 2 and 3
(d) Only 3 and 4

Ans: a

Sol: Statements 2 and 3 are correct:
- Tokamaks mimic the fusion process of the Sun (Statement 2).
- ADITYA and ADITYA-U are India's Tokamaks focused on plasma behavior (Statement 3).

Statements 1 and 4 are incorrect:
- Tokamaks are fusion reactors, not fission reactors (Statement 1).
- While fusion reactors have the potential to produce more energy, they are not yet operational for large-scale energy production, so this remains theoretical (Statement 4).

Topic 195

195. Nuclear Energy Summit,2024

- World's **first ever** Nuclear Energy Summit
- held in **Brussels, Belgium**
- **Organized by** the International Atomic Energy Agency **(IAEA)** in association with **Belgium government.**
- It was organised in the **wake of more inclusion of nuclear energy deployment (three times by 2050)** agreed at **UN Climate Change Conference (COP28), 2023** held at **Dubai**.
- Summit was attended by **more than 30 nations** (including **India)** and European Union.

IAEA (International Atomic Energy Agency)
- **Specialised agency** of the UN.
- **Created in 1957** to prevent misuse of Nuclear technologies.
- **Headquarter: Vienna, Austria**.
- In **2005,** it was awarded the **Nobel Peace Prize**
- Members: **178 (Including India)**
- Key Initiative: **Atoms4NetZero**

Q583. Consider the following statements about the Nuclear Energy Summit, 2024:
1. It was the world's first-ever Nuclear Energy Summit, held in Brussels, Belgium.
2. The summit was organized by the IAEA in association with the government of Belgium.
3. The summit emphasized nuclear energy deployment tripling by 2050, as agreed upon at COP28.
4. The summit was attended by more than 50 nations and the European Union.

How many of the above statements are correct?

(a) Only 2
(b) Only 3
(c) Only 1
(d) All 4

Ans: b

Sol: Statements 1, 2, and 3 are correct:

- The summit was the world's first Nuclear Energy Summit, held in Brussels, Belgium (Statement 1).
- It was organized by the IAEA in collaboration with the Belgian government (Statement 2).
- The emphasis on tripling nuclear energy deployment by 2050 aligns with agreements at COP28 (Statement 3).

Statement 4 is incorrect:

- The summit was attended by more than 30 nations, not 50, along with the European Union.

Q584. Consider the following statements about the IAEA:

1. It is a specialized agency of the United Nations created in 1957.
2. Its headquarters is located in Vienna, Austria.
3. It was awarded the Nobel Peace Prize in 2005.
4. The IAEA currently has 150 member states.

Which of the above statements are correct?
(a) Only 1 and 2
(b) Only 1, 2, and 3
(c) Only 1, 3, and 4
(d) All 4

Ans: b

Sol: Statements 1, 2, and 3 are correct:

- The IAEA is a specialized UN agency established in 1957 (Statement 1).
- Its headquarters is in Vienna, Austria (Statement 2).
- It received the Nobel Peace Prize in 2005 (Statement 3).

Statement 4 is incorrect:

- The IAEA currently has 178 member states, not 150.

Q585. Consider the following statements regarding the global context of the Nuclear Energy Summit, 2024:

1. The summit was organized in response to nuclear energy goals discussed at COP28, held in Dubai.
2. The IAEA's "Atoms4NetZero" initiative was a focal point of the summit.
3. India, a member of the IAEA, was among the participating nations at the summit.
4. The European Union did not participate in the summit.

Which of the above statements are correct?
(a) Only 1, 2, and 3
(b) Only 2, 3, and 4
(c) Only 1 and 3
(d) All 4

Ans: a

Sol: Statements 1, 2, and 3 are correct:

- The summit was held to promote nuclear energy deployment goals aligned with COP28 agreements (Statement 1).
- The IAEA's "Atoms4NetZero" initiative was a key topic (Statement 2).
- India, an IAEA member, participated in the summit (Statement 3).

Statement 4 is incorrect:

- The European Union participated in the summit.

Topic 196

196. India's Mission to Moon

Chandrayaan 1,2008

- It was an **Orbiter Mission.**
- Proved Existence of **water on Moon.**

Chandrayaan 2,2019

- **Orbiter** - a module which will orbit the moon, like any satellite does. Named as Chandrayaan 2
- **Lander Vikram** - It had to land on the **south pole** of the moon **(Tiranga Point).**
- **Rover Pragyan**- It will be robotic vehicle which will move on the moon's surface to collect important samples take readings.

Outcome

- The Lander- **Vikram** could **not land softly.**
- Thus it became **dysfunctional.**
- But **Orbiter** is **working well.**

Chandrayaan 3

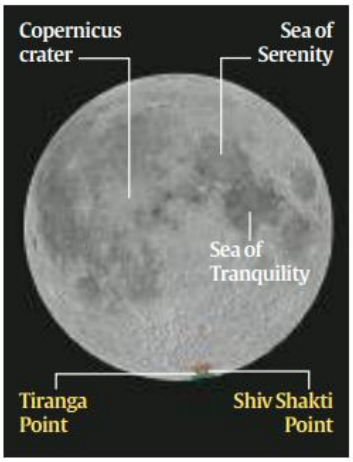
- **Successful soft landing** on Moon's **South Pole** on **August 23(National Space Day).**
- **Spot of landing of Vikram lander** will be known as **'Shivshakti'** point.

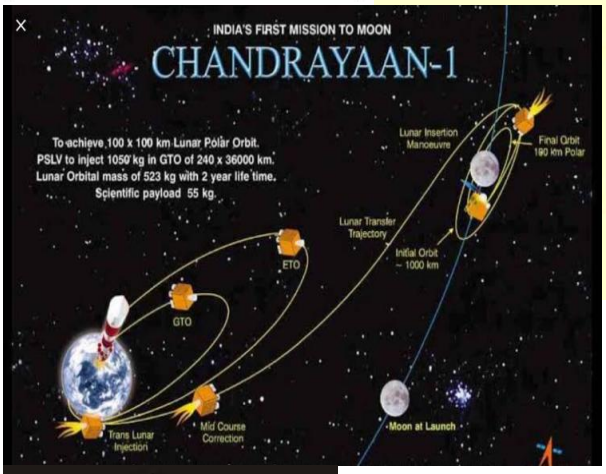
Chandrayaan 4(will launched in 2028)

- **Lunar rock sample collection**

LUPEX mission (to be launched after Chandrayan4)

- It will be jointly launched by **ISRO** and **JAXA** (Space agency of Japan),
- Lunar Polar Exploration or **Chandrayan 5**
- Will evaluate **water deposit on Moon**





Q586. Consider the following statements:

1. Chandrayaan-1 was India's first moon mission and confirmed the presence of water on the Moon.
2. Chandrayaan-2 included an orbiter, a lander named Vikram, and a rover named Pragyan.
3. Chandrayaan-2's Vikram lander achieved a successful soft landing on the Moon's south pole.
4. Chandrayaan-3 successfully landed on the Moon's south pole on August 23, 2023, at the Shivshakti point.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2 and 3 only
(d) All four

Ans: b

Sol:

- Statement 1 is correct: Chandrayaan-1, launched in 2008, confirmed the presence of water on the Moon.
- Statement 2 is correct: Chandrayaan-2 had an orbiter, lander (Vikram), and rover (Pragyan).
- Statement 3 is incorrect: Vikram lander failed to achieve a soft landing and became non-functional.
- Statement 4 is correct: Chandrayaan-3 achieved a successful soft landing at the Moon's south pole, with the landing site named Shivshakti point.

Thus, statements 1, 2, and 4 are correct.

Q587. Which of the following statements about India's Moon missions are correct?

1. Chandrayaan-1 was an orbiter mission that explored the Moon's water reserves.
2. Chandrayaan-2's orbiter is still operational and provides valuable data about the Moon.
3. The LUPEX mission is a joint collaboration between ISRO and NASA to explore the Moon's polar regions.
4. Chandrayaan-4 will focus on collecting lunar rock samples and is planned for launch in 2028.

(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol:

- Statement 1 is correct: Chandrayaan-1 was an orbiter mission that explored the presence of water on the Moon.
- Statement 2 is correct: The orbiter from Chandrayaan-2 remains operational and provides critical lunar data.
- Statement 3 is incorrect: The LUPEX mission is a collaboration between ISRO and JAXA (Japan's space agency), not NASA.
- Statement 4 is correct: Chandrayaan-4, planned for 2028, will focus on collecting lunar rock samples.

Thus, statements 1, 2, and 4 are correct.

Q588. Consider the following statements regarding future lunar missions by ISRO:
1. Chandrayaan-4 will primarily focus on evaluating water deposits on the Moon.
2. The LUPEX mission, a collaboration with JAXA, will explore the Moon's polar regions.
3. Chandrayaan-5 will evaluate the Moon's water deposits.
4. Chandrayaan-5 and LUPEX are the same mission with joint objectives.
Which one of the statement(s) given above is/are correct?
(a) 1 only
(b) 2 and 3 only
(c) 3 and 4 only
(d) 2, 3 and 4 only

Ans: d

Sol: Statement 1 is incorrect: Chandrayaan-4 will focus on collecting lunar rock samples, not water deposits.
Statement 2 is correct: The LUPEX mission, a collaboration between ISRO and JAXA, will explore the Moon's polar regions.
Statement 3 is correct: Chandrayaan-5 will evaluate water deposits.
Statement 4 is correct: Yes, Chandrayaan-5 and LUPEX (Lunar Polar Exploration Mission) are the same mission, a joint endeavor between India's ISRO and Japan's JAXA, with the goal of exploring the Moon's south pole for water and other resources.

Topic 197

197. Oxytocin

- It is a **male/female sexual hormone(also known as 'love hormone')**.
- Released from **Pituitary glands of women**.
- It is present in **Hypothalamus section of Brain**.
- Its release in **female helps to control bleeding** at the **time of delivery of Child.**
- It also helps in **release of milk for breastfeeding**.
- So its regular **supply in the hospitals** is important.

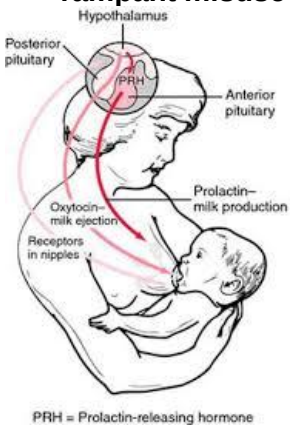
Side effects of Oxytocin

1. **Animal cruelty**
- Excessively injected in milch animals for more milk- causing pain.
2. **Artificial freshness in vegetables and fruits**
- Injected in vegetables.
- That makes its look bigger and fresh.
3. **Enter into human body through vegetables and fruits**

This can have effects like-
A. Confusion.
B. convulsions (seizures)
C. difficulty in breathing.
D. fast or irregular heartbeat.
E. headache (continuing or severe)
F. hives.

Why in news?

- **Delhi High Court** called for action against **'rampant misuse of Oxytocin'**



Q589. Consider the following statements about oxytocin:
1. Oxytocin is released from the pituitary gland and is present in the hypothalamus section of the brain.

2. It controls bleeding during childbirth and aids in milk release for breastfeeding.
3. Oxytocin is a male hormone that supports reproductive functions.
4. Its supply is critical in hospitals for maternal care during delivery.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol:
- Statement 1 is correct: Oxytocin is synthesized in the hypothalamus and released by the pituitary gland.
- Statement 2 is correct: Oxytocin helps control bleeding after childbirth and supports milk release during breastfeeding.
- Statement 3 is incorrect: Oxytocin is primarily a female hormone, though it is present in males but does not serve the same functions.
- Statement 4 is correct: Hospitals require oxytocin for maternal care, especially during childbirth.

Thus, statements 1, 2, and 4 are correct.

Q590. Which of the following statements about the misuse and side effects of oxytocin are correct?
1. Oxytocin is injected into milch animals to increase milk production, causing pain and animal cruelty.
2. It is used on vegetables and fruits to make them appear fresher and larger.
3. Oxytocin misuse in humans through contaminated vegetables can lead to confusion, convulsions, and irregular heartbeat.
4. There are no significant health concerns associated with consuming oxytocin-treated fruits or vegetables.

(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol:
- Statement 1 is correct: Oxytocin is injected into milch animals, causing pain and animal cruelty.
- Statement 2 is correct: It is used on vegetables and fruits to enhance their size and appearance artificially.
- Statement 3 is correct: Human consumption of oxytocin-contaminated produce can cause confusion, convulsions, and irregular heartbeat.
- Statement 4 is incorrect: Misuse of oxytocin is a major health concern, and consuming oxytocin-treated produce has adverse effects.

Thus, statements 1, 2, and 3 are correct.

Q591. Consider the following statements about oxytocin:
1. The Delhi High Court has called for stricter regulations against the rampant misuse of oxytocin.
2. Excessive use of oxytocin in agriculture has been completely eliminated in India.
3. Oxytocin's misuse in dairy and agriculture industries poses ethical and health challenges.
4. Oxytocin is exclusively used for medical purposes with no reported misuse.

Which one of the statements given above is correct?
(a) 1 only
(b) 2 only
(c) 3 only
(d) 4 only

Ans: a

Sol:
- Statement 1 is correct: The Delhi High Court has raised concerns over the rampant misuse of oxytocin and called for action.
- Statement 2 is incorrect: The misuse of oxytocin in agriculture and dairy practices still exists in India.
- Statement 3 is incorrect: While true, this is not the focus of the question.
- Statement 4 is incorrect: Oxytocin has been misused in non-medical industries, including dairy and agriculture.

Thus, statement 1 is correct.

Topic 198

198. Turing Test and Artificial General Intelligence

Artificial General Intelligence

- AGI aims to **emulate human cognitive abilities** such that it allows it **to do unfamiliar tasks,** learn from new experiences, and apply its knowledge in new ways.

Humans vs AGI

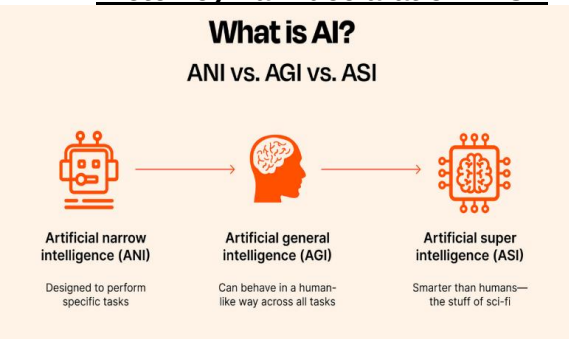
- **Humans learn through their experiences —** in school, home, or elsewhere; by talking to people or observing things; by reading books, watching television, reading articles, etc.
- The human brain then **uses the information** it has gathered to **make decisions (often subconscious)** that **solve any given problem.**
- **With AGI,** researchers aim to build **a software or computer that can do all this.**

Turing test

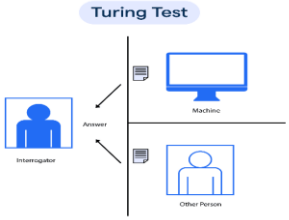
- The Turing test is an **assessment** to determine **whether a machine** is able to **exhibit the same intelligence** as a **human.**
- It means **ANI may not pass** Turing test but **AGI will.**
- Named after **Alan Turing, in 1949** after **British Scientist and Mathematician.**

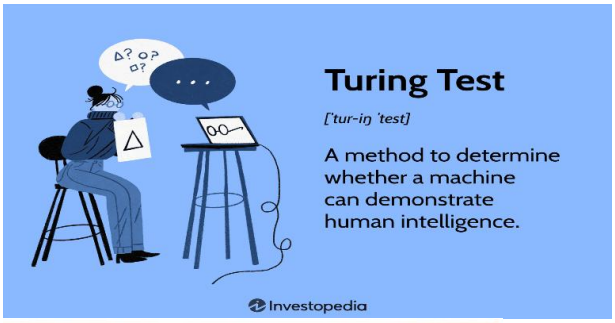
2 Global Summit on AI in 2023

1. **Global Partnership on Artificial Intelligence (GPAI)**
   - Held in New Delhi
2. **Bletchley Park declaration in UK**



Currently the AI we use like **ChatGPT is known as Narrow AI.**





Global Partnership on Artificial Intelligence

- India is a part of this initiative.
- UNESCO has an observer status to GPAI.

Q592. Consider the following statements about Artificial General Intelligence (AGI):

1. AGI aims to emulate human cognitive abilities, including learning unfamiliar tasks and applying knowledge in new ways.
2. AGI systems make subconscious decisions like humans, influenced by personal experiences.
3. AGI systems are designed to replicate the problem-solving capabilities of the human brain.
4. Unlike Artificial Narrow Intelligence (ANI), AGI can pass the Turing Test.

Which of the statements given above are correct?

(a) 1 and 3 only
(b) 1, 3, and 4 only
(c) 2, 3, and 4 only
(d) All four

Ans: b

Sol:

- Statement 1 is correct: AGI emulates human cognitive abilities, enabling it to adapt to new tasks and apply knowledge in novel situations.
- Statement 2 is incorrect: AGI systems do not make subconscious decisions; they are

guided by algorithms and logic, unlike humans.
- Statement 3 is correct: AGI aims to replicate the problem-solving capabilities of the human brain.
- Statement 4 is correct: AGI can pass the Turing Test, unlike ANI, which is limited to specific tasks.

Thus, statements 1, 3, and 4 are correct.

Q593. Which of the following statements about the Turing Test are correct?
1. The Turing Test assesses whether a machine exhibits intelligence indistinguishable from that of a human.
2. The Turing Test was introduced by Alan Turing in 1949.
3. Artificial Narrow Intelligence (ANI) systems can pass the Turing Test in specific scenarios.
4. The Turing Test requires a machine to demonstrate reasoning, learning, and adaptation similar to humans.

(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2 and 3 only
(d) All four

Ans: b

Sol:
- Statement 1 is correct: The Turing Test determines whether a machine's intelligence is indistinguishable from human intelligence.
- Statement 2 is correct: Alan Turing introduced the test in 1949, marking a milestone in AI.
- Statement 3 is incorrect: ANI systems cannot pass the Turing Test as they lack general cognitive capabilities.
- Statement 4 is correct: The Turing Test evaluates reasoning, learning, and adaptation to simulate human-like intelligence.

Thus, statements 1, 2, and 4 are correct.

Q594. Consider the following statements about recent global AI summits and initiatives:
1. The Global Partnership on Artificial Intelligence (GPAI) summit in 2023 was held in New Delhi.
2. The Bletchley Park Declaration focused on regulating Artificial General Intelligence (AGI) worldwide.
3. The GPAI summit emphasized the ethical use of AI technologies and global cooperation.
4. The Bletchley Park Declaration was announced during the GPAI summit.

Which of the statements given above are correct?
(a) 1 and 3 only
(b) 1, 2, and 3 only
(c) 2 and 4 only
(d) All four

Ans: b

Sol:
- Statement 1 is correct: The Global Partnership on Artificial Intelligence (GPAI) summit in 2023 was hosted in New Delhi, India.
- Statement 2 is correct: The Bletchley Park Declaration, announced in the UK, aimed to regulate AI, particularly AGI.
- Statement 3 is correct: The GPAI summit stressed the ethical use of AI and international cooperation.
- Statement 4 is incorrect: The Bletchley Park Declaration was not part of the GPAI summit; it was a separate initiative in the UK.

Thus, statements 1, 2, and 3 are correct.

Topic 199

199. Goldene

Goldene
- It is the first free-standing 2D Gold metal leaf.
- Only one atom thick.

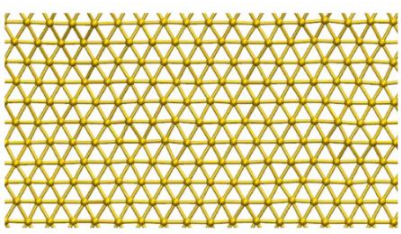
How it has been created?
- First an atomic monolayer of silicon was sandwiched between layers of titanium carbide.
- Gold was deposited on top of this sandwich structure.
- The gold atoms diffused into the material and replaced the silicon atoms, forming a trapped monolayer of gold atoms.

Application of Goldene

1. Electronics industry
- Can potentially revolutionise the electronics industry

2. Great catalyst
- Can expedite chemical reactions.

3. Economically viable
- Electronics, which use gold due to its electrical conductivity, can potentially use lesser amounts for the same purpose.



Goldene
- These sheets of goldene are roughly **100 nanometres thick**, approximately **400 times thinner than** the **thinnest commercially available gold leaf.**

Q595. Consider the following statements about Goldene:
1. Goldene is a 2D gold metal leaf that is only one atom thick.
2. It was created by depositing a monolayer of silicon atoms on gold, which replaced titanium carbide atoms.
3. The process of creating Goldene involves diffusion of gold atoms into a material to replace silicon atoms.
4. Goldene is a three-dimensional structure that provides excellent electrical conductivity.

Which of the statements given above are correct?
(a) 1 and 3 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All four

Ans: a

Sol:
- Statement 1 is correct: Goldene is a free-standing 2D gold metal leaf that is one atom thick.
- Statement 2 is incorrect: Gold was deposited on a silicon-titanium carbide sandwich, and gold replaced silicon atoms, not titanium carbide.
- Statement 3 is correct: The gold atoms diffused into the material, replacing silicon atoms to create Goldene.
- Statement 4 is incorrect: Goldene is not three-dimensional; it is a 2D structure.

Thus, statements 1 and 3 are correct.

Q596. Which of the following statements about the applications of Goldene are correct?
1. Goldene has the potential to revolutionize the electronics industry due to its electrical conductivity.
2. It can act as a highly effective catalyst for chemical reactions.
3. Its economic viability stems from the possibility of using lesser amounts of gold in electronics.
4. Goldene is exclusively used in the electronics industry because of its conductivity.

(a) 1, 2, and 3 only
(b) 2 and 4 only
(c) 1 and 4 only
(d) All four

Ans: a

Sol:
- Statement 1 is correct: Goldene's exceptional electrical conductivity can revolutionize the electronics industry.
- Statement 2 is correct: It is a great catalyst, capable of expediting chemical reactions.
- Statement 3 is correct: Goldene is economically viable as it reduces the amount of gold required for electronics.
- Statement 4 is incorrect: While its conductivity is valuable for electronics, Goldene's applications extend beyond this field, such as catalysis.

Thus, statements 1, 2, and 3 are correct.

Q597. Consider the following statements about the creation of Goldene:
1. Goldene is formed by sandwiching a monolayer of titanium carbide between two layers of gold atoms.
2. The silicon atoms in the material are replaced by gold atoms during the diffusion process.
3. Goldene's unique structure was achieved by depositing gold atoms on a silicon-titanium carbide composite.
4. Goldene's creation involved direct deposition of gold on a pure silicon monolayer.

Which one of the statements given above is correct?
(a) 1 only
(b) 2 only
(c) 3 only
(d) 4 only

Ans: b

Sol:

- Statement 1 is incorrect: Goldene was formed by depositing gold on a silicon-titanium carbide sandwich, not titanium carbide between gold.
- Statement 2 is correct: During the process, gold atoms replaced silicon atoms in the material.
- Statement 3 is incorrect: Goldene's structure involved gold diffusion into the silicon-titanium carbide sandwich, not a direct composite.
- Statement 4 is incorrect: Gold was deposited on a sandwich structure, not directly on a pure silicon monolayer.

Thus, statement 2 is correct.

Topic 200

200. Preservatives

Ethylene oxide

- This preservative is used as a **sterilizing agent** in **spices and dried vegetables**.
- **Extends products shelf life** and makes their storage safe.
- But Long-term exposure to ethylene oxide is associated with cancers including lymphoma and leukemia.

Sodium benzoate

- It effectively **prevents the growth** of **bacteria and fungi** in **acidic items** like **soft drinks and fruit juices.**
- Apart from Soda it is **also used in packaged foods.**

Sulfur dioxide

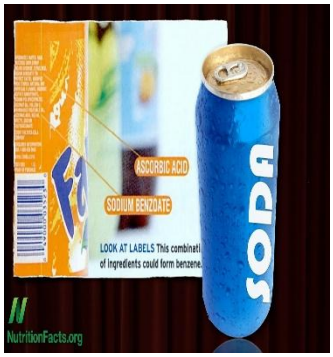
- Primarily used for preserving **dried fruits** and **preventing discoloration.**
- It **inhibits growth of microbes** such as yeasts, bacteria

Nitrites

- Prevents **growth of bacteria,** particularly **Clostridium botulinum,** in **meats** and **cheese.**

Current news?

- More than **five countries** — including Singapore, Hong Kong and the U.S. — have announced an **investigation into possible contamination of spice** with **Ethylene Oxide** mixes sold by top Indian brands, **MDH and Everest.**



Q598. Consider the following statements about preservatives:

1. Ethylene oxide is used as a sterilizing agent in spices and dried vegetables, but long-term exposure is linked to certain cancers.
2. Sodium benzoate is effective in preventing the growth of bacteria in acidic food items like soft drinks and fruit juices.
3. Sulfur dioxide is used to prevent discoloration in dried fruits and inhibit microbial growth.
4. Nitrites are primarily used to preserve vegetables and prevent discoloration.

Which of the statements given above are correct?

(a) 1, 2, and 3 only
(b) 2, 3, and 4 only
(c) 1 and 4 only
(d) All four

Ans: a

Sol:

- Statement 1 is correct: Ethylene oxide sterilizes spices and vegetables but has health risks like cancer (lymphoma and leukemia).
- Statement 2 is correct: Sodium benzoate prevents microbial growth in acidic foods like soft drinks and fruit juices.
- Statement 3 is correct: Sulfur dioxide prevents discoloration in dried fruits and inhibits microbial growth.
- Statement 4 is incorrect: Nitrites are used in meats and cheese, not vegetables, to prevent Clostridium botulinum growth.

Thus, statements 1, 2, and 3 are correct.

Q599. Which of the following statements about recent news involving preservatives are correct?

1. Ethylene oxide contamination in spices has led to investigations by multiple countries, including Singapore and the U.S.

2. Ethylene oxide is a sterilizing agent used in spices to extend shelf life but is not linked to any health risks.
3. Indian spice brands MDH and Everest are under scrutiny for ethylene oxide contamination.
4. Sulfur dioxide contamination has been detected in packaged foods exported from India.

(a) 1 and 3 only
(b) 2 and 4 only
(c) 1, 3, and 4 only
(d) All four

Ans: a

Sol:

- Statement 1 is correct: Countries like Singapore, Hong Kong, and the U.S. are investigating ethylene oxide contamination in spices.
- Statement 2 is incorrect: Ethylene oxide is linked to serious health risks like cancer.
- Statement 3 is correct: Brands like MDH and Everest are being investigated for potential contamination.
- Statement 4 is incorrect: The contamination involves ethylene oxide, not sulfur dioxide.

Thus, statements 1 and 3 are correct.

Q600. Consider the following statements about specific preservatives and their uses:

1. Sulfur dioxide inhibits the growth of microbes in dried fruits.
2. Sodium benzoate is used to preserve meats and cheese by preventing bacterial growth.
3. Nitrites are effective in preventing the growth of Clostridium botulinum in packaged meats.
4. Ethylene oxide is commonly used to sterilize vegetables, extending their shelf life.

Which one of the statements given above is correct?

(a) 1 only
(b) 2 only
(c) 3 only
(d) 4 only

Ans: c

Sol:

- Statement 1 is incorrect: While sulfur dioxide inhibits microbial growth, it is primarily used for preserving dried fruits and preventing discoloration.
- Statement 2 is incorrect: Sodium benzoate is used in acidic food items, not meats and cheese.
- Statement 3 is correct: Nitrites prevent the growth of Clostridium botulinum, particularly in meats.
- Statement 4 is incorrect: Ethylene oxide sterilizes spices and vegetables but also poses health risks.

Thus, statement 3 is correct.

Day 21

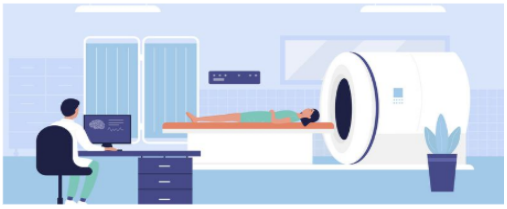
Topic 201

201. Magnetic Resonance Imaging (MRI)

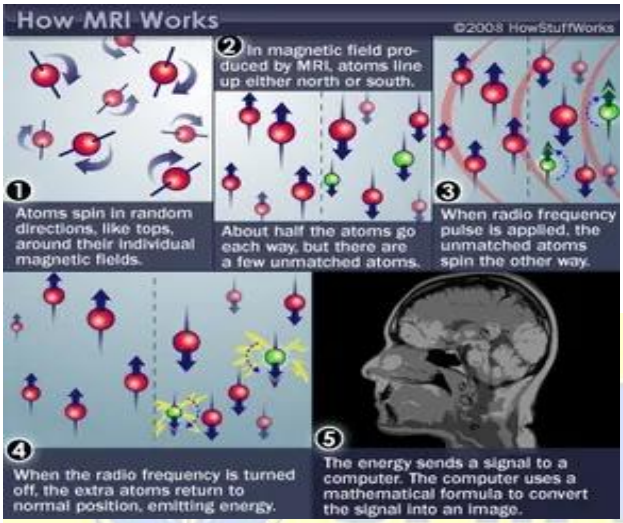
- **non-invasive diagnostic procedure.**
- used to **image the soft tissues** like **brain**, the **cardiovascular system,** the **spinal cord** and joints, various muscles, the liver, arteries, etc.
- important in the observation and **treatment of certain cancers, Alzheimer's, dementia, epilepsy, and stroke**.

Working

- uses the **body's natural magnetic properties**
- An MRI procedure reveals an **image of a body part** using **the hydrogen atoms** in that part.
- For imaging purposes the **hydrogen nucleus** (a single proton) is used because of its **abundance** in **body water and fat.**
- The machine includes a **superconducting magnet** creating a **stable magnetic field,** aligning **hydrogen atom spins**.
- A **radiofrequency pulse** is emitted to **align other atoms** that were **not aligned earlier**.
- When **radiofrequency pulse is stopped** the **extra atoms return to normal position** and **emit energy**.
- The **energy released** is **converted into a signal** to plot a **2D or 3D image by the computer.**



The MRI techniques use of **strong magnetic fields**, thus individuals with embedded metallic objects (like shrapnel) and metallic implants, including pacemakers, may not be able to undergo MRI scans.



Q601. Which property of the human body is primarily utilized in Magnetic Resonance Imaging (MRI)?
(a) Electrical conductivity
(b) Natural magnetic properties
(c) Thermal radiation
(d) Acoustic resonance

Ans: b

Sol: MRI works by using the body's natural magnetic properties, specifically the hydrogen atoms abundant in water and fat, to create detailed images of soft tissues.

Q602. Consider the following statements about the working of MRI:
1. MRI uses hydrogen atoms in the body for imaging purposes due to their abundance in water and fat.
2. A superconducting magnet in the MRI machine creates a stable magnetic field, aligning hydrogen atom spins.
3. A radiofrequency pulse emitted during the procedure permanently aligns all hydrogen atoms in the body.
4. The energy released by atoms returning to their normal positions is used to generate a signal for image creation.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol:
- Statement 1: Correct. Hydrogen atoms are abundant in water and fat, making them ideal for imaging.
- Statement 2: Correct. The superconducting magnet creates a stable field to align hydrogen atoms.
- Statement 3: Incorrect. The alignment caused by the radiofrequency pulse is temporary, not permanent.
- Statement 4: Correct. The energy released by atoms returning to their normal positions is converted into signals for imaging.

Q603. Which of the following statements about the applications of MRI are correct?
1. MRI is used to image soft tissues such as the brain, spinal cord, and joints.
2. MRI is effective in diagnosing conditions like Alzheimer's, stroke, and epilepsy.
3. MRI is primarily used for imaging bones and hard tissues.
4. MRI is a non-invasive diagnostic procedure.
(a) 1 and 3 only
(b) 2 and 4 only
(c) 1, 2, and 4 only
(d) All of the above

Ans: c

Sol:
- Statement 1: Correct. MRI specializes in imaging soft tissues such as the brain, cardiovascular system, and joints.
- Statement 2: Correct. MRI is important in diagnosing conditions like Alzheimer's, epilepsy, and stroke.

- Statement 3: Incorrect. MRI is not ideal for imaging bones; X-rays are more suitable for hard tissues.
- Statement 4: Correct. MRI is non-invasive, making it safe and widely applicable.

Topic 202

202. Widal test

- It is a **test** done for diagnosing **typhoid fever.**

Typhoid fever

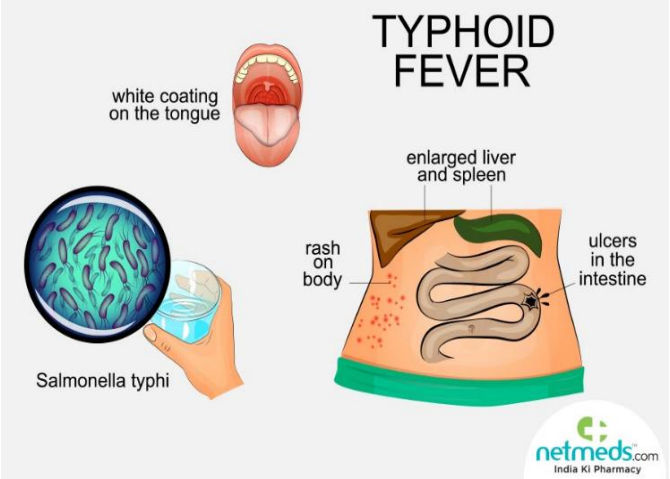
- It is a **bacterial infection** caused by the **bacterium Salmonella Typhi.**
- It is spread through **contaminated food or water.**

How Typhoid is detected?

- As with other infections, **our immune system** produces **antibodies** in the **blood** against the bacteria, in case of Typhoid too.
- The widal test is a **serological test** that **detects antibodies** against the bacteria in a patient's blood sample.

Limitations of Widal test ?

- A **single positive Widal test** report **doesn't necessarily** mean a **typhoid infection is present.**
- And a **negative report doesn't confirm** the **disease's absence.**
- To **diagnose** an **active infection**, clinicians must test at least two serum samples taken at **least 7-14 days apart,** so that they may **detect a change in the concentrations** of the antibodies.



Typhoid symptoms

- **Fatigue**, **high fever,** **headache**, **diarrhoea** or **constipation**, abdominal pain, weight loss, and red spots.
- These symptoms **mimic** those of **malaria**, **dengue**, **influenza** making it **difficult to diagnose** without proper testing.

Q604. What is the primary purpose of the Widal test?
(a) To measure the red blood cell count
(b) To detect antibodies against *Salmonella Typhi*
(c) To identify symptoms of malaria
(d) To confirm the presence of red spots in typhoid patients

Ans: b

Sol: The Widal test is a serological test designed to detect the presence of antibodies against the bacterium *Salmonella Typhi* in a patient's blood sample.

Q605. Consider the following statements about the Widal test and its limitations:
1. A single positive Widal test result is sufficient to confirm typhoid fever.
2. A negative Widal test result doesn't necessarily rule out typhoid fever.
3. To diagnose an active typhoid infection, clinicians must compare two serum samples taken 7–14 days apart.
4. Widal test can also detect symptoms of malaria and dengue.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: b

Sol:

- Statement 1: Incorrect. A single positive result doesn't confirm typhoid fever.
- Statement 2: Correct. A negative result doesn't rule out typhoid fever.
- Statement 3: Correct. Two samples are needed to detect a change in antibody concentrations.
- Statement 4: Incorrect. The Widal test is specific to *Salmonella Typhi* and does not detect other diseases.

Q606. Which of the following statements about typhoid fever are correct?
1. Typhoid is caused by the bacterium *Salmonella Typhi*.
2. Typhoid is primarily spread through airborne droplets.
3. Symptoms of typhoid mimic those of malaria, dengue, and influenza.
4. Abdominal pain and red spots are common symptoms of typhoid.
(a) 1 and 3 only
(b) 1, 3, and 4 only
(c) 2 and 4 only
(d) All of the above

Ans: b

Sol:
- Statement 1: Correct. Typhoid is caused by *Salmonella Typhi*.
- Statement 2: Incorrect. Typhoid is spread through contaminated food or water, not airborne droplets.
- Statement 3: Correct. Typhoid symptoms mimic malaria, dengue, and influenza.
- Statement 4: Correct. Abdominal pain and red spots are among the common symptoms of typhoid fever.

Topic 203

203. Sickle Cell disease

- Characterized by a **modification in the shape** of **RBC** from a **smooth, donut-shape** into a **crescent or Sickle shape.**
- These RBC **lack flexibility** and **can block** small blood vessels, impairing blood flow.
- This condition leads to **reduction in blood flow** and subsequent **anaemia,** often called **sickle-cell anaemia.**

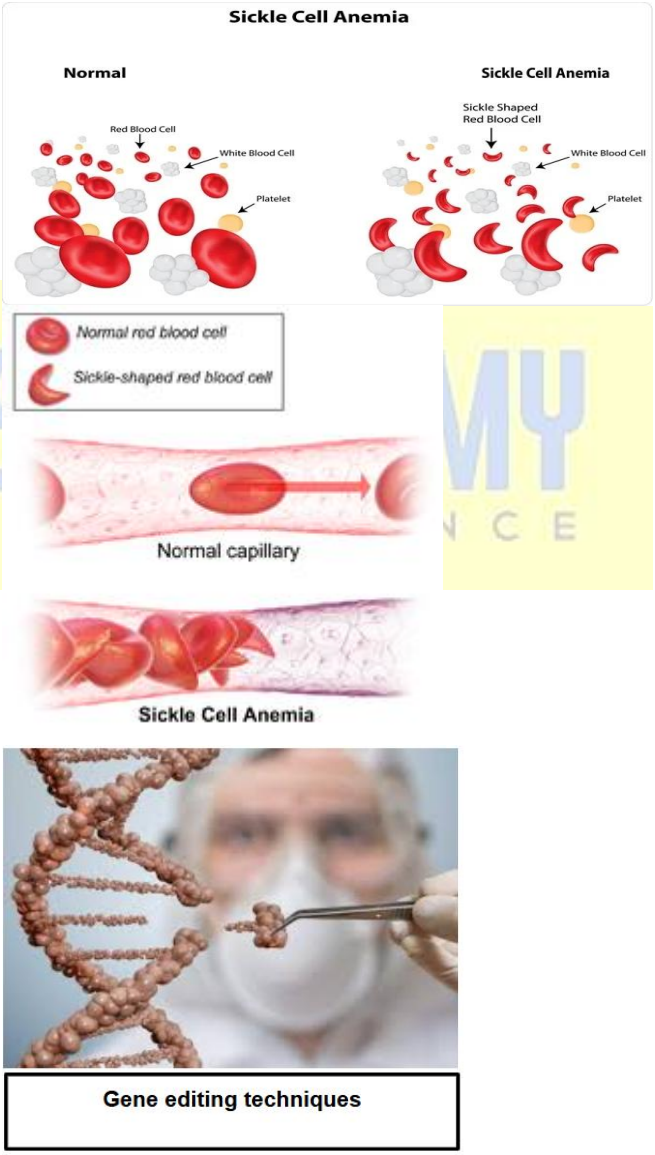
Anaemia
- Anaemia is a medical condition in which the **hemoglobin is less than normal.**
- Symptoms of anemia include **Fatigue, Shortness of breath, Hair loss etc.**
- Mostly **inherited blood disorder**/prevalent **amongst tribals of Central India.**

Current news?
- Recently, a **12-year-old boy** from USA, underwent **gene editing therapy ie CRISPR technology** to treat **Sickle cell anaemia**.

CRISPR technology
- It is done with a **special type of gene protein Cas9** with help of which **DNA could be cut and altered.**
- Thus **gene protein Cas9** is known as **genetic scissor.**

Nobel Chemistry Prize in 2020
- **Emmanuelle Charpentier** of France and **Jennifer Doudna** of the **U.S. for CRISPR Technology.**

Note- CRISPR tech can be used to **alter DNA of mosquitoes to control vector borne diseases**(this is known as **"precision-guided sterile insect technique" (pgSIT))**



Gene editing techniques

Q607. What is the role of Cas9 in CRISPR technology?
(a) To create crescent-shaped red blood cells
(b) To act as a genetic scissor for altering DNA

(c) To enhance hemoglobin levels in patients with anemia
(d) To block small blood vessels in sickle cell disease

Ans: b

Sol: Cas9 is a key protein in CRISPR technology that cuts and edits DNA sequences, earning it the nickname "genetic scissor."

Q608. Consider the following statements about Sickle Cell Disease (SCD):
1. SCD is characterized by a crescent-shaped modification in red blood cells.
2. Sickle cells lack flexibility and can block small blood vessels, impairing blood flow.
3. SCD is primarily an acquired condition and not hereditary.
4. SCD often results in anemia due to reduced blood flow.
How many of the above statements are incorrect?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: a

Sol:
- Statement 1: Correct. SCD modifies red blood cells into a crescent or sickle shape.
- Statement 2: Correct. Sickle cells lack flexibility and block small blood vessels.
- Statement 3: Incorrect. SCD is primarily a hereditary blood disorder.
- Statement 4: Correct. The condition often results in anemia, known as sickle-cell anemia.

Q609. Which of the following statements about CRISPR technology and its applications are correct?
1. CRISPR technology involves the use of Cas9 protein to cut and alter DNA sequences.
2. CRISPR technology was awarded the Nobel Prize in Physics in 2020.
3. CRISPR can be used to edit genes of mosquitoes to control vector-borne diseases.
4. A recent case involved the use of CRISPR to treat sickle cell anemia in a 12-year-old boy.
(a) 1 and 3 only
(b) 1, 3, and 4 only
(c) 2 and 4 only
(d) All of the above

Ans: b

Sol:
- Statement 1: Correct. CRISPR uses Cas9 protein as a genetic scissor to alter DNA.
- Statement 2: Incorrect. CRISPR technology was awarded the Nobel Prize in Chemistry, not Physics.
- Statement 3: Correct. CRISPR can alter mosquito DNA to control vector-borne diseases via pgSIT.
- Statement 4: Correct. Recently, CRISPR was used in a 12-year-old boy to treat sickle cell anemia.

Topic 204

204. Xenotransplantation

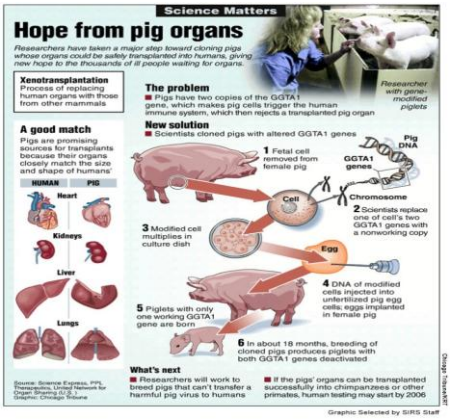
- A procedure that involves the **transplantation, implantation** or infusion into a **human recipient** live cells, tissues, or organs from a **nonhuman animal source.**
- Mainly **organs of the Pig** could be **transplanted into human body**(as pigs body organs are almost of same size that of men).

Current news?

- The **first recipient** of a **modified pig kidney transplant** Richard Slayman passed away, around two months after the surgery was carried out.

Similar example from Assam

- **Dr Dhani Ram Baruah,** a transplant surgeon from Assam, who had transplanted a **pig's heart into a person way back in 1997.**
- However, the patient **died of multiple infections a week later.**



Dr Dhani Ram Baruah transplanted a pig's heart into a person way back in 1997

Ray-ban/Facebook smart glasses spectacles known as **'Stories'**

- It allows the **wearer to video record or take photos** of events and conversation **without permission** or knowledge of those in the wearer's vicinity.

Q610. Consider the following statements regarding 'Xenotransplantation':
1. It involves the transplantation of the tissues or organs of one human into another human.
2. Gene editing is used in this process to reduce the likelihood of organ rejection.
Which of the statement(s) given above is/ are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: b

Sol:

- Statement 1: Incorrect. Xenotransplantation involves the transplantation of tissues or organs from one species to another, typically from animals (such as pigs) to humans, not between humans. Transplantation between humans is referred to as allotransplantation.
- Statement 2: Correct. Gene editing, such as using CRISPR-Cas9, is employed in xenotransplantation to modify the donor animal's genes. This reduces the risk of organ rejection by minimizing immune system incompatibility and addressing issues like the presence of certain sugars on animal tissues that trigger immune responses in humans.

Thus, only statement 2 is correct.

Q611. Consider the following statements about xenotransplantation:
1. Xenotransplantation involves transplanting organs or tissues from nonhuman animals into humans.
2. Pigs are commonly used in xenotransplantation due to the similarity in organ size with humans.
3. The first recipient of a modified pig kidney transplant, Richard Slayman, lived over a year after surgery.
4. Dr. Dhani Ram Baruah successfully performed the first pig heart transplant in Assam in 1997, with the patient surviving long-term.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: b

Sol:

- Statement 1: Correct. Xenotransplantation involves transplantation from nonhuman animals to humans.
- Statement 2: Correct. Pigs are preferred due to their organ size similarity with humans.
- Statement 3: Incorrect. Richard Slayman passed away two months after receiving a pig kidney transplant.
- Statement 4: Incorrect. Dr. Baruah's patient died a week after the pig heart transplant due to multiple infections.

Q612. Which of the following statements about historical and current aspects of xenotransplantation are correct?
1. Richard Slayman was the first person to receive a modified pig kidney transplant.
2. Xenotransplantation has a history of challenges, including infections and immune rejection.
3. Dr. Dhani Ram Baruah's attempt at pig heart transplantation in 1997 marked the beginning of successful xenotransplantation in India.
4. Recent advancements in genetic modification of animal organs aim to improve the success of xenotransplantation.
(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2 and 3 only
(d) All of the above

Ans: b

Sol:

- Statement 1: Correct. Richard Slayman was the first to receive a modified pig kidney transplant.
- Statement 2: Correct. Infections and immune rejection have been significant challenges in xenotransplantation.
- Statement 3: Incorrect. Dr. Baruah's transplant attempt in 1997 was not successful and highlighted the challenges.
- Statement 4: Correct. Genetic modifications aim to reduce rejection and improve xenotransplantation outcomes.

Topic 205

205. Space Tourism

- Space tourism is a **section of the aviation sector** which seeks to **provide tourists** with the **opportunity to become astronauts**.

Types of space tourism:

1. **Sub-orbital Spacecraft**

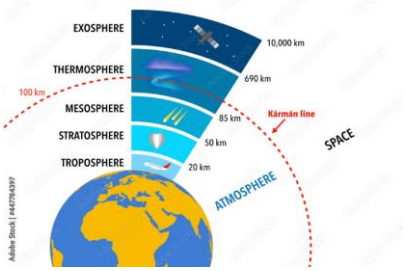
- It takes passengers **just beyond the Kármán line**.
- The passengers get to spend a **few minutes** in outer space and then **come back to Earth**.
- Eg **NS-25 mission** of **Blue Origin company**

2. **Orbital Spacecraft**

- It takes passengers **much further than the Kármán line.**
- Usually, passengers can spend from a **couple of days** to more than a week.
- Eg **Spacex's Falcon 9** took **four passengers** to an **altitude of 160 km** where they spent **three days orbiting the Earth.**

Note-

1. **Kármán line** is a **conventional boundary** between **Earth's atmosphere** and **outer space,** defined as an **altitude of 100 kilometers.**
2. **ISRO plans** to start **'Space Tourism'** for passenger by **2030. RLV** will be used for this purpose.



Gopi Thotakura became **first Indian Space Tourist.**
He went to space as a tourist on the **NS-25 mission** of **Blue Origin Company.**

Q613. What is the significance of the Kármán line in space tourism?
(a) It marks the beginning of Earth's atmosphere.
(b) It defines the boundary between Earth's atmosphere and outer space.
(c) It is the maximum altitude for sub-orbital flights.
(d) It is the starting point for orbital spacecraft journeys.

Ans: b

Sol: The Kármán line, at an altitude of 100 kilometers, is the internationally recognized boundary between Earth's atmosphere and outer space.

Q614. Consider the following statements about space tourism:
1. Sub-orbital spacecraft take passengers beyond the Kármán line for a brief stay in outer space.
2. Orbital spacecraft allow passengers to spend multiple days orbiting the Earth.
3. SpaceX's Falcon 9 and Blue Origin's NS-25 are examples of sub-orbital missions.
4. ISRO plans to start space tourism by 2030 using a reusable launch vehicle (RLV).
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol:

- Statement 1: Correct. Sub-orbital spacecraft take passengers just beyond the Kármán line.
- Statement 2: Correct. Orbital spacecraft provide passengers the opportunity to spend several days in space.

- Statement 3: Incorrect. SpaceX's Falcon 9 is an orbital mission, not sub-orbital.
- Statement 4: Correct. ISRO plans to use RLV for space tourism by 2030.

Q615. Which of the following statements about notable milestones and examples in space tourism are correct?
1. Blue Origin's NS-25 mission is an example of sub-orbital space tourism.
2. SpaceX's Falcon 9 carried passengers to orbit at an altitude of 160 km for three days.
3. Gopi Thotakura became the first Indian space tourist on a SpaceX mission.
4. ISRO plans to use Falcon 9 for its space tourism program.
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 1 and 4 only
(d) All of the above

Ans: a

Sol:
- Statement 1: Correct. Blue Origin's NS-25 mission is a sub-orbital space tourism mission.
- Statement 2: Correct. SpaceX's Falcon 9 carried passengers to an altitude of 160 km for a three-day orbital mission.
- Statement 3: Incorrect. Gopi Thotakura became the first Indian space tourist on Blue Origin's NS-25 mission, not SpaceX.
- Statement 4: Incorrect. ISRO plans to use its reusable launch vehicle (RLV), not Falcon 9.

Topic 206

206. Brain eating Amoeba

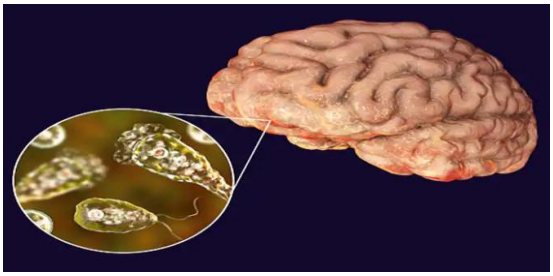
Primary Amoebic Meningoencephalitis (PAM)
- A rare brain infection that is caused by **Naegleria fowleri**.

Naegleria fowleri
- **An amoeba (Single-celled organism).**
- Found in **soil and warm freshwater bodies** (best grows in high temperatures up to **46°C and above)**.

How does it infect humans?
- Enters the human body **through the nose** and **then travels up to the brain**.
- People got infected when they **cleaned their nostrils** with **contaminated water**.

Treatment
- Scientists **haven't been able** to **identify any effective treatments** yet.
- PAM has **fatality rate** of **95-97%.**

Current
- Some cases of **Brain eating Amoeba** was found in **Kerala.**



Q616. Consider the following statements regarding Primary Amoebic Meningoencephalitis (PAM):
1. It is an infection of the brain caused by the amoeba Naegleria fowleri, commonly known as the "brain-eating amoeba".
2. This infection can be spread from one person to another.
Which of the statement(s) given above is/ are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: a

Sol:
- Statement 1: Correct.
  Primary Amoebic Meningoencephalitis (PAM) is a rare but often fatal brain infection caused by the amoeba *Naegleria fowleri*, commonly referred to as the "brain-eating amoeba." This amoeba is typically found in warm freshwater environments like lakes, rivers, and hot springs. Infection occurs when water containing the amoeba enters the nose, allowing it to travel to the brain.
- Statement 2: Incorrect.
  PAM caused by *Naegleria fowleri* is not contagious and cannot be spread from one person to another. The infection occurs solely through the direct entry of contaminated water into the nasal passages.

Thus, only statement 1 is correct.

Q617. Consider the following statements about Naegleria fowleri and Primary Amoebic Meningoencephalitis (PAM):
1. Naegleria fowleri is a single-celled organism found in warm freshwater bodies.
2. PAM is a brain infection caused by Naegleria fowleri and has a fatality rate of 95-97%.
3. The infection primarily spreads through contaminated water ingested orally.
4. Effective treatments for PAM are readily available and widely used.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: b

Sol:
- Statement 1: Correct. Naegleria fowleri is a single-celled organism found in warm freshwater bodies.
- Statement 2: Correct. PAM caused by Naegleria fowleri has a very high fatality rate of 95-97%.
- Statement 3: Incorrect. The infection occurs when the amoeba enters the body through the nose, not through ingestion.
- Statement 4: Incorrect. There are no effective treatments for PAM identified yet.

Q618. Which of the following statements about Naegleria fowleri infections are correct?
1. The amoeba thrives in high temperatures, up to 46°C or more.
2. PAM cases have recently been reported in Kerala.
3. Infections occur when contaminated water is ingested through the mouth.
4. People have been infected while cleaning their nostrils with contaminated water.
(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2 and 3 only
(d) All of the above

Ans: b

Sol:
- Statement 1: Correct. Naegleria fowleri thrives in warm freshwater at high temperatures up to 46°C or more.
- Statement 2: Correct. Cases of PAM caused by Naegleria fowleri have recently been reported in Kerala.
- Statement 3: Incorrect. The amoeba infects through the nose, not by ingestion through the mouth.
- Statement 4: Correct. Some infections occurred when people cleaned their nostrils with contaminated water.

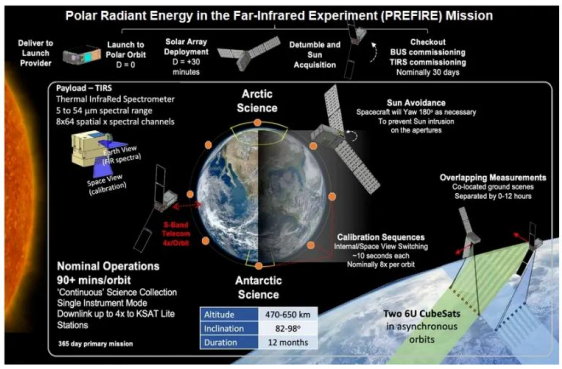
Topic 207

207. PREFIRE Cubesat

- NASA launched the **"PREFIRE mission".**
- The mission includes **twin CubeSats** which will study **heat emissions** in the **Arctic and Antarctic regions.**
- The mission has been developed by **NASA** and the **University of Wisconsin-Madison.**
- These CubeSats will help in study **heat emission from Polar** areas and thus will **enhance climate research.**

What are Cubesats?

- CubeSats are essentially miniature satellites whose basic design is a **10 cm x 10 cm x 10 cm** (which makes up for "one unit" or "1U") cube — just a little bigger than a Rubik's cube.



Q619. Which of the following best describes the purpose of NASA's PREFIRE mission?
(a) To study the effects of solar flares on Earth's magnetosphere.
(b) To study heat loss to space in Earth's polar regions.
(c) To monitor and predict wildfires using satellite data.

(d) To analyze the impact of greenhouse gasses on global sea levels.

Ans: b

Sol: NASA's PREFIRE (Polar Radiant Energy in the Far-InfraRed Experiment) mission aims to measure and understand how much heat is lost to space from Earth's polar regions. This involves studying the far-infrared radiation emitted by the Earth, which plays a critical role in regulating the planet's energy balance and influencing the climate, particularly in polar areas where ice and snow dynamics are significant.
This research is crucial for improving climate models and understanding the effects of global warming on polar regions.

Q620. Consider the following statements about the PREFIRE mission:
1. PREFIRE is a NASA mission that involves twin CubeSats to study heat emissions in polar regions.
2. The mission has been developed by NASA and the University of Wisconsin-Madison.
3. PREFIRE CubeSats aim to enhance climate research by studying heat emission from the equatorial regions.
4. CubeSats are miniature satellites designed as 10 cm x 10 cm x 10 cm cubes.
How many of the above statements are incorrect?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: a

Sol:
- Statement 1: Correct. The PREFIRE mission involves twin CubeSats to study heat emissions in Arctic and Antarctic regions.
- Statement 2: Correct. The mission has been developed collaboratively by NASA and the University of Wisconsin-Madison.
- Statement 3: Incorrect. PREFIRE CubeSats focus on polar regions, not equatorial regions.
- Statement 4: Correct. CubeSats are miniature satellites with a basic design of 10 cm x 10 cm x 10 cm cubes.

Q621. Which of the following statements about CubeSats and their role in the PREFIRE mission are correct?
1. CubeSats are small satellites whose basic design resembles a “1U” cube.
2. PREFIRE CubeSats are expected to enhance climate research by studying heat emissions from polar regions.
3. The PREFIRE mission is solely developed by NASA without collaboration.
4. CubeSats in the PREFIRE mission will study heat emissions to understand climate dynamics better.
(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2 and 3 only
(d) All of the above

Ans: b

Sol:
- Statement 1: Correct. CubeSats are miniature satellites based on a 10 cm x 10 cm x 10 cm cube design, termed “1U.”
- Statement 2: Correct. PREFIRE CubeSats aim to enhance climate research by studying polar heat emissions.
- Statement 3: Incorrect. The mission is a collaboration between NASA and the University of Wisconsin-Madison.
- Statement 4: Correct. The PREFIRE CubeSats aim to study polar heat emissions to improve understanding of climate dynamics.

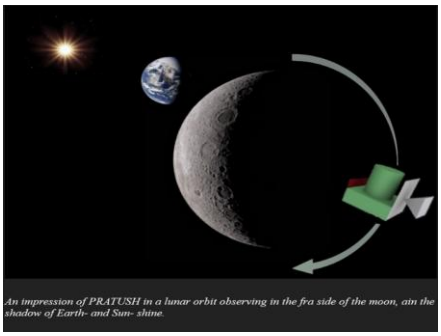
Topic 208

208. PRATUSH Telescope

- PRATUSH stands for **Probing ReionizATion of the Universe using Signal from Hydrogen.**
- It is a **radio telescope** to be **sited on the moon’s far side** (always faces away from Earth).
- It is being built by the **Raman Research Institute (RRI)** collaboration from the **Indian Space Research Organisation (ISRO).**
- PRATUSH, from India, will be **one of the many high-resolution telescopes**, from different countries that **will be stationed on Moon**.

What PRATUSH will do?

- It **will detect signals** from the **first stars** and **galaxies** and **probe about origin of the universe.**



Q622. What does PRATUSH stand for?
(a) Probing Radiation and the Universe using Signal from Hydrogen
(b) Probing ReionizATion of the Universe using Signal from Hydrogen
(c) Probing the Atmosphere of the Universe using Signal from Hydrogen
(d) Probing Reflection and Universe Signals from Hydrogen

Ans: b

Sol: PRATUSH stands for "Probing ReionizATion of the Universe using Signal from Hydrogen." This name reflects the telescope's primary objective of studying signals related to the early universe and its reionization phase.

Q623. Consider the following statements about the PRATUSH telescope:
1. It will be stationed on the moon's far side.
2. It is being developed solely by ISRO.
3. It aims to detect signals from the first stars and galaxies.
4. It will be the only high-resolution telescope on the Moon.
Which of the above statements are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 1, 3, and 4 only
(d) 1, 2, 3, and 4

Ans: b

Sol:
- Statement 1 is correct: PRATUSH will be sited on the Moon's far side.
- Statement 2 is incorrect: PRATUSH is being developed by the Raman Research Institute (RRI) in collaboration with ISRO, not solely by ISRO.
- Statement 3 is correct: PRATUSH will detect signals from the first stars and galaxies.
- Statement 4 is incorrect: PRATUSH will be one of many high-resolution telescopes from different countries stationed on the Moon.

Q624. Which of the following statements about PRATUSH are incorrect?
1. PRATUSH will probe the origin of the universe.
2. It will be stationed on the near side of the Moon.
3. PRATUSH is a radio telescope developed in collaboration with ISRO.
4. It is the only telescope being developed by India for lunar deployment.
(a) 1 and 2 only
(b) 2 and 4 only
(c) 1, 2, and 4 only
(d) 2, 3, and 4 only

Ans: b

Sol:
- Statement 1 is correct: PRATUSH will study signals related to the origin of the universe.
- Statement 2 is incorrect: PRATUSH will be stationed on the far side of the Moon.
- Statement 3 is correct: It is a radio telescope developed by the Raman Research Institute in collaboration with ISRO.
- Statement 4 is incorrect: While PRATUSH is an Indian initiative, it is not the only telescope for lunar deployment, as other nations will also contribute telescopes.

Topic 209

209. Red Shift theory

Red Shift (related to Doppler effect Topic no 129)
- When a **light-emitting device moves away** from an **observer,** the **light that reaches** the **observer shifts from blue to red** (reduction in the frequency)**.**
- This is referred to as **redshift.**

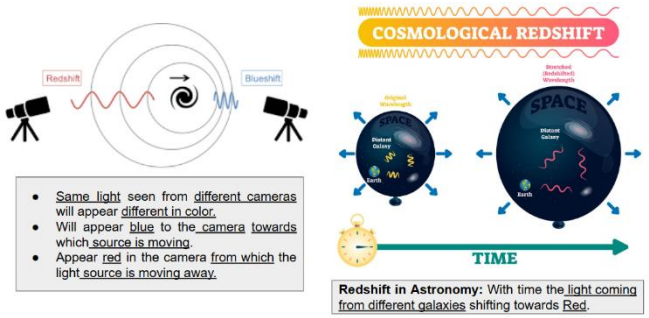
1929
- American astronomer **Edwin Hubble** claimed that **universe is expanding** on the basis of **Red shift observation.**

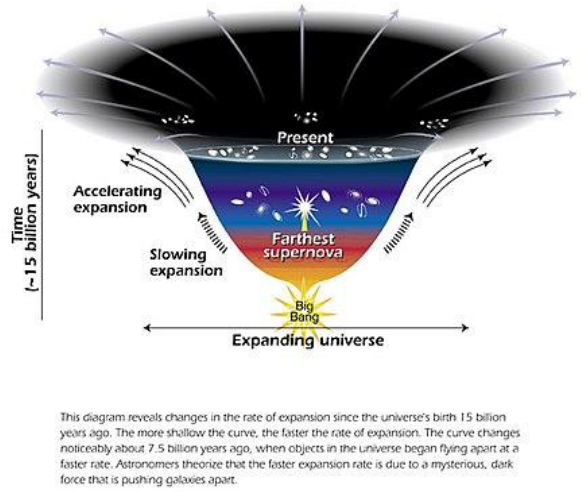
1998

- Scientists found that this **expansion** was happening at an **accelerated rate.**
- The **scientists (Saul Perlmutter, Brian P Schmidt, and Adam G Riess)** who discovered **cosmic acceleration received the 2011 Nobel Prize in Physics.**

But the question that remains unanswered till day?

- What makes the universe expanding and that too at an increased pace?
- **Scientists did not have any clue** about what energy this could be leading to expansion of universe.
- So they called it **"dark energy" (Covered in topic 156).**





Q625. Who discovered that the universe is expanding based on redshift observations?
(a) Albert Einstein
(b) Edwin Hubble
(c) Isaac Newton
(d) Galileo Galilei

Ans: b

Sol: Edwin Hubble, an American astronomer, claimed in 1929 that the universe is expanding based on redshift observations. This finding marked a major milestone in cosmology.

Q626. Consider the following statements regarding redshift and the universe's expansion:
1. Redshift occurs when light from a source moving away from the observer shifts to a lower frequency.
2. Edwin Hubble discovered the accelerated expansion of the universe in 1929.
3. The term "dark energy" refers to the unknown force driving the accelerated expansion of the universe.
4. Saul Perlmutter, Brian P. Schmidt, and Adam G. Riess received the Nobel Prize in Physics for discovering redshift.
Which of the above statements are correct?
(a) 1 and 3 only
(b) 2 and 4 only
(c) 1, 3, and 4 only
(d) 1, 2, 3, and 4

Ans: a

Sol:
- Statement 1 is correct: Redshift involves light shifting to lower frequencies as the source moves away.
- Statement 2 is incorrect: Edwin Hubble discovered the universe's expansion, but the accelerated expansion was discovered in 1998.
- Statement 3 is correct: "Dark energy" refers to the unknown force driving the accelerated expansion.
- Statement 4 is incorrect: The Nobel Prize was awarded to Saul Perlmutter, Brian P. Schmidt, and Adam G. Riess for discovering the universe's accelerated expansion, not redshift.

Q627. Which of the following statements about the Redshift theory and its implications are incorrect?
1. The universe's expansion was discovered in 1998 by Edwin Hubble.
2. Scientists have determined the exact nature of the energy causing the universe's accelerated expansion.
3. The discovery of cosmic acceleration won the Nobel Prize in Physics in 2011.

4. Redshift is caused by the increase in frequency of light waves as a source moves closer to the observer.
(a) 1 and 2 only
(b) 2 and 4 only
(c) 1, 2, and 4 only
(d) 2, 3, and 4 only

Ans: c

Sol:
- Statement 1 is incorrect: The universe's expansion was discovered in 1929 by Edwin Hubble, not in 1998.
- Statement 2 is incorrect: Scientists do not know the exact nature of the energy driving the accelerated expansion and call it "dark energy."
- Statement 3 is correct: The Nobel Prize in Physics in 2011 was awarded for the discovery of cosmic acceleration.
- Statement 4 is incorrect: Redshift is caused by the reduction, not an increase, in the frequency of light waves as a source moves away.

Topic 210

210. DESI Experiment

- The Dark Energy Spectroscopic Instrument (DESI) is a piece of **Telescopic equipment** with **5,000 robotic 'eyes'.**
- **Each one** of which can separately **capture and process light** coming **from a galaxy.**
- DESI has the capability to observe **5,000 galaxies** at the same time.
- DESI is **mounted** on the at the **Kitt Peak National Observatory in Arizona, US.**
- **DESI** has been operating for **three years.**

Why in news?
- **Recently DESI experiment has captured data that** allowed scientists to work out the **expansion rate of the universe** through **different times in history.**
- This has given more **insight about universe.**
- But still there is **no insight about 'dark energy'.**

Dark Energy Spectroscopic Instrument (DESI) in Arizona,The US

Q628. Where is the Dark Energy Spectroscopic Instrument (DESI) mounted?
(a) Mauna Kea Observatory, Hawaii, US
(b) Paranal Observatory, Chile
(c) Kitt Peak National Observatory, Arizona, US
(d) Roque de los Muchachos Observatory, Spain

Ans: c

Sol: DESI is mounted at the Kitt Peak National Observatory in Arizona, US. This location allows it to capture and process light from galaxies to study the universe's expansion and properties.

Q629. Consider the following statements regarding the DESI experiment:
1. DESI is equipped with 5,000 robotic 'eyes' capable of observing 5,000 galaxies simultaneously.
2. DESI is mounted in Hawaii, US.
3. DESI has provided data allowing scientists to determine the universe's expansion rate at different times in history.
4. DESI has been operational for over three years.
Which of the above statements are correct?
(a) 1 and 3 only
(b) 1, 3, and 4 only
(c) 2, 3, and 4 only
(d) 1, 2, 3, and 4

Ans: b

Sol:
- Statement 1 is correct: DESI is equipped with 5,000 robotic 'eyes' that can observe 5,000 galaxies at once.
- Statement 2 is incorrect: DESI is mounted in Arizona, not Hawaii.

- Statement 3 is correct: DESI has provided data on the universe's expansion rate at different times.
- Statement 4 is correct: DESI has been operational for over three years.

Q630. Which of the following statements about the DESI experiment are incorrect?
1. DESI has helped scientists fully understand dark energy.
2. DESI operates from the Paranal Observatory in Chile.
3. DESI captures light from galaxies to study the expansion of the universe.
4. DESI has been instrumental in gaining more insight into the universe's history.
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1, 2, and 4 only
(d) 1, 3, and 4 only

Ans: a

Sol:
- Statement 1 is incorrect: DESI has not provided insight into dark energy; its nature remains unknown.
- Statement 2 is incorrect: DESI operates from the Kitt Peak National Observatory in Arizona, not the Paranal Observatory in Chile.
- Statement 3 is correct: DESI captures light from galaxies to study the universe's expansion.
- Statement 4 is correct: DESI has provided valuable insights into the universe's history, though dark energy remains unexplained.

Day 22

Topic 211

211. Glycaemic index

- The glycemic index (GI) **ranks foods containing carbohydrates** according to their **effect on blood glucose** levels **after eating.**

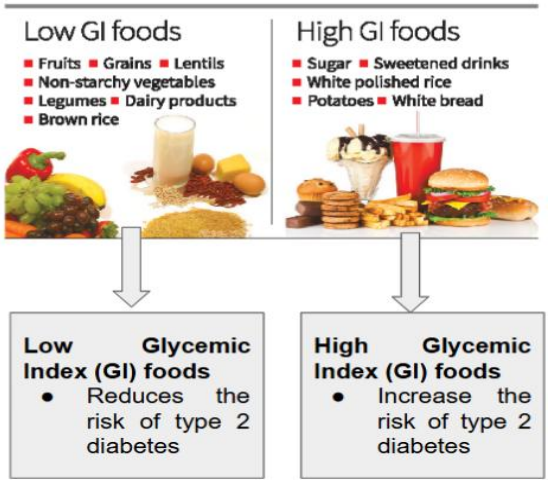
High Glycemic Index (GI) foods

- High Glycemic Index (GI) foods are **digested and absorbed** by the body **quickly.**
- They lead to **rapid spike** in blood **sugar levels.**
- For ex- **Sugary foods and beverages**, white bread, potatoes, and white rice.

Low Glycemic Index (GI) foods

- Low and medium GI foods are those whose **Sugar content are digested slowly,** causing a more **gradual increase in blood sugar levels.**
- For ex- **Fruits and vegetables**, pulses, and whole grains like porridge oats.

(Read this topic in association with topic 127)



Q631. What does the Glycaemic Index (GI) measure?
(a) The calorie content of food
(b) The blood glucose response to carbohydrate-containing foods
(c) The fiber content of food
(d) The insulin levels after eating food

Ans: b

Sol: The Glycaemic Index (GI) ranks carbohydrate-containing foods based on their impact on blood glucose levels after a meal, with a scale ranging from 0 to 100.

Q632. Consider the following statements about the Glycaemic Index (GI) and Glycaemic Load (GL):
1. Foods with higher GI values cause blood sugar to rise more quickly than those with lower GI values.
2. Glycaemic Load (GL) combines the GI of a food with the quantity of carbohydrate in a serving.
3. The more fiber or fat a food contains, the higher its GI value.
4. Highly processed foods generally have lower GI values.
Which of the above statements are correct?

(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 1, 3, and 4 only
(d) 1, 2, 3, and 4

Ans: a

Sol:

- Statement 1 is correct: Foods with a higher GI cause blood sugar to rise faster.
- Statement 2 is correct: GL accounts for both the GI and the amount of carbohydrate in a serving.
- Statement 3 is incorrect: Foods with more fiber or fat have lower, not higher, GI values.
- Statement 4 is incorrect: Highly processed foods generally have higher GI values.

Q633. Which of the following statements about diabetes are incorrect?
1. Type 1 diabetes occurs when the body cannot effectively use insulin.
2. Type 2 diabetes is often linked to obesity and physical inactivity.
3. Insulin is a hormone that raises blood glucose levels.
4. High glucose levels over time can damage organs and tissues.
(a) 1 and 3 only
(b) 2 and 4 only
(c) 1, 3, and 4 only
(d) 1, 2, and 3 only

Ans: a

Sol:

- Statement 1 is incorrect: Type 1 diabetes is caused by the immune system destroying insulin-producing beta cells in the pancreas.
- Statement 2 is correct: Type 2 diabetes is often linked to excess body weight and physical inactivity.
- Statement 3 is incorrect: Insulin regulates blood glucose levels by lowering them, not raising them.
- Statement 4 is correct: Chronic high glucose levels can cause damage to organs and tissues.

Topic 212

212. God Particle

How Standard Model of Particle Physics evolved?

- 1808-**John Dalton**-Matter is made up of **atoms**(indivisible particles)
- **Subatomic particles** like **Proton,Neutron and Electrons** were discovered by different scientists.
- Then **other fundamental particles** like **gluons** that made Protons and Neutrons were found.

Current accepted Standard Model of Particle Physics?

- **17 elementary particles** classified **into two main categories: fermions and bosons** (they differ on the basis of spin type).
- They incorporate **three of the four fundamental forces** of nature: **electromagnetism, the weak nuclear force, the strong nuclear force.**
- **Dark Energy** and **Dark Matter** remains **outside the** domain of **Standard Model of Particle Physics.**
- **Photons and Z Bosons** together make a particle known as **Higgs Boson.**

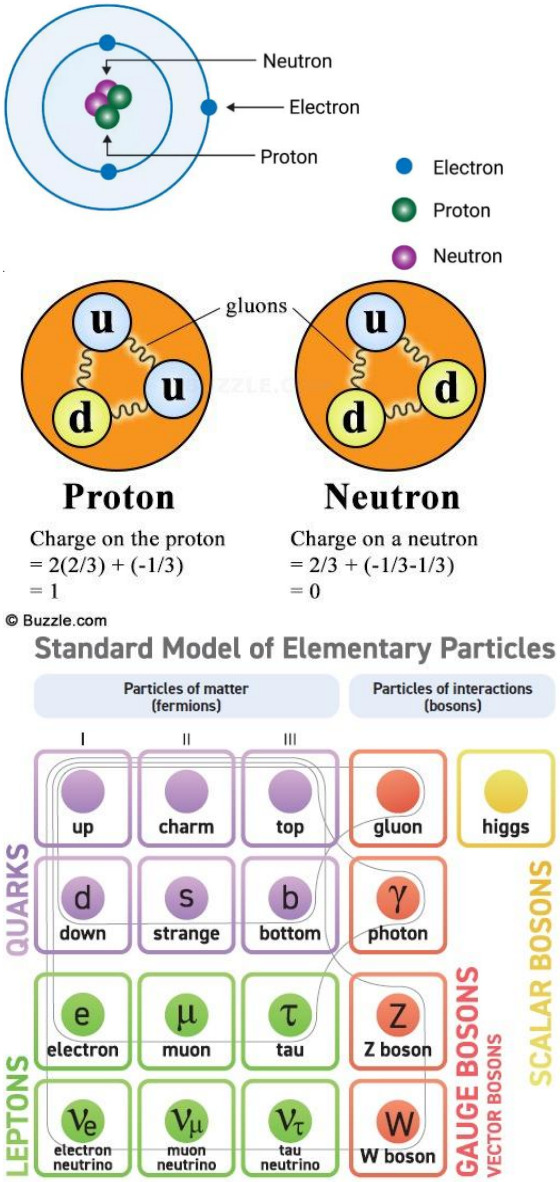
Higgs-Boson particle

- Create an **energy field ie Higgs field.** It plays **2 role in particles-**
  1. Acts as a **syrup** to keep **clot of Protons intact.**
  2. **Gives mass** to all **other fundamental particles** such as **electrons, Photons,Neutrinos etc**
- Due to its **elusive nature**,Higgs Boson particle is known as **'God particle'.**

Its **existence was predicted in the 1960s** by **Nobel physics laureate Peter Higgs(who died in 2024).**The word **'Boson** in the Higgs Boson particle **owes its name** to **Indian physicist SN Bose.** The discovery of the **Higgs boson completed Standard Model of Particle Physics.**

Discovery of Electrons, Protons and Neutrons

	Discoverer	Year of Discovery
Proton	E. Rutherford	1909
Neutron	James Chadwick	1932
Electron	J.J. Thomson	1897



Q634. Which of the following statements regarding 'Higgs Boson' is incorrect?
(a) It has a mass higher than that of proton
(b) It is the only elementary particle with a spin
(c) It is sometimes referred to as the "God particle"
(d) It is a "force carrier" particle that comes into play when particles interact with each other

Ans: b

Sol:
- Statement 1: Correct. The Higgs boson has a mass significantly higher than that of a proton.
- Statement 2: Incorrect. The Higgs boson is not the only elementary particle with a spin. In fact, it is unique in that it has a spin of 0 (a scalar particle), unlike many other elementary particles that have non-zero spin (e.g., electrons with spin 1/2, photons with spin 1).
- Statement 3: Correct. The Higgs boson is sometimes referred to as the "God particle" due to its importance in explaining the mechanism of mass generation in the universe, though the term is more colloquial than scientific.
- Statement 4: Correct. The Higgs boson is not a "force carrier" particle like photons or gluons; rather, it is associated with the Higgs field, which imparts mass to particles via their interaction with it.

Q635. Consider the following statements about the Standard Model of Particle Physics and Higgs Boson:
1. The Standard Model includes 17 elementary particles categorized into fermions and bosons.
2. It accounts for electromagnetism, the weak nuclear force, and the strong nuclear force.
3. Dark energy and dark matter are included in the Standard Model.
4. The Higgs Boson particle is essential for giving mass to fundamental particles like electrons and photons.
How many of the above statements are incorrect?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: a

Sol:
- Statement 1: Correct. The Standard Model includes 17 elementary particles divided into fermions and bosons.
- Statement 2: Correct. The Standard Model incorporates three fundamental forces: electromagnetism, the weak nuclear force, and the strong nuclear force.
- Statement 3: Incorrect. Dark energy and dark matter are outside the domain of the Standard Model.
- Statement 4: Correct. The Higgs Boson particle is crucial for imparting mass to fundamental particles like electrons.

Q636. Which of the following statements about the Higgs Boson and its significance are correct?
1. The Higgs Boson creates the Higgs field, which acts as a syrup to hold protons together.
2. The Higgs Boson gives mass to particles such as electrons, neutrinos, and photons.
3. The discovery of the Higgs Boson completed the Standard Model of Particle Physics.
4. The name "Boson" in Higgs Boson comes from Indian physicist S.N. Bose.
(a) 1 and 2 only
(b) 1, 3, and 4 only
(c) 2, 3, and 4 only
(d) All of the above

Ans: b

Sol:
- Statement 1: Correct. The Higgs field acts as a "syrup" to keep protons intact.
- Statement 2: Incorrect. The Higgs Boson gives mass to fundamental particles like electrons and neutrinos but not photons.
- Statement 3: Correct. The discovery of the Higgs Boson completed the Standard Model of Particle Physics.
- Statement 4: Correct. The term "Boson" in Higgs Boson is named after Indian physicist S.N. Bose.

Topic 213

213. Hepatitis

- The word hepatitis refers to any **inflammation of the liver.**

Causes
- Caused by a **group of viruses**-known as Hepatitis **A, B, C, D and E**

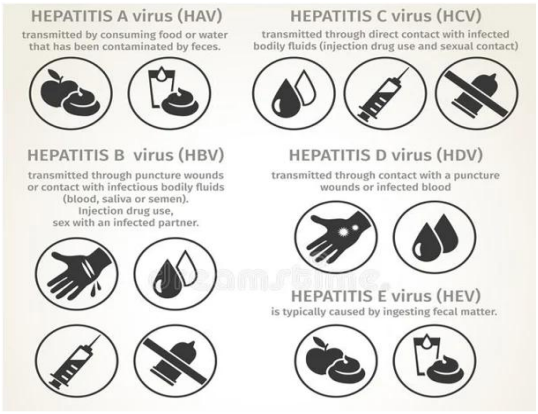
Hepatitis A and E
- caused due to **contaminated water or food(by faecal matter)**
- **Self-limiting diseases** (i.e. go away on their own)

Hepatitis B and C
- Spread through **contact** with the **blood or body fluid** of someone who already has the disease.
- Requires **specific treatment.**

Hepatitis D
- Affect those who **already have Hepatitis B.**

Vaccination
- Possible against **A and B**

Note-
- **Hepatitis B and hepatitis C** are **not usually** spread **through saliva**



Q637. Consider the following statements about hepatitis and its causes:
1. Hepatitis A and E are caused by contaminated food or water and are self-limiting diseases.
2. Hepatitis B and C are primarily spread through contact with blood or body fluids.
3. Hepatitis D can infect individuals regardless of their Hepatitis B status.
4. Vaccines are available for Hepatitis A and B.
How many of the above statements are correct?
(a) Only 2
(b) Only 3
(c) Only 4
(d) Only 1

Ans: b

Sol:
- Statement 1: Correct. Hepatitis A and E are caused by contaminated food or water and are self-limiting.
- Statement 2: Correct. Hepatitis B and C spread through contact with blood or body fluids of infected individuals.
- Statement 3: Incorrect. Hepatitis D affects only individuals who already have Hepatitis B.
- Statement 4: Correct. Vaccines are available for Hepatitis A and B.

Q638. Which of the following statements about Hepatitis and its transmission are correct?
1. Hepatitis A and E are spread through faecal contamination of food or water.
2. Hepatitis B and C are not usually spread through saliva.
3. Vaccination is available for Hepatitis A, B, C, and D.

4. Hepatitis D requires the presence of Hepatitis B for infection.
(a) 1 and 3 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) All of the above

Ans: b

Sol:
- Statement 1: Correct. Hepatitis A and E spread through faecal contamination of food or water.
- Statement 2: Correct. Hepatitis B and C are not usually transmitted through saliva.
- Statement 3: Incorrect. Vaccination is only available for Hepatitis A and B, not for C or D.
- Statement 4: Correct. Hepatitis D requires Hepatitis B for infection.

Q639. Which types of Hepatitis are caused by faecal contamination of food or water?
(a) Hepatitis B and C
(b) Hepatitis A and E
(c) Hepatitis D and E
(d) Hepatitis C and D

Ans: b

Sol: Hepatitis A and E are transmitted through contaminated food or water, often due to faecal contamination. These types are self-limiting and do not require specific treatment.

Topic 214

214. Project Kusha

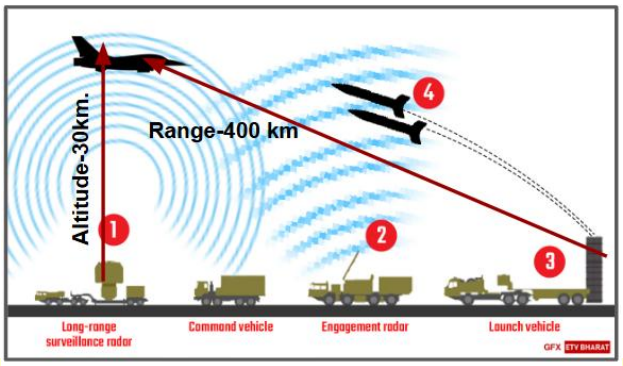
- Led by **DRDO.**
- **Aims-** to **develop long-range air defence system** by **2028-29**
- Part of **Atma Nirbhar Bharat Abhiyan** in defence sector.

India's Air Defence System

1. Long Range interception
- Prithvi Air Defence (PAD) missile
- **S-400 Triumf Missile**-**Russia imported**-most versatile

2. Short Range Interception
- Akash Air Defence System
- SPYDER-Israel
- S-125 Pechora-USSR
- Barak 8 -Joint DRDO and Israel Aerospace Industries
- Quick Reaction Surface-to-Air Missile (QRSAM)- DRDO in association with Bharat Electronics Limited and Bharat Dynamics Limited

Akashteer air defence systems(short range)
- Range is up to **25–30 kilometers**
- Developed by **Bharat Electronics Limited (BEL)**
- For **Indian Army's Corps of Army Air Defence**
- **Supersonic speeds**



S- 400 missile system
- **Surface-to-air missile** system (SAM).
- **Range of 400 km**, Altitude of up to **30 km.**
- **5 units** Imported from **Russia.**
- **First unit of S-400** deployed in **Punjab** to defend **against Pakistan**.
- It is considered much ahead of the US-developed **Terminal High Altitude Area Defense system (THAAD).**
- The system can track **100 airborne targets** and **engage six** of them **simultaneously.**

Q640. Consider the following statements regarding Project Kusha and India's Air Defence Systems:
1. Project Kusha aims to develop a long-range air defence system under the Atma Nirbhar Bharat Abhiyan.
2. Akash Air Defence System is used for long-range interception.
3. S-400 Triumf missile system was developed jointly by India and Russia.
4. The QRSAM system was developed by DRDO in collaboration with Bharat Electronics Limited and Bharat Dynamics Limited.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: b

Sol:

- Statement 1: Correct. Project Kusha is aimed at developing a long-range air defence system under the Atma Nirbhar Bharat Abhiyan.
- Statement 2: Incorrect. Akash Air Defence System is used for short-range interception.
- Statement 3: Incorrect. The S-400 Triumf missile system is imported from Russia, not developed jointly.
- Statement 4: Correct. QRSAM was developed by DRDO in collaboration with Bharat Electronics Limited and Bharat Dynamics Limited.

Q641. Which of the following statements about the S-400 missile system are correct?
1. The S-400 is a surface-to-air missile system with a range of up to 400 km.
2. It is capable of engaging up to 10 airborne targets simultaneously.
3. It has a deployment altitude of up to 30 km.
4. It is more advanced than the US-developed Terminal High Altitude Area Defense system (THAAD).
(a) 1 and 3 only
(b) 1, 3, and 4 only
(c) 2 and 4 only
(d) All of the above

Ans: b

Sol:

- Statement 1: Correct. The S-400 has a range of 400 km.
- Statement 2: Incorrect. The S-400 can track 100 airborne targets but can engage only 6 of them simultaneously.
- Statement 3: Correct. The system has a deployment altitude of up to 30 km.
- Statement 4: Correct. The S-400 is considered more advanced than the US-developed THAAD system.

Q642. Which air defence system was jointly developed by DRDO and Israel Aerospace Industries?
(a) Akash Air Defence System
(b) SPYDER Air Defence System
(c) Barak 8 Missile System
(d) S-400 Triumf Missile System

Ans: c

Sol: Barak 8 is a joint venture between DRDO and Israel Aerospace Industries, developed for short- to medium-range surface-to-air defence.

Topic 215

215. Integrated Guided Missile Development Programme

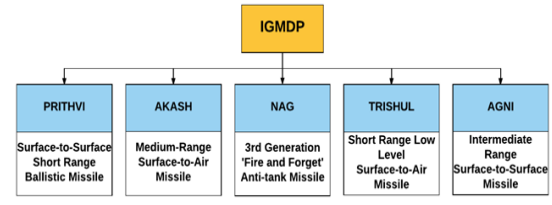
- launched in **1982-83** by the **Indian Government**.
- Conceived and **led by Dr A P J Abdul Kalam**,
- 5 set of missiles **Prithvi, Agni, Trishul, Akash and Nag** were developed.
- The programme was **completed in 2008.**
- **Post IGMDP** completion in 2008, **new missiles** like **Brahmos, Nirbhaya etc are developed.**
- Also **upgradation is brought in existing 5 missiles** developed under **IGMDP (Integrated Guided Missile Development Programme).**

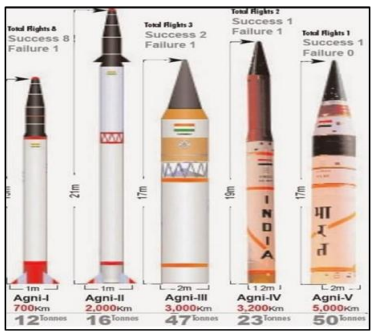
Current news?

- India's recent successful testing of an **Agni-5 Missile** equipped with **Multiple Independently Targetable Re-entry Vehicle (MIRV) technology** with multiple warhead capabilities, termed **Mission Divyastra.**

MIRV technology

- A weapon system to deliver **multiple nuclear warheads** against **different targets** spread across **hundreds of kilometers.**
- Only **United States, the United Kingdom, France, Russia, and China have this.**





Q643. Consider the following statements about the Integrated Guided Missile Development Programme (IGMDP):
1. The programme was launched in 1982-83 under the leadership of Dr. A.P.J. Abdul Kalam.
2. Five missiles—Prithvi, Agni, Trishul, Akash, and BrahMos—were developed under the programme.
3. The programme was successfully completed in 2008.
4. Post-2008, upgradation of missiles developed under IGMDP has continued.
How many of the above statements are correct?
(a) Only 2
(b) Only 3
(c) Only 4
(d) Only 1

Ans: b

Sol:
- Statement 1: Correct. The IGMDP was launched in 1982-83 and led by Dr. A.P.J. Abdul Kalam.
- Statement 2: Incorrect. The five missiles developed were Prithvi, Agni, Trishul, Akash, and Nag (not BrahMos).
- Statement 3: Correct. The programme was completed in 2008.
- Statement 4: Correct. Post-2008, upgradation of the five missiles under IGMDP has been carried out.

Q644. Which of the following statements about MIRV technology are correct?
1. MIRV allows a single missile to carry and deliver multiple nuclear warheads.
2. These warheads can strike multiple targets spread across hundreds of kilometres.
3. India recently tested the Agni-5 missile equipped with MIRV technology.
4. Only India, Russia, and the United States have developed MIRV technology.
(a) 1 and 2 only
(b) 1, 2, and 3 only
(c) 2, 3, and 4 only
(d) All of the above

Ans: b

Sol:
- Statement 1: Correct. MIRV allows a missile to carry and deliver multiple nuclear warheads.
- Statement 2: Correct. These warheads can hit multiple targets over large distances.
- Statement 3: Correct. India recently tested the Agni-5 missile with MIRV technology under Mission Divyastra.
- Statement 4: Incorrect. Apart from India, MIRV technology has been developed by the United States, the United Kingdom, France, Russia, and China, not just India, Russia, and the U.S.

Q645. Which missile was not part of the IGMDP but was developed post-2008?
(a) Agni
(b) BrahMos
(c) Trishul
(d) Prithvi

Ans: b

Sol: BrahMos is a supersonic cruise missile developed post-2008, in collaboration with Russia, and was not part of the IGMDP.

Topic 216

216. Brahmos Missile

Manufactured by-
- **joint venture** between the **Defence Research and Development Organisation of India (DRDO)** and the NPOM of **Russia(**Brahmos is named on the **rivers Brahmaputra and Moskva).**

Speed
- **BrahMos missile** flies at a speed of **2.8 Mach (Supersonic)** -almost **three times** the **speed of sound.**

Range
- **Current** range-**290 Km**
- **Work in progres**s to increase range to **500 km from land** and **400 km from ship.**

Attack Mode
- can be launched from **submarines, ships, aircraft, or land** platforms.
- Can carry **Conventional** and **nuclear payloads.**

Engine
- It is a **two-stage** (solid propellant engine in the first stage and liquid ramjet in second).

- It is the **fastest supersonic cruise missile** in the world.

Current news?

- India's BrahMos supersonic cruise missiles were **delivered to the Philippines ($375 million deal)**

International Relations-Mains

This will help in countering **China's threat in South China Sea.**

BrahMos- two-stage missile

First stage

- Solid propellant booster engine
- brings the missile to supersonic speed (faster than sound), then separates

Second stage

- liquid ramjet or the second stage then takes the missile closer to three times
- Can manage even at the altitude of 15 km.

Fire and Forget missile (the target need not to be in line of sight)

Q646. Consider the following statements about the BrahMos missile:
1. BrahMos is a joint venture between India's DRDO and Russia's NPOM.
2. It is the fastest cruise missile in the world with a speed of 2.8 Mach.
3. It can carry only nuclear payloads.
4. The current range of the missile is 290 km, with work ongoing to extend it to 500 km.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol:

- Statement 1: Correct. The BrahMos missile is a collaborative project between DRDO and NPOM.
- Statement 2: Correct. BrahMos is the fastest supersonic cruise missile in the world with a speed of 2.8 Mach.
- Statement 3: Incorrect. BrahMos can carry both conventional and nuclear payloads.
- Statement 4: Correct. The current range is 290 km, with plans to extend it to 500 km from land.

Q647. Which of the following statements about the BrahMos missile's engine and attack modes are correct?
1. The BrahMos missile uses a two-stage engine system with a solid propellant in the first stage and a liquid ramjet in the second.
2. It can be launched from submarines, ships, aircraft, or land platforms.
3. The solid propellant booster engine helps the missile reach subsonic speed before separation.
4. The missile is capable of managing operations at altitudes as high as 15 km.
(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 1, 3, and 4 only
(d) All of the above

Ans: b

Sol:

- Statement 1: Correct. BrahMos uses a two-stage engine system: solid propellant in the first stage and liquid ramjet in the second.
- Statement 2: Correct. It can be launched from multiple platforms, including submarines, ships, aircraft, and land.
- Statement 3: Incorrect. The solid propellant booster engine brings the missile to supersonic speed, not subsonic, before separation.
- Statement 4: Correct. The missile can operate at altitudes up to 15 km.

Q648. Consider the following statements about BrahMos missile:
1. BrahMos is named after the Brahmaputra and Moskva rivers.
2. It has been sold to the Philippines in a $375 million deal.
3. BrahMos operates on a "line of sight" targeting mechanism.
4. The missile's current range from a ship platform is 400 km.

How many of the above statements are incorrect?
(a) Only 1
(b) Only 2
(c) Only 3
(d) None

Ans: b

Sol:

- Statement 1: Correct. BrahMos is named after the Brahmaputra and Moskva rivers.
- Statement 2: Correct. BrahMos has been sold to the Philippines in a $375 million deal.
- Statement 3: Incorrect. BrahMos is a fire-and-forget missile and does not require the target to be in the line of sight.
- Statement 4: Incorrect. The correct range from a ship platform is 290 km.

Topic 217

217. Indian Space Policy 2023

- Main focus-**enhance private sector participation** in Space sector.

Steps taken by the government to enhance private sector participation-

1. IN-SPACE

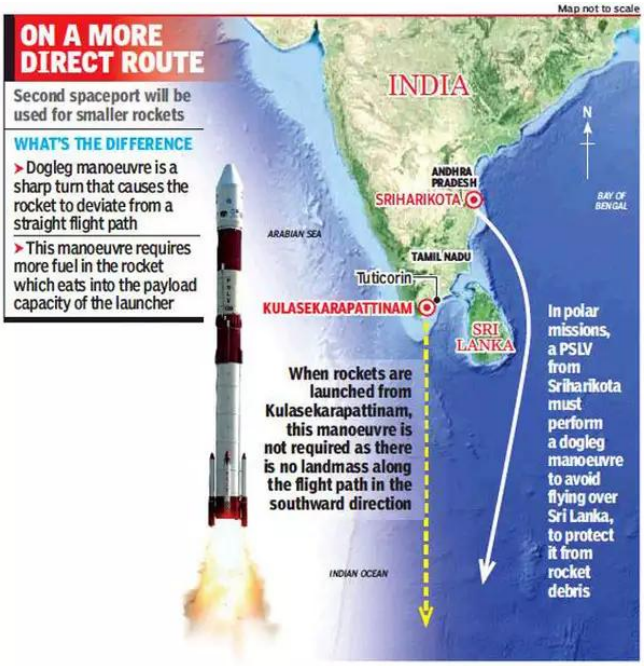
- established under the **Department of Space (DoS)**
- encourages **startups, businesses**, and **academic institutions** to **participate** in India's **space activities**.
- Recently **IN-SPACe** suggested **private sector participation** in **ground station as a service (GSaaS)** market.

2. Indian Space Association (ISpA)

- It aims to **open the Indian space industry** to private companies and startups. **Voluntary association** of Space industries in India.

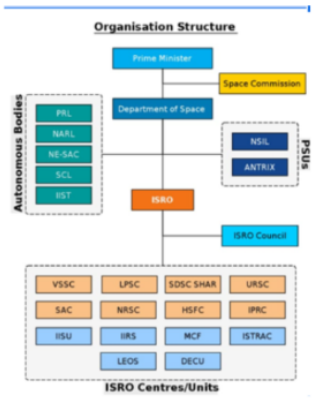
Second rocket launch port of ISRO

- at **Kulasekarapattinam** in **Thoothukudi district** of **Tamil Nadu.**
- existing launchport is at **Satish Dhawan Space Centre** (SDSC) SHAR in **Sriharikota, Island in Andhra Pradesh.**



Indian Space Research Organization

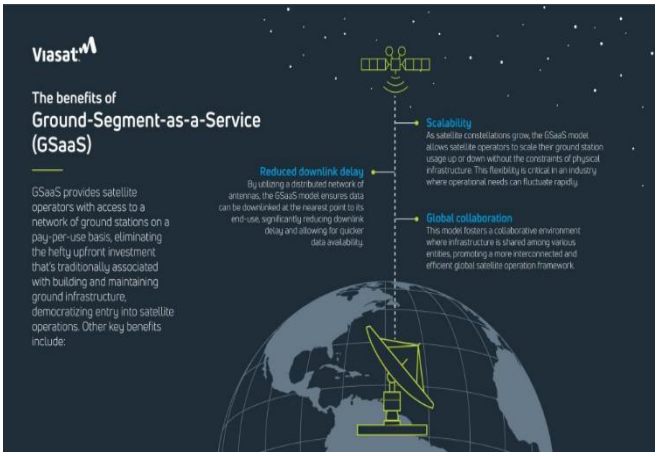
Dept of Space and Space Commission is headed by PM



- Both ANTRIX and NSIL takes care of **commercial wing of ISRO**.

How their role is different?

- **Antrix will handle ISRO's commercial deals** for satellites and launch vehicles with foreign customers.
- NSIL (New Space India Ltd) will deal with **capacity building of local industry** for space manufacturing.



GSaaS Works

- **antennas** and **communication systems**

- facilitate tasks like **data reception, tracking, and command** of satellites.

Q649. Consider the following statements about the Indian Space Policy 2023 and related developments:
1. IN-SPACe is established under the Department of Space to promote private sector participation.
2. Indian Space Association (ISpA) is a mandatory association for all space industries in India.
3. India's second rocket launch port is being developed at Kulasekarapattinam in Tamil Nadu.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) All 3
(d) None

Ans: b

Sol:
- Statement 1: Correct. IN-SPACe is under the Department of Space and aims to encourage startups and businesses in space activities.
- Statement 2: Incorrect. ISpA is a voluntary association, not mandatory.
- Statement 3: Correct. The second rocket launch port is being developed in Kulasekarapattinam, Tamil Nadu.

Q650. Which of the following statements correctly describe the GSaaS (Ground Station as a Service) market and its function?
1. GSaaS involves the use of antennas and communication systems for satellite operations.
2. It facilitates tasks such as data reception, tracking, and satellite command.
3. IN-SPACe has suggested that the private sector should not participate in GSaaS.
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) All 3

Ans: a

Sol:
- Statement 1: Correct. GSaaS involves antennas and communication systems.
- Statement 2: Correct. It facilitates tasks like data reception, tracking, and satellite command.
- Statement 3: Incorrect. IN-SPACe actively promotes private sector participation in the GSaaS market.

Q651. Consider the following statements regarding Indian Space Policy 2023:
1. Satish Dhawan Space Centre (SDSC) SHAR is located on an island in Tamil Nadu.
2. IN-SPACe has no role in encouraging academic institutions to participate in space activities.
3. The policy primarily focuses on enhancing private sector participation in the space sector.
4. Indian Space Association (ISpA) aims to open the space industry to startups and private companies.
How many of the above statements are incorrect?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: b

Sol:
- **Statement 1: Incorrect.** SDSC SHAR is located on an island in Andhra Pradesh, not Tamil Nadu.
- **Statement 2: Incorrect.** IN-SPACe encourages startups, businesses, and academic institutions to participate in space activities.
- **Statement 3: Correct.** The main focus of the policy is private sector participation.
- **Statement 4: Correct.** ISpA facilitates opening the space industry to private entities and startups.

Topic 218

218. Biomarkers and Biohacks

Biomarkers
- Biomarkers are a substance that is **generated inside an organism** as a means to **examine organ function** or other aspects of health.
- In medicine, **a biomarker** is a **measurable indicator** of the **severity or presence** of some **disease** state.

Biohacking

- **It means** enhancing the **body's ability to function** at peak performance—and maybe even **extend one's lifespan.**

Ways of Biohacking

- Lifestyle-dietary shifts, breathwork, meditation and exercise
- Genetic engineering
- Technology- smartwatches and diagnostics such as blood sugar monitors

Types of Biohacking

- Age Biohacking
- Energy Biohacking
- Physical Health Biohacking
- Brain Biohacking

Q652. Consider the following statements about biomarkers:
1. Biomarkers are substances produced inside an organism to examine health aspects like organ function.
2. In medicine, biomarkers can indicate the severity or presence of a disease state.
3. Biomarkers are exclusively used in genetic engineering practices.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) All 3
(d) None

Ans: b

Sol:

- **Statement 1: Correct.** Biomarkers are substances used to assess health aspects such as organ function.
- **Statement 2: Correct.** Biomarkers are measurable indicators of disease presence or severity.
- **Statement 3: Incorrect.** Biomarkers are not exclusive to genetic engineering; they are widely used in diagnostics and medicine.

Q653. Which of the following statements correctly describe biohacking and its types?
1. Biohacking involves methods to enhance the body's performance and possibly extend lifespan.
2. Genetic engineering is not considered a form of biohacking.
3. Energy biohacking is one of the types of biohacking.
4. Biohacking includes technologies like blood sugar monitors and smartwatches.
(a) 1, 2, and 4 only
(b) 1, 3, and 4 only
(c) 2, 3, and 4 only
(d) All 4

Ans: b

Sol:

- Statement 1: Correct. Biohacking aims to enhance body performance and extend lifespan.
- Statement 2: Incorrect. Genetic engineering is a type of biohacking.
- Statement 3: Correct. Energy biohacking is one of the biohacking categories.
- Statement 4: Correct. Biohacking includes technologies like smartwatches and diagnostic tools.

Q654. Consider the following statements about biohacking methods and categories:
1. Lifestyle biohacking includes meditation and dietary changes.
2. Brain biohacking is a type of biohacking that focuses on cognitive enhancement.
3. Physical health biohacking involves using genetic engineering only.
4. Biohacking excludes any use of wearable technology.
How many of the above statements are incorrect?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: c

Sol:

- Statement 1: Correct. Lifestyle biohacking involves practices like meditation and dietary shifts.
- Statement 2: Correct. Brain biohacking aims at cognitive improvements.
- Statement 3: Incorrect. Physical health biohacking is broader than genetic engineering; it also includes lifestyle changes and technologies.
- Statement 4: Incorrect. Wearable technology, like smartwatches, is a crucial part of biohacking.

Topic 219

219. Artemis Accord

- Set of **non-binding principles** and **agreements**
- **Introduced** by **NASA in 2020**
- Aim-responsible and **cooperative exploration** of the **Moon, Mars, and other celestial bodies.**

Key Features of the Artemis Accords

- **Safe coordination of activities** on the **Moon and other celestial bodies**.
- Supports the **use of space resources** in **responsible manner** inline with **Outer Space Treaty of 1967.**

Outer Space Treaty,1967

- Outer Space is **a Global common.**
- **No country** should **weaponize it.**
- **Benefits of research** in Outer space should be **shared with all.**

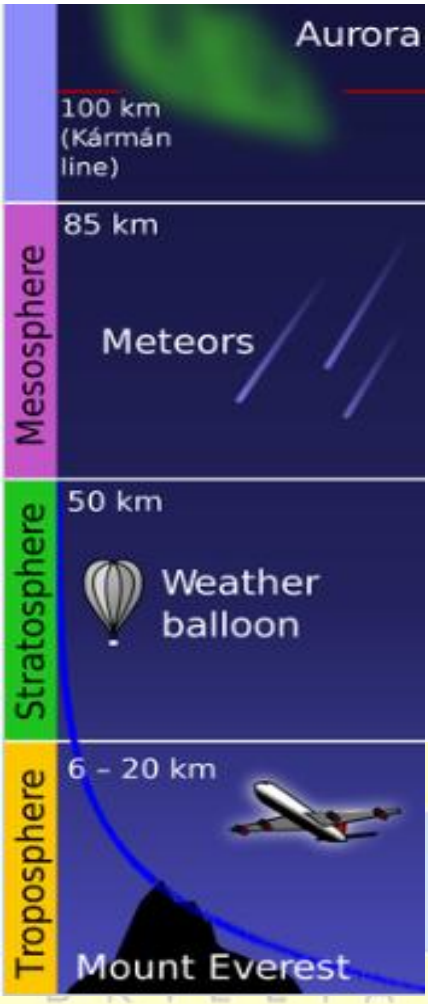
Outer space

- It is generally agreed that its the **region beyond 100 km** from the Earth's surface.
- **100 km line above Earth** surface is known as **Karman line.**

Note-

- **NASA** is **promoting Artemis Accord** under its **Artemis mission**.

52 countries have signed Artemis Accord, **including India.**



Q655. Consider the following statements about the Artemis Accords:
1. The Artemis Accords are legally binding agreements initiated by NASA.
2. The accords promote responsible use of space resources in line with the Outer Space Treaty of 1967.
3. They aim for the safe coordination of activities on the Moon and other celestial bodies.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) All 3
(d) None

Ans: b

Sol:

- Statement 1: Incorrect. The Artemis Accords are non-binding agreements.

- Statement 2: Correct. They align with the Outer Space Treaty of 1967 for responsible resource use.
- Statement 3: Correct. A key aim of the accords is to ensure safe coordination of activities on celestial bodies.

Q656. Which of the following statements are true regarding the Outer Space Treaty of 1967?
1. Outer Space is considered a global common.
2. Countries are prohibited from weaponizing outer space.
3. Benefits of outer space research should be shared with all nations.
4. Outer space begins at an altitude of 200 km above the Earth's surface.
(a) 1, 2, and 3 only
(b) 1 and 3 only
(c) 2, 3, and 4 only
(d) All 4

Ans: a

Sol:
- Statement 1: Correct. The Outer Space Treaty designates outer space as a global common.
- Statement 2: Correct. The treaty prohibits the weaponization of outer space.
- Statement 3: Correct. The treaty promotes equitable sharing of benefits derived from space research.
- Statement 4: Incorrect. Outer space is generally agreed to begin at 100 km (Kármán line), not 200 km.

Q657. Consider the following statements about the Artemis mission and related facts:
1. The Artemis mission is a NASA-led initiative to promote the Artemis Accords.
2. The Kármán line marks the boundary of outer space, generally agreed to be 100 km above Earth's surface.
3. Only 10 countries, including India, have signed the Artemis Accords.
4. The Artemis Accords support the weaponization of space for national security purposes.
How many of the above statements are incorrect?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: b

Sol:
- Statement 1: Correct. NASA promotes the Artemis Accords under the Artemis mission.
- Statement 2: Correct. The Kármán line is the generally accepted boundary of outer space.
- Statement 3: Incorrect. A total of 52 countries, including India, have signed the Artemis Accords.
- Statement 4: Incorrect. The accords do not support weaponization of space; they align with the Outer Space Treaty's principle of peaceful use.

Topic 220

220. Artemis Mission

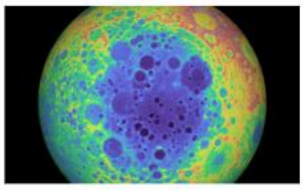
Cold war (1945-1991)
- Power projection-arms race and **space race**
- **USSR sent the first rocket in space** to **launch Sputnik**, the **first satellite**, on **October 4, 1957.**
- **US President John F Kennedy** had made a **public announcement** in **1961** that the **US would put a man on the Moon** before the decade was out.

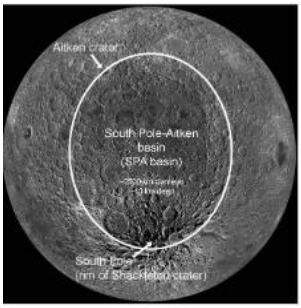
Apollo 11 Mission
- **Neil Armstrong, Michael Collins and Buzz Aldrin** landed the Apollo 11 mission on Moon on **July 20, 1969.**
- Overall **six Apollo human moon landings** between **1969 and 1972.**

Current news
- **NASA** is set to launch the **Artemis mission.**
- It will take **humans back to the Moon** after more than **half a century (last in 1972).**

The mission will launched in 3 phases
- **Artemis-1** will be **non-crew mission.**
- **Artemis-2-human orbital mission.**
- **Artemis-3-manned landing mission** by 2025.

How Artemis 1 is improved over Apollo?
1. **Landing on South pole**
2. **To mark permanent human presence on Moon**
3. **Act as basis for future mission to Mars**





Apollo mission brought only **few rock samples.** Artemis will ensure landing on South pole.

Q658. Consider the following statements about the Cold War and the Apollo 11 Mission:
1. The USSR launched Sputnik, the first satellite, in 1957.
2. John F. Kennedy announced in 1961 that the US would put a man on the Moon within the decade.
3. Apollo 11 was the only human moon landing during the Apollo program.
How many of the above statements are correct?
(a) Only 1
(b) Only 2
(c) All 3
(d) None

Ans: b

Sol:
- Statement 1: Correct. Sputnik was the first satellite sent into space by the USSR in 1957.
- Statement 2: Correct. President Kennedy's 1961 announcement emphasized US ambitions to achieve a moon landing before 1970.
- Statement 3: Incorrect. There were six human moon landings during the Apollo program from 1969 to 1972.

Q659. Which of the following statements about NASA's Artemis mission are correct?
1. Artemis-1 is planned as a non-crew mission.
2. Artemis-2 will involve a human landing on the Moon's South Pole.
3. Artemis-3 will aim to establish a permanent human presence on the Moon.
4. Artemis missions are aimed at enabling future exploration of Mars.
(a) 1, 3, and 4 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) All 4

Ans: a

Sol:
- Statement 1: Correct. Artemis-1 is a non-crew mission.
- Statement 2: Incorrect. Artemis-2 is a human orbital mission, not a landing mission.
- Statement 3: Correct. The Artemis program aims to establish a permanent human presence on the Moon.
- Statement 4: Correct. The Artemis mission will act as a foundation for future Mars exploration.

Q660. Consider the following statements about the Artemis mission and its advancements over Apollo:
1. The Apollo missions marked six human landings on the Moon between 1969 and 1972.
2. Artemis missions will focus on landing humans on the Moon's North Pole.
3. Artemis-1 is an improvement over Apollo as it aims for a landing on the Moon's South Pole.
4. The Artemis mission envisions a human landing by 2030.
How many of the above statements are incorrect?
(a) Only 1
(b) Only 2
(c) Only 3
(d) All 4

Ans: b

Sol:
- Statement 1: Correct. Apollo achieved six moon landings from 1969 to 1972.

- Statement 2: Incorrect. Artemis aims to land humans on the Moon's South Pole, not the North Pole.
- Statement 3: Correct. Artemis-1 aims for technological improvements and focuses on the Moon's South Pole for permanent presence.
- Statement 4: Incorrect. Artemis plans a manned moon landing (Artemis-3) by 2025, not 2030.