# Test Series Question Paper-24-02-2024

### 1. With reference to ISRO's Aditya L1 Mission, consider the following statements:

1. India became the first country to successfully park its solar observatory at the Lagrange Point near the Sun.

2. The Aditya L1 spacecraft will observe the photosphere, chromosphere, and the corona layers of the Sun.

3. The Lagrange point L1 is an unstable Lagrange point in space where the Aditya L1 spacecraft is being placed.

### 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: b

#### **Explanation:**

- Statement 1 is incorrect: Aditya-L1 was launched aboard the PSLV C57 by ISRO on 2 September 2023. Though this mission was first of its kind for India, however, India is not the first country to launch such mission successfully. Previously, space agencies of Europe, the US, Japan and China have launched such missions. Parker Solar Probe was a similar mission launched successfully by NASA in 2021 to unlock the mysteries of the Sun's corona and solar wind.
- Statement 2 is correct: The Aditya L1 will observe the photosphere, chromosphere, and the
  outermost layers of the Sun (the corona) using electromagnetic particle and magnetic field
  detectors. It will study the Sun from a halo orbit around the Lagrange point 1 (L1) of the SunEarth system.
- Statement 3 is correct: The gravitational forces between multiple massive bodies in space create Lagrange points. Lagrange Points are positions in space where the gravitational forces of a two-body system like the Sun and the Earth produce enhanced regions of attraction and repulsion. In the context of sun and earth of our solar system, Lagrange point is the balanced gravitational location between the Earth and the Sun. We have five Lagrange points, three are unstable and two are stable. The unstable Lagrange points are labelled L1, L2 and L3 lie along the line connecting the two large masses, while L4 and L5 are stable points. The L1 point is a unique location in space where the gravitational pull of the Sun and the Earth, precisely equals the centripetal force required for a small object to move with them.

# 2. The Indian government in its efforts to reshape governance and public services in the country has decided to set up three Centre of Excellence (CoEs) in three crucial sectors. The three sectors are:

- 1. Agriculture
- 2. Defence
- 3. Sustainable Cities
- 4. Health

5. Environment and Clean Energy

Select the correct option using the code given below:

- (a) Only 1, 4 and 5
- (b) Only 2, 3 and 4
- (c) Only 1, 3 and 4
- (d) Only 1, 2 and 5

Ans (c) Explanation Artificial intelligence (AI) is the simulation of human intelligence processes with the help of machines. India is embracing artificial intelligence (AI) to reshape governance and public services. The government has decided to set three Centre of Excellence (CoEs). These three CoEs are to be set up as one Centre of Excellence in each of the three crucial sectors, namely, 1) Agriculture 2) Health, and 3) Sustainable Cities.

- **Agriculture:** The CoE in Agriculture will involve the creation of a unified platform that would be available on the cloud and can be accessed publicly. It would allow the capturing of in-situ field data such as yield, proximally sensed images, crops, and a variety of growing information.
- **Health:** The CoE in Health would involve setting up a digital platform to capture and analyze health records, creating a test bed for early-disease prediction and diagnosis, and a pandemic or endemic prediction at different places in our country.
- **Sustainable Cities:** The CoE in Sustainable Cities would involve resolving issues about city planning, traffic management, water and sewage network systems, effective distribution of gas and electricity, etc. So, option (c) is correct.

# 3. On August 23, 2023, the world witnessed the successful landing of India's Chandrayaan-3 on Moon. In this context, consider the following statements:

1. This landing made India the first country to do so successfully on moon's south pole.

2. The Chandrayaan-3's landing site near the moon's south pole has been named Tiranga point.

3. The Pragyan rover of Chandrayaan-3 mission has confirmed the presence of Mica mineral on the lunar surface.

4. The mission life of the Lander and Rover of Chandrayaan-3 equals to 14 lunar days.

# Which of the statements given above is/are correct?

- (a) 1 Only
- (b) 2 & 3 Only
- (c) 1, 2 and 4 Only(d) 1, 2, 3 and 4
- (d)

#### Ans: a Explanation:

- Statement 1 is correct: Chandrayaan-3 was launched aboard an LVM3-M4 rocket on 14 July 2023 from Satish Dhawan Space Centre in Sriharikota, Andhra Pradesh. On August 23, 2023, the world witnessed the successful landing of India's Chandrayaan-3 on Moon. This made India the first country to do so successfully on moon's south pole.
- Statement 2 is incorrect: The Tiranga Point is a location on the Moon near the lunar south pole where Chandrayaan-2's lander Vikram crashed. Chandrayaan-3's landing site near the moon's south pole has been named Shiv Shakti Point.
- **Statement 3 is incorrect:** Chandrayaan-3's Vikram rover made a groundbreaking discovery by confirming the presence of sulphur on the lunar surface.
- **Statement 4 is incorrect:** The lunar lander of the Chandrayan-3 mission was named Vikram and the lunar rover was named as Pragyan. The mission life of the Lander and Rover was equal to one lunar day, which is equivalent to 14 Earth days.

### 4. Consider the following processes:

- 1. Natural Language Processing (NLP)
- 2. Pattern Recognition
- 3. Machine Vision
- 4. Empathy-based social skills

### Which of the above are applications of Artificial intelligence (AI)?

- (a) Only 1, 2 and 3
- (b) Only 2, 3 and 4

- (c) Only 2 and 3
- (d) 1, 2, 3 and 4

# Ans (a)

## Explanation

- Artificial intelligence (AI) is the simulation of human intelligence processes with the help of machines.
- Natural Language Processing (NLP): It is a machine learning technology that gives computers the ability to interpret, manipulate, and comprehend human language. For example, spam detection classifies an email as junk by looking at its subject matter.
- Pattern Recognition: It is a data analysis method that uses machine learning algorithms. Artificially intelligent machines can be used for pattern recognition in security software and business inventory solutions.
- Machine Vision: This technology gives industrial equipment the ability to "see" what it is doing and make rapid decisions based on it. The most common uses of machine vision are visual inspection, defect detection, signature identification, medical image analysis, security systems, etc.
- Empathy-based social skills: AI cannot make Moral or Ethical Decisions. It is based on programmed algorithms, without a sense of right or wrong. So, option (a) is correct.

# 5. Recently, the James Webb Space Telescope was in news for capturing the spiral galaxy IC 5332, which is over 29 million light-years away from earth. With reference to this, consider the following statements:

1. James Webb Space Telescope is an infrared telescope.

2. This telescope has been placed at the Lagrange point-L5 in the space.

# 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: a

# Explanation:

- **Statement 1 is correct:** James Webb Space Telescope is an infrared telescope with a 6.5m mirror. An infrared telescope is a telescope that uses infrared light to detect celestial bodies.
- Since infrared light is undetectable to human vision, scientists and image processors convert infrared light wavelengths into colours that can be seen. To do this, Near Infrared Camera filters are used.
- Statement 2 is incorrect: The James Webb Space Telescope orbits the Sun near Sun-Earth Lagrange point 2 (L2). The gravitational forces between multiple massive bodies in space create Lagrange points. Lagrange Points are positions in space where the gravitational forces of a two-body system like the Sun and the Earth produce enhanced regions of attraction and repulsion. In the context of the sun and earth of our solar system, the Lagrange point is the balanced gravitational location between the Earth and the Sun. We have five Lagrange points, three are unstable and two are stable. The unstable Lagrange points are labelled L1, L2 and L3 - lie along the line connecting the two large masses, while L4 and L5 are stable points.

### 6. Consider the following countries:

- 1. India
- 2. Mexico
- 3. Brazil
- 4. China

#### 5. New Zealand

## Which of the above are founding members of the Global Partnership on Artificial Intelligence (GPAI)?

- (a) Only 1, 2 and 3
- (b) Only 2, 3 and 4
- (c) Only 1, 2 and 5
- (d) Only 1, 3 and 5

## Ans (c)

## Explanation

- The Global Partnership on Artificial Intelligence (GPAI) is a multi-stakeholder initiative that engages minds and experts from science, industry, civil society, governments, international organizations, and academia. It aims to bridge the gap between theory and practice on AI by supporting cutting-edge research and applied activities on AI-related priorities.
- The 2023 Global Partnership on Artificial Intelligence (GPAI) Summit took place in New Delhi, from 12th to 14th December. The 29 existing GPAI Members have reaffirmed their commitment to promoting responsible and trustworthy AI through GPAI.
- The government of India has also joined the GPAI as its founding member.
- GPAI was officially launched on June 15, 2020, with fifteen founding members. The members are Australia, Canada, France, Germany, India, Italy, Japan, Mexico, New Zealand, the Republic of Korea, Singapore, Slovenia, the United Kingdom, the United States, and the European Union. So, option (c) is correct.

# 7. In the context of space technology, which of the following best describes the Armstrong limit or Armstrong's line?

- (a) Altitudes till which the pressure of oxygen is sufficient to sustain human life
- (b) conventional boundary between Earth's atmosphere and outer space.
- (c) altitude at which near space starts.
- (d) Altitude till which white light is capable of dispersing into monochromatic lights of seven different wavelength.

### Ans: c

### **Explanation:**

• Near Space starts from the line above the earth's surface where the atmospheric pressure reduces to 1/16th of the normal atmospheric pressure at the sea level. The normal atmospheric pressure at sea level is 101.325 kilopascals. Therefore, we can say that near space starts from the line above the earth's surface where the atmospheric pressure is below 6.3 kilopascals (i.e 1/16th of normal atmospheric pressure at sea level). The altitude at which near space starts is called Armstrong Limit. The exact altitude of the Armstrong Line or Limit depends on weather conditions in the stratosphere, but usually, it lies between 18 and 19 km. So, option (c) is the correct.

# 8. With reference to India's progress and achievements in the field of Artificial Intelligence (AI), consider the following statements:

- 1. India's first AI-empowered anti-drone system has been named 'Prachand'
- 2. India's first Artificial Intelligence school has been opened in Telangana.
- 3. India's first ChatGPT-powered AI chatbot is named 'Manav'.

# Which of the statements given above is/are correct?

- (a) Only 1
- (b) Only 2 and 3
- (c) Only 2
- (d) None

Ans (d) Explanation

- Artificial Intelligence (AI) refers to a machine system that is capable of performing tasks that resemble human problem-solving abilities. The system uses computer algorithms to do things that would normally require human intelligence.
- Statement 1 is incorrect: Grene Robotics, a Hyderabad-based firm has launched India's, first AI-empowered anti-drone system. The system has been named 'Indrajaal'. The system has an extensive Counter-Unmanned Aircraft System (C-UAS), that covers an expanse of 4000 square kilometers.
- **Statement 2 is incorrect:** Santhigiri Vidhyabhavan is India's first Artificial Intelligence school. It has been opened in Thiruvananthapuram, Kerala. The school inauguration ceremony was done by former President Ram Nath Kovind.
- **Statement 3 is incorrect:** India's first ChatGPT-powered AI chatbot has been named 'Lexi'. Velocity, an Indian financial technology company, has launched this integrated chatbot.

# 9. Consider the following statements about the Mars Orbiter Mission (MOM):

- 1. It was ISRO's first manned mission to the planet Mars.
- 2. Prior to India, only the United States and China had successfully explored Mars.

# 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: d

### **Explanation:**

- Statement 1 is incorrect: Mars Orbiter Mission (MOM) was ISRO's first mission to red planet Mars. It was an unmanned mission. The Mangalyaan spacecraft successfully enters Mars orbit on September 23, 2014.
- Statement 2 is incorrect: The success of the mission made ISRO only the fourth space agency in the world to do so. Before India, only the United States, the Soviet Union and the European Space Agency (ESA) had successfully explored Mars.
- Mangalyaan operated for seven and a half years, observing Martian landscapes and studying their composition using its five science instruments. Mangalyaan entered Mars orbit with its closest point to the planet at about 420 kilometers (about 261 miles) and farthest at about 80,000 kilometers (about 49,710 miles), which is a much longer orbit than contemporary Mars Mission. Over the years, ISRO reduced the orbit's size. In April 2022, ISRO lost contact with Mangalyaan after it passed into Mars' shadow for an extended period.

### 10. Consider the following statements about Quantum Computing:

- 1. Quantum Computing is the ability to learn from data without being explicitly programmed.
- 2. India's first quantum computing-based telecom network link has been started in Bengaluru.
- 3. 'First International Quantum Communication Conclave' was held in Hyderabad.

### How many of the statements given above is/are correct?

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

### Ans (d)

# Explanation

• Statement 1 is incorrect: Quantum Computing is related to the speed of a computer. While a conventional computer stores and processes information in bits i.e. 0 and 1; a quantum computer does the same through 'qubits' or 'quantum bits'. A quantum computer is several

million times faster than the most sophisticated conventional computer. Machine Learning is the ability to learn without being explicitly programmed.

- Statement 2 is incorrect: India's first quantum computing-based telecom network link is operational in New Delhi. It lies between Sanchar Bhawan and the National Informatics Centre office.
- Statement 3 is incorrect: Recently, the Department of Telecom organized the First International Quantum Communication Conclave in New Delhi. It was launched in collaboration with CDOT, TSDSI, and IEEE Communications Society. The conclave provides an excellent opportunity to learn about the latest advancements in quantum communication technologies.

# 11. India has recently signed the Artemis Accords thereby becoming the 27th country to do so. Which one of the following best describes the Artemis accords?

- (a) commitment towards the long-term goal of reaching net-zero emission by 2050
- (b) a US-led international partnership on planetary exploration and research
- (c) avoiding border coercion and advocating for dialogue and diplomacy to resolve international border disputes
- (d) Ceasing fossil fuel exploration by 2030 and shifting to green energy production on larger scale

### Ans: b

### **Explanation:**

- The Artemis Accords has been built upon the foundation of the Outer Space Treaty of 1967 (OST). It constitutes a comprehensive framework of guidelines that aim to govern the exploration and utilization of space in the modern era. India became the 27th country to sign the nonbinding Artemis Accords. This will involve joint participation of ISRO and NASA in space exploration programmes in near future.
- The Artemis Accords is closely linked to the Artemis Program, which aims to return astronauts to the lunar surface, build a space camp there, and carry out deep space exploration. The upcoming Artemis-III mission by NASA will land the first woman and first person of color on the Moon, using innovative technologies to explore more of the lunar surface. In 2024, Orion will deliver its crew to lunar orbit. The commercially developed lander that will take the crew to the lunar surface. So, option (b) is correct.

# 12. In India, while forest fires are predominant in April-May, farm fires are mainly witnessed in September to November. In this context, consider the following statements:

1. While forest fires are predominant in Himalayan states, farm fires are predominant in northwestern India.

2. While forest fires occur mainly due to the dominance of Chir-Pine trees, the practice of stubble burning by farmers is the main reason for farm fires.

# Which of the statements given above is/are correct?

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

### Ans (c)

- **Statement 1 is correct:** In the Himalayan region, forest fire is common in the foothills (< 500 m elevation) and subtropical elevations (600–2000 m). Himachal Pradesh, Jammu Kashmir, and Uttarakhand are predominantly affected by it. Farm fires in India are mainly across six states— Punjab, Haryana, Uttar Pradesh, Delhi, Rajasthan, and Madhya Pradesh.
- **Statement 2 is correct:** The resin ducts of the chirpine tree make the tree prone to fire. The "needles" or needle-like leaves of the tree are also highly inflammable and prevent

regeneration of undergrowth on the forest floor. The Himalayan region is dominated by chirpine trees, which are the main reason for forest fires. Stubble burning is the practice of intentionally setting fire to the straw stubble that remains after harvesting the grains, such as rice and wheat. Stubble burning is the main reason for farm fires in India.

# **13.** India recently updated its Nationally Determined Contribution (NDC) to be communicated to the United Nations Framework Convention on Climate Change. In this context, consider the following statements:

1. As per the updated NDC in 2022, India now stands committed to reduce Emissions Intensity of its GDP by 33 to 35 percent by 2030.

2. India will follow the LIFE movement proposed by Indian Prime Minister at COP 28 to meet its NDC target.

### 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: d

#### **Explanation:**

- Statement 1 is incorrect: Earlier, in 2015, India submitted its Intended Nationally Determined Contribution (NDC) to UNFCCC. The India's NDC comprised of eight goals; three of these had quantitative targets up to 2030. These were namely, cumulative electric power installed capacity from non-fossil sources to reach 40%; reduce the emissions intensity of GDP by 33 to 35 percent compared to 2005 levels and creation of additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover. As per the updated NDC in 2022, India now stands committed to reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level and achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030.
- Statement 2 is incorrect: The Indian Prime Minister at COP 26, proposed a 'One-Word Movement', to the global community. This one word is LIFE...L, I, F, E, i.e. Lifestyle for Environment. The vision of LIFE is to live a lifestyle that is in tune with our planet and does not harm it. The mass movement for 'LIFE'- 'Lifestyle for Environment' is a key to achieve India's NDC. The 2023 United Nations Climate Change Conference or Conference of the Parties of the UNFCCC, is known as COP28. It was held from 30 November until 12 December at Expo City, Dubai, United Arab Emirates. In 2021, the COP 26 was held in Glasgow, Scotland.

14. The Laser Interferometer Gravitational-Wave Observatory (LIGO) being built in India aims to study the Gravitational waves. In this context, consider the following statements:

1. The LIGO India observatory is being built in the Theni District in Tamil Nadu.

2. Gravitational waves are generated due to the acceleration of electric charges propagating in space and time.

#### Which of the statements given above is/are correct?

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

Ans (d) Explanation

- **Statement 1 is incorrect:** The Union Cabinet has approved LIGO-India, the gravitational-wave detector to be built in Maharashtra. It is being built in the Hingoli district of Maharashtra.
- **Statement 2 is incorrect:** Gravitational waves are different from electromagnetic waves. While the acceleration of electric charges in space creates electromagnetic waves, gravitational waves are created by the acceleration of different masses in space.
- The Laser Interferometer Gravitational-Wave Observatory (LIGO) is a large-scale physics experiment and observatory designed to detect cosmic gravitational waves.
- The LIGO-India project is being built by different institutions viz. the Department of Atomic Energy (DAE) and the Department of Science and Technology (DST), Government of India, with a Memorandum of Understanding (MoU) with the National Science Foundation (NSF), USA.

# 15. Which of the following supercomputers of India has been ranked at No. 75 in the world at the International Supercomputing Conference (ISC 2023) in Germany and has also become the fastest supercomputer in India?

- (a) Mihir
- (b) Pratyush
- (c) PARAM Ganga
- (d) AIRAWAT

# Ans: d

# Explanation:

 The National Supercomputing Mission was introduced by the Ministry of Electronics and Information Technology in 2015 to install a large number of supercomputers in India to meet the complex computational challenges. Several supercomputers have been installed to date under the mission. Recently, a supercomputer named AIRAWAT has been ranked 75th fastest in the world in global top 500 list of supercomputers. Also, it is the fastest supercomputer of India at present. AIRAWAT has been installed at the Centre for Development of Advanced Computing (C-DAC) in Pune. The United States' Frontier is the most powerful supercomputer on earth currently. So, option (d) is correct.

### 16. Consider the following statements about the Aditya L1 Mission:

- 1. The mission aims to study the Sun's chromosphere and photosphere.
- 2. The launch of Aditya-L1 was done by PSLV-C57 rocket.

3. The spacecraft has been placed in a Low Earth Orbit (LEO).

# Which of the statements given above are correct?

- (a) Only 1 and 2
- (b) Only 2 and 3
- (c) Only 1 and 3
- (d) 1, 2 and 3

# Ans (a)

- **Statement 1 is correct:** The Aditya L1 mission aims to study and observe the photosphere, chromosphere, and corona of the Sun.
- Statement 2 is correct: The launch of the Aditya-L1 spacecraft was accomplished by ISRO using the PSLV-C57 rocket on September 2.
- **Statement 3 is incorrect:** The Aditya-L1 has been placed in a halo orbit around the Lagrange point-L1. It is not placed in the Low Earth Orbit (LEO).
- The major objectives of Aditya-L1's mission are to study:
- ✓ solar upper atmospheric (chromosphere and corona) dynamics.
- ✓ the chromosphere and coronal heating
- ✓ in-situ particle and plasma environment
- ✓ physics of solar corona and its heating mechanism.

- ✓ diagnostics of the coronal and coronal loops plasma: Temperature, velocity, and density.
- ✓ development, dynamics, and origin of Coronal Mass Ejections.
- ✓ the sequence of processes that occur at multiple layers (chromosphere, base, and extended corona) which eventually leads to solar eruptive events.
- ✓ magnetic field topology and magnetic field measurements in the solar corona.
- ✓ drivers for space weather
- ✓ solar wind

# 17. The Nobel Prize 2023 in Physics has been awarded to three people namely Pierre Agostini, Ferenc Krausz and Anne L'Huillier. They received prize for which of the following tasks?

- (a) for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science
- (b) for experimental methods that generate attosecond pulses of light for the study of electro dynamics in matter
- (c) for the physical modelling of Earth's climate, quantifying variability and reliably predicting global warming
- (d) for the groundbreaking discoveries concerning about the black holes.

#### Ans: b

Explanation:

• The Nobel Prize 2023 in Physics has been awarded to three people namely Pierre Agostini, Ferenc Krausz and Anne L'Huillier. The three Nobel Prize laureates have been recognised for their experiments, that have demonstrated a way to create extremely short pulses of light to measure the rapid processes in which electrons move or change energy. So, option (b) is correct.

18. Recently, the Union Science and Technology Minister unveiled two new products named 'Namoh 108' and 'NBRI-Nihar' developed by the National Botanical Research Institute (NBRI). The two products are new varieties of which of the following?

- (a) Lotus and Turmeric
- (b) Basmati Rice and Sharbati Wheat
- (c) Lotus and Aloe Vera
- (d) Mango and Tea

### Ans (c)

Explanation

- Recently a new variety of Lotus was unveiled by the Union Science and Technology Minister. The new variety of lotus flower with 108 petals has been named "Namoh 108". It has been developed by the National Botanical Research Institute (NBRI) located in Lucknow, Uttar Pradesh.
- The "NBRI Namoh 108" lotus variety flowers from March to December and is the first flower whose genome is completely sequenced for its characteristics.
- Also, the S&T Minister released a new variety of Aloe vera named 'NBRI-Nihar'. The new variety has approximately 2.5 times higher gel yield in comparison to normal Aloe vera. So, option (c) is correct.

# 19. The Covid-19 event led to the development of mRNA and DNA vaccines at record pace to replace the traditional vaccines. In what way(s) is/are the mRNA and DNA vaccines different from traditional vaccines?

1. While traditional vaccines are prepared by using weakened or inactive versions of that virus, DNA and RNA vaccines use part of the virus' own genes to stimulate an immune response.

2. While Covishield is a type of traditional vaccine, ZyCoV-D and Covaxin are examples of DNA and m-RNA vaccine.

#### Select the correct answer using the code given below:

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

#### Ans: a

#### **Explanation:**

- Statement 1 is correct: The Covid-19 event led to the development of mRNA and DNA vaccines at record pace to replace the traditional vaccines. Both DNA and RNA vaccines are used to create an immune response against a specific pathogen. However, traditional vaccines are different from vector vaccines like m-RNA and DNA. Unlike conventional vaccines that stimulate the immune system through the use of a weakened or inactivated version of a pathogen (virus or bacteria), DNA and mRNA vaccines use genetic materials that code for the pathogen's spike protein to trigger an immune response. Specifically, DNA vaccines use small DNA molecules, while mRNA vaccines use the pathogen's messenger RNA to do the job.
- Statement 2 is incorrect: Bharat Biotech's Covaxin is India's first indigenous vaccine against COVID-19. It is a traditional vaccine developed with Whole-Virion Inactivated Vero Cell-derived technology, which uses a dead virus, incapable of infecting the host cell or replicating. ZyCoV-D is a DNA plasmid-based COVID-19 vaccine developed by Indian pharmaceutical company Cadila Healthcare, and Covishield is a m-RNA vaccine Serum Institute of India Pvt Ltd.

Operation	Related to	
1. Operation Kaveri:	Evacuation of lakhs of people from the coastland of Odisha and Andhra	
	Pradesh to safer places during Cyclone Michaung.	
2. Operation Sajag:	Evacuation mission by the Indian government to evacuate Indian citizens from	
$\mathbf{x}$	Israel during the 2023 Israel–Hamas war.	
3.Operation Ganga:	Evacuation mission by the Indian government to rescue its citizens stranded	
	in Ukraine	

#### 20. Consider the following pairs:

#### How many of the pairs given above is/are correctly matched?

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

#### Ans (a)

#### Explanation

- **Pair 1 is incorrect:** Operation Kaveri is an operation conducted by the Indian Armed Forces to evacuate Indian citizens and foreign nationals from Sudan during the 2023 Sudan conflict.
- Pair 2 is incorrect: 'Operation Sajag' is a drill involving all stakeholders of the coastal security construct. It was conducted by the Indian Coast Guard along the west coast on September 18, 2023. The drill facilitates revalidation of the coastal security mechanism and brings awareness among the fishermen at sea. The evacuation mission by the Indian Armed Forces to evacuate Indian citizens from Israel during the 2023 Israel–Hamas war has been named 'Operation Ajay'.
- **Pair 3 is correct:** Operation Ganga was an evacuation mission carried out by the Indian government to rescue its citizens stranded in Ukraine during the Russian invasion of Ukraine.

21. Recently, the Union Minister for Road Transport and Highways launched the world's first flex fuel ethanol powered vehicle in India. With reference to this, consider the following statements:

1. A flex-fuel vehicle has an internal combustion engine designed to run on more than one fuel.

2. While use of flex fuels reduces the vehicular pollutants, it also reduces the efficiency and mileage of the vehicles.

3. E85 is a flex fuel which can have a maximum of 15% ethanol blending with 85% of other fuels. Which of the statements given above are correct?

- (a) 1 and 2 Only
- (b) 2 and 3 Only
- (c) 1 and 3 Only
- (d) None of the above

#### Ans: a

#### **Explanation:**

**Statement 1 is correct:** Toyota Innova HyCross is the world's first flex-fuel ethanol-powered car, launched in India. A flex-fuel vehicle has an internal combustion engine designed to run on more than one fuel, most frequently hydrocarbon and alcohol.

E85 (or flex fuel) is a term that refers to high-level ethanol-gasoline blends containing 51% to 83% ethanol. The BS 6 (Stage II) Electrified Flex Fuel Vehicle has both a flex-fuel engine as well as an electric powertrain.

**Statement 2 is correct:** Bioethanol contains less energy per unit volume than petrol. Flex fuel vechile are considered more environmentally friendly than traditional petrol powered vehicle. Thus, use of flex flue or E85 that has almost 85% ethanol blending lowers the fuel efficiency. As a result, Flex Fuel Vehicles (FFVs) experience a decrease in mileage compared to using regular petrol.

**Statement 3 is incorrect:** E85 is the official name for flex-fuel. It has 85 percent ethanol fuel and 15 percent gasoline or other hydrocarbon by volume. Flex fuel vehicles can use E85, unleaded gasoline or any combination of the two. Conventional vehicles are not certified for use with E85. Ethanol is an indigenous, eco-friendly, and renewable fuel which is cheaper than petrol or diesel. Ethanol is made from biomass and can be produced by fermenting the sugar in the starches of grains such as corn, sorghum, and barley and the sugar in sugar cane and sugar beets.

#### 22. Consider the following statements about the OSIRIS-Rex Mission:

1. It is a joint mission of the European Space Agency (ESA) and the Indian Space Research Organisation (ISRO).

2. The mission aims to study the tropical atmosphere and climate-related aspects such as monsoons and cyclones.

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#### Which of the statements given above is/are correct?

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

Ans (d)

Explanation

- Statement 1 is incorrect: OSIRIS-Rex Mission was launched on Sept. 8, 2016, by the National Aeronautics and Space Administration (NASA). OSIRIS-Rex stands for Origins, Spectral Interpretation, Resource Identification, and Security-Regolith Explorer.
- Statement 2 is incorrect: Under this mission, the spacecraft visited a near-Earth asteroid named Bennu and collected a sample of rocks and dust from the surface. OSIRIS-REx is the first U.S. mission to collect a sample from an asteroid. It returned to Earth on Sept. 24, 2023, to drop off material from asteroid Bennu.

# 23. At the recently concluded COP 28 of UNFCCC, nearly 200 countries adopted deal that called for a "transition away from fossil fuels". In this context, consider the following statements:

1. A fund named 'loss and damage' fund has been proposed for the first time at COP 28

2. COP 28 allows for continuing usage of transitional fuels like natural gas, while rapidly phasing down unabated coal.

3. COP 28 sets the target for tripling of renewable energy capacity and a doubling of energy efficiency, both by 2030.

4. The next COP 29 is scheduled to take place in Azerbaijan.

## Which of the statements given above are correct?

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

### Ans: b

Explanation:

- Statement 1 is incorrect: The 'Loss and Damage' (L&D) fund was first proposed at Sharm el-Sheikh Climate Change Conference (COP 27) and not at COP 28. The fund is a financial mechanism designed to address the irreversible consequences of climate change. The aim is to provide financial assistance to poorer nations.
- Statement 2 is correct: The final draft of COP28 called for a "transitioning away from fossil fuels in energy systems, so as to achieve net zero by 2050. The exclusive focus has been on rapidly phasing down unabated coal, though it allows transitional fuels like methane to continue.
- Statement 3 is correct: The agreement calls for a tripling of renewable energy capacity and a doubling of energy efficiency, both by 2030.
- Statement 4 is correct: COP29 is set to take place in Baku, Azerbaijan.

### 24. Which one of the following best describes the term 'Quantum Supremacy'?

- (a) ability to learn without being explicitly programmed.
- (b) computer performing a calculation millions of times faster than usual.
- (c) a technique of manufacturing computers of very small size.
- (d) simulation of human intelligence processes by machines.

# Ans (b)

### Explanation

- In 2019, Google became the first to achieve 'quantum supremacy'. computer performing a calculation millions of times faster than usual.
- The computer was able to solve complex problems in about 200 seconds which would take classical supercomputers millennia.
- While a conventional computer stores and processes information in bits i.e. 0 and 1; a quantum computer does the same through 'qubits' or 'quantum bits'.
- A quantum computer is several million times faster than the most sophisticated conventional computer. So, option (b) is correct.

# 25. The Nobel Prize in Chemistry for 2023 has been given for "the discovery and synthesis of quantum dots". In this context, consider the following statements:

- 1. Quantum dots functions are predominantly based on Newtonian physics.
- 2. Zero-dimensional quantum dots have higher intensity than three-dimensional quantum dots.

# 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: b Explanation:

- Statement 1 is incorrect: Quantum dots are nanoparticles and are based on quantum physics rather than classical physics which applies to bigger particles. Nanoparticles are the semiconductor between 1 and 100 nm in diameter. The properties of Quantum Dots can vary depending on their shape and size.
- Statement 2 is correct: Quantum dots can exit as zero as well as three-dimensional nanomaterials. Since all three dimensions of the body are in a nanometre scale in zero-dimensional nanomaterial, it has much more intensity than three-dimensional nanomaterial of which no dimension is in the nanometre scale. As a result, they have superior transport and optical properties. Moungi G. Bawendi, Louis E. Brus, and Alexei Ekimov have received the 2023 Nobel Prize in Chemistry. Quantum dots have enabled significant advances in light-emitting diode (LED) displays and medical imaging, among other applications.

# 26. Consider the following statements about the India's Chandrayaan-3 Mission:

1. India is the fourth country to reach the moon after the US, China, and the Soviet Union.

2. Chandrayaan-3 was launched using an LVM3-M4 rocket.

### 3. Through this mission, ISRO aimed to conduct in-situ scientific experiments on the moon.

# Which of the statements given above is/are correct?

- (a) Only 1
- (b) Only 2 and 3
- (c) Only 3
- (d) 1, 2 and 3

# Ans (d)

Explanation

- Statement 1 is correct: On August 23, 2023, the world witnessed the successful landing of India's Chandrayaan-3 on the south pole of the Moon. This made India the first country to do so successfully. However, India is the fourth country to reach the moon after the US, China, and the Soviet Union.
- Statement 2 is correct: Chandrayaan-3 was launched aboard an LVM3-M4 rocket on 14 July 2023 from Satish Dhawan Space Centre in Sriharikota, Andhra Pradesh.
- **Statement 3 is correct:** The mission had three objectives. First, to demonstrate the ability to soft-land on the moon. The second objective is to demonstrate the rover Vikram's ability to move on the moon. Thirdly, ISRO aims to conduct in-situ scientific experiments.

# 27. Consider the following statements with respect to the ISRO's Venus orbiter mission Shukrayaan-1:

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1. ISRO has become the first space agency in the world to schedule a mission to Venus.

2. The mission aims to study the Venusian clouds.

### 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: b

- Statement 1 is incorrect: Shukrayaan will be ISRO's first mission to Venus, however, it is not the first agency to plan a mission on Venus. Earlier to this, US space agency NASA and space agency of Japan have already sent missions to study Venus. Nasa, have more than 40 spacecraft launched for Venus and one spacecraft Japan's Akatsuki is currently in Venus's orbit.
- Statement 2 is correct: The mission involves a spacecraft to orbit Venus to study
- Venusian clouds that are thick and are composed mainly (75–96%) of sulfuric acid droplets.

• Nasa's Mariner 2 was the first spacecraft to visit any planet beyond Earth when it flew past Venus on December 14, 1962. It revealed Venus as a runaway global hothouse. ISRO's Venus mission Shukrayaan was expected to be launched in December 2024, however, as per latest update the mission may be rescheduled in 2031.

# 28. Which one of the following space agencies has planned a mission to determine the origin of Mars' moons named Phobos and Deimos?

- (a) European Space Agency (ESA)
- (b) National Aeronautics and Space Administration (NASA)
- (c) Indian Space Research Organisation (ISRO)
- (d) Japan Aerospace Exploration Agency (JAXA)

# Ans (d)

### Explanation

- Martian Moons Exploration (MMX) is a robotic space probe planned by the Japan Aerospace Exploration Agency (JAXA).
- The Mission aims to travel to Mars and survey the red planet's two moons; Phobos and Deimos.
- Also, the mission aims to bring back the first samples from Mars' largest moon Phobos.
- The mission is planned to be launched in 2026 and bring the samples by 2029.
- One of MMX's two sample collection devices is PlanetVac. So, option (d) is correct.

### 29. Which of the following statements best describes India's Gaganyaan project?

- (a) To park and maintain a space station at approximately 400km low earth orbit
- (b) To send a human spaceflight up to a 400 km low earth orbit and safely return them to Indian sea waters.
- (c) To send a human spaceflight up to a 100 km Karman line orbit and safely return them to Indian sea waters.
- (d) To launch the first global water survey mission with the help of satellites placed in low earth orbit.

### Ans: b

### **Explanation:**

- Under the Gaganyaan Mission, ISRO will be sending three humans to an orbit of 400 km for a 3-day mission and bring them back safely to Earth by 2025. This will be India's first Human Space Mission. LVM-3 rocket will be used during the Gaganyaan mission. With the accomplishment of this mission, India will become only the fourth country to send a human into space after the Soviet Union, the US, and China.
- Also, Vyommitra is a female-looking spacefaring humanoid robot being developed by the Indian Space Research Organisation to function on-board the Gaganyaan. So, option (b) is the correct.

### **30.** Consider the following statements about the Lagrange points:

- 1. The gravitational forces between multiple massive bodies in space create Lagrange points.
- 2. Currently, there are only five Lagrange points discovered for the Sun-Earth system.

# Which of the statements given above is/are correct?

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

Ans (c) Explanation

- Statement 1 is correct: The gravitational forces that exist between multiple massive bodies in space create Lagrange points. Lagrange Points are positions in space where the gravitational forces of a two-body system like the Sun and the Earth produce enhanced regions of attraction and repulsion. In the context of sun and earth of our solar system, Lagrange point is the balanced gravitational location between the Earth and the Sun.
- **Statement 2 is correct:** Currently, we have the five Lagrange points discovered in the Sun-Earth System. Of the five, three are unstable and two are stable. The unstable Lagrange points have been labelled L1, L2, and L3, while the stable Lagrange points have been labelled L4 and L5.

# 31. Carbon nanotube nowadays on account of its light weight and a tensile strength of over 100 times that of steel is replacing steel in several applications. What is the basic structural building block of carbon nanotubes?

- (a) Diamond
- (b) Graphite
- (c) Fullerene
- (d) Graphene

Ans: d

### **Explanation:**

• Carbon nanotubes are very light in weight and are said to possess a tensile strength that is over 100 times that of steel. They are replacing steel in many applications. Graphene is the basic structural building block of carbon nanotubes. Graphene is a single layer (monolayer) of carbon atoms, tightly bound in a hexagonal honeycomb lattice. It is an allotrope of carbon. Graphite is an allotrope of carbon having a high number of carbon sheets whereas the graphene is a single carbon sheet of graphite. Carbon nanotubes are extremely robust and difficult to break, but they are still light. So, option (d) is the correct.

# 32. Which one of the following best describes the objective of the ISRO and NASA's joint mission called NISAR (NASA ISRO Synthetic Aperture Radar)?

- (a) To orbit around and study a dwarf planet.
- (b) To strengthen the International Satellite System for search and rescue operations.
- (c) Multi-wavelength observations of the celestial bodies and cosmic sources in space.
- (d) To study the changes occurring in the Earth's cryosphere.

### Ans (d)

### Explanation

- NASA-ISRO Synthetic Aperture Radar (NISAR) is a joint project between NASA and ISRO.
- The project aims to launch a dual-frequency synthetic aperture radar satellite to be used for remote sensing. It is notable for being the first dual-band radar imaging satellite.
- NISAR will provide the most comprehensive picture to date of motion and deformation of Earth's cryosphere.
- NISAR's orientation in orbit will enable it to collect data from Antarctica's far interior, close to the South Pole. So, option (d) is correct.

# **33.** Outer space is the expanse beyond celestial bodies and their atmosphere. The altitude or boundary for outer space near Earth has been decided as what?

- (a) 10kms
- (b) 100kms
- (c) 400Kms
- (d) 10000kms

Ans: b

## Explanation:

• The altitude or boundary for outer space has been decided as 100 km. This line is also called the Karman Line. At this point or line the air becomes too thin to support any aeronautic flight. Anything traveling above the Kármán line needs a propulsion system that doesn't rely on lift generated by Earth's atmosphere. So, option (b) is the correct.

# 34. As of now, which of the following countries/organizations have successfully sent missions to explore Mars?

- 1. China
- 2. India
- 3. European Space Agency (ESA)

# 4. Japan Aerospace Exploration Agency (JAXA)

# Select the correct answer using the code given below:

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

# Ans (b)

# **Explanation:**

- China launched the Tianwen-1 mission in July 2020 and the mission had a rover, named Zhurong. The rover touched down on the Red Planet in May 2021. The duo explored Mars smoothly until May 2022, when Zhurong was put into hibernation, hunkering down for the harsh winter.
- Mars Orbiter Mission (MOM) was ISRO's first mission to red planet Mars. It was an unmanned mission. The Mangalyaan spacecraft successfully entered Mars orbit on September 23, 2014.
- The success of the mission made ISRO only the fourth space agency in the world to do so. Before India, only the United States, the Soviet Union and the European Space Agency (ESA) had successfully explored Mars.
- In December 2003, the European Space Agency's (ESA) Mars Express successfully arrived in orbit around Mars.
- Mangalyaan operated for seven and a half years, observing Martian landscapes and studying their composition using its five science instruments. In April 2022, ISRO lost contact with Mangalyaan after it passed into Mars' shadow for an extended period.
- Japan Aerospace Exploration Agency (JAXA) has yet not explored Mars through a successful mission. It has planned its first mission to Mars in the year 2026 to explore the moons of Mars. So, option (b) is correct.

### 35. Consider the following statements about Sun-synchronous orbit (SSO):

1. It is a particular kind of geostationary orbit.

- 2. A satellite in a Sun-synchronous orbit generally remains at an altitude of between 600 to 800 km.
- 3. It is mainly used for communication satellites.

# Which of the statements given above is correct?

- (a) 1 Only
- (b) 2 Only
- (c) 3 Only
- (d) None of the above

# Ans: b

# **Explanation:**

• **Statement 1 is incorrect:** Sun-synchronous orbit (SSO) is a particular kind of polar orbit. Satellites in polar orbits usually travel past Earth from north to south rather than from west to east. These pass roughly over Earth's poles. Polar orbits are a type of low Earth orbit.

- **Statement 2 is correct:** Since sun-synchronous orbit (SSO) is a polar orbit, a satellite in a sunsynchronous orbit would usually be at an altitude of between 600 to 800 km.
- **Statement 3 is incorrect:** sun-synchronous orbit means they are synchronized to always be in the same 'fixed' position relative to the Sun. Due to this, the satellite always visits the same spot at the same local time. This is why sun-synchronous satellites are used as weather satellites.

36. Recently, the Minister of Fisheries, Animal Husbandry & Dairying, laid the foundation stone for establishing a Multi-Purpose Seaweed Park. In this context, consider the following statements:

- 1. Seaweeds are flowering plants that grow predominantly over land and water.
- 2. The multipurpose seaweed park is being set up in Odisha.

3. Seaweeds contain anti-inflammatory and anti-microbial properties.

### Which of the statements given above is/are correct?

- (a) Only 1
- (b) Only 2 and 3
- (c) Only 3
- (d) 1, 2 and 3

### Ans (c)

#### **Explanation:**

- Statement 1 is incorrect: Seaweeds are a type of macro-algae and not plants. So, they do not have flowers. Seaweeds are divided into three main groups based on color: brown, green, and red algae. They are predominantly found in cool, nutrient-rich waters and are known for their high biodiversity, providing home, shelter, and food for a variety of marine species.
- Statement 2 is incorrect: The multipurpose seaweed park is being set up in Tamil Nadu. The seaweed park includes the promotion of seaweed cultivation in 136 coastal fishing villages in 6 coastal districts of Tamil Nadu. Objectives of Seaweed Park include the creation of employment opportunities for coastal fisher youth and fisherwomen, the development of value-added seaweed products by encouraging the private sector/ entrepreneurs, and the conservation of marine ecosystems.
- Statement 3 is correct: Some seaweed compounds, such as alginate, are already used regularly in the medicinal field as binding agents. They are used for making medical tablets or wound dressings. Seaweeds are full of vitamins, minerals, and fibers. It contains anti-inflammatory and anti-microbial properties.

#### 37. Consider the following statements with respect to the orbital velocity of a body in space:

1. As the height (h) of a satellite from the Earth increases, its orbital velocity increases.

2. The orbital velocity of mercury is more than that of Earth.

### 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: b

### Explanation:

• **Statement 1 is incorrect:** Orbital velocity is defined as the velocity required for a natural or an artificial satellite to remain in its particular orbit. The orbital speed for a satellite depends upon its altitude from the earth. As the height (h) of a satellite from the earth increases, its orbital velocity decreases.

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• **Statement 2 is correct:** Since Mercury is closest to the Sun, it has a higher orbital velocity than Earth. The orbital velocity of mercury is 47.9 kms/sec, while orbital velocity of earth is 29.8kms/sec.

# **38.** With reference to the report titled 'Fostering Effective Energy Transition 2023', consider the following statements:

1. The report has been released by the Greenpeace International.

2. India ranked 67th in the Index.

3. Finland leads the global rankings, followed by New Zealand and Norway.

4. Among all the considered economies, currently only India and Australia, are showing sustained momentum in building energy equity.

### How many of the statements given above is/are correct?

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

#### Explanation:

- Statement 1 is incorrect: The report titled 'Fostering Effective Energy Transition 2023' was published by the World Economic Forum (WEF).
- Statement 2 is correct: The report ranked 120 countries based on energy transition. In the Energy Transition Index (ETI) so released, WEF has placed India at 67th position.
- Statement 3 is incorrect: Sweden leads the global rankings, followed by Denmark and Norway.
- **Statement 4 is incorrect:** Only two major economies, India and Singapore, are showing sustained momentum in building energy equity, sustainability, and security. The rest of the world's energy transition momentum is insufficient.
- Other features of the report are:
- This edition also evaluated countries' "transition momentum" for the first time to highlight the urgency of consistent progress on timely and effective transition.
- Among the world's 10 largest economies, only France features in the top 10.
- The top 10 accounts for 2% of energy-related CO2 emissions, 4% of the total energy supply, and 2% of the global population.
- Notably, large emerging centers of demand, such as China, India, and Indonesia, have seen strong improvements.

#### 39. Consider the following statements about spacecrafts and launch vehicles used for the same:

1. The launch vehicle used for Chandrayaan-1 was PSLV-C11.

2. The launch vehicle used for Chandrayaan-2 was the Geosynchronous Satellite Launch Vehicle Mark III (GSLV MK3).

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3. The launch vehicle used for the Chandrayaan-3 is LVM3 M4.

### 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

- Space launch vehicles are meant for launching satellites or certain payloads into space or into spacecraft.
- Statement 1 is correct: The launch vehicle used for Chandrayaan-1 was PSLV-C11.
- **Statement 2 is correct:** The launch vehicle used for Chandrayaan-2 was the Geosynchronous Satellite Launch Vehicle Mark III.
- Statement 3 is correct: The launch vehicle used for the Chandrayaan-3 is LVM 3 M4.

#### 40. Consider the following pairs:

Military Exercises	: Countries
1. Zayed Talwar	: India and Oman
2. Bold Kurukshetra	: India and USA
3. Ajeya Warriors	: India and France

#### How many of the above pairs is/are correctly matched?

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

#### Explanation:

- **Pair 1 is incorrect:** The Indian Navy and the United Arab Emirates conducted a bilateral exercise named 'Zayed Talwar from 8th to 11 August 2023.
- **Pair 2 is incorrect:** The Singapore Army and Indian Army participated in the 13th edition of Exercise Bold Kurukshetra. It is a bilateral armor exercise held from 06-13 March 2023 at Jodhpur Military Station, India.
- Pair 3 is incorrect: The 7th edition of the joint military exercise "AJEYA WARRIOR-23" between India and the United Kingdom was conducted at Salisbury Plains, United Kingdom from 27 April to 11 May 2023.

# 41. You must have noted that most of the rocket or spacecraft launching sites are located close to the Equator. What is the reason for choosing launching station near equator?

- (a) It lowers orbital speed required for the spacecraft to remain in orbit.
- (b) Earth rotates faster at the Equator than it does at the poles.
- (c) Outer space distance from earth reduces by the length equal to the earth's radius.
- (d) The value of acceleration due to gravity is least at the equator and maximum at the poles.

### Ans: b

#### Explanation:

- Earth rotates faster at the Equator than it does at the poles. Earth is wider at the Equator, so equatorial regions race nearly 1,600 kilometers (1,000 miles) per hour. The rotational speed decreases towards poles and at poles, it becomes zero.
- If a spacecraft is launched from a site near Earth's equator, it can take optimum advantage of the Earth's substantial rotational speed. Sitting on the launch pad near the equator, it is already moving at a speed of over 1650 km per hour relative to Earth's centre. So, option (b) is correct.

# 42. Recently, India decided to crash its satellite Megha-Tropiques-With reference to this, consider the following statements:

1. Megha-Tropiques-1 was developed jointly by the Indian Space Research Organisation and the European Space Agency.

2. It was placed in the geostationary orbit.

3. ISRO crashed the satellite as part of its commitment to the United Nations Inter-Agency Space Debris Coordination Committee.

### How many of the statements given above is/are correct?

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

Ans (a)

- **Statement 1 is incorrect:** Megha-Tropiques-1 was developed jointly by the Indian Space Research Organisation (ISRO) and the French space agency, CNES.
- Statement 2 is incorrect: Megha-Tropiques-1 was launched into Low Earth Orbit (LEO) on October 12, 2011. It was launched for monitoring tropical weather and climate studies. Megha in Sanskrit is 'cloud' and Tropiques in French means 'tropics'. The mission was initially planned to operate for three years, but it was extended later as it continued to deliver key data about the climate for a decade.
- Statement 3 is correct: The Megha-Tropiques-1 (MT1) was decommissioned by ISRO and so ISRO decided to crash the satellite as part of its commitment to the United Nations Inter-Agency Space Debris Coordination Committee (UNIADC). The satellite was allowed to re-enter Earth's atmosphere where it got burned in the skies.

#### 43. Consider the following statements:

1. Small satellites are those with a mass less than 180 kilograms

2. Nanosatellite are those satellite with mass between 1 to 10 nanograms.

### 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: a

#### Explanation:

- Statement 1 is correct: Small satellites are those with a mass less than 180 kilograms and about the size of a large kitchen fridge.
- Statement 2 is incorrect: Nanosatellite" or "nanosat" is applied to an artificial satellite with a wet mass between 1 and 10 kg. A nanogram is one-billionth of a gram.

#### 44. Consider the following statements about Bluetooth technology:

- 1. It relies on short-range radio frequency.
- 2. It allows devices to communicate without cables or wires.
- 3. Attack by hackers on devices using Bluetooth technology is called Phishing.

### How many of the statements given above is/are correct?

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

### Ans (b)

- **Statement 1 is correct:** Bluetooth is a short-range technology that is used for exchanging data between fixed and mobile devices. It is based on short-range radio frequency.
- Statement 2 is correct: It is a wireless technology and allows devices to communicate with each other without cables or wires.
- Statement 3 is incorrect: Bluebugging refers to attacks on devices equipped with Bluetooth technology. Whenever a person's mobile, computers, laptops, tablets, smartphones, smartwatches, air buds, etc., are simplifying communications through Bluetooth, they are also putting one's virtual property at risk via Bluetooth. On the other hand, Phishing is when attackers attempt to trick users into doing 'the wrong thing', such as clicking a bad link that will download malware, or direct them to a dodgy website.

45. In the realm of television technology, in what way is Quantum dots Organic light emitting diode (QD-OLED) television different from Organic light emitting diode (OLED) television?

- (a) QD-OLED is based on zero-dimensional nanotechnology whereas OLED is based on threedimensional nano technology.
- (b) QD-OLED does not use color filters to create primary colors whereas OLED does.
- (c) QD-OLED converts electric energy into light by using minerals, whereas OLED does so by using organic material.
- (d) QD-OLED can be charged with electromagnetic waves, whereas OLED cannot.

#### Ans: b

## Explanation:

In the realm of television technology, both Quantum dots Organic light emitting diode (QD-OLED) and Organic light emitting diode (OLED) are emerging technologies. However, there exist differences between them. QD-OLED uses tiny nanoparticles called quantum dots to supercharge its color, while OLED is not based on nanotechnology. Also, QD-OLED does not use color filters to create primary colors viz. Red, Green and Blue whereas OLED does. This reason accounts for the differences in color brightness, color volume, color accuracy, that exists between QD-OLED and OLED. So, option (b) is correct.

# 46. India has recently signed the Artemis Accords. In this context, consider the following statements:

1. The Artemis Accord has been built upon the foundation of the Outer Space Treaty of 1967 (OST).

2. The accord provides for the exploration of outer space for military purposes.

# Which of the statements given above is/are correct?

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

### Ans (a)

### Explanation:

- Statement 1 is correct: The Artemis Accord has been built upon the foundation of the Outer Space Treaty of 1967 (OST). It constitutes a comprehensive framework of guidelines that aim to govern the exploration and utilization of space in the modern era. India became the 27th country to sign the nonbinding Artemis Accords. This will involve the joint participation of ISRO and NASA in space exploration programs.
- Statement 2 is incorrect: Artemis Accord is a non-binding set of principles designed to guide civil space exploration and use in the 21st century. The Artemis Accord is closely linked to the Artemis Program, which aims to return astronauts to the lunar surface, build a space camp there, and carry out deep space exploration. The upcoming Artemis-III mission by NASA will land the first woman on the Moon.

### 47. Identify the Indian scientist with the help of given information:

- 1. He is best known for his work in solid-state and structural chemistry.
- 2. He is the first Indian to reach the h-index (Hirsch index).
- 3. He is one of three Indian scientists to receive the Bharat Ratna award.

### Select the correct answer using the options given below:

- (a) Har Gobind Khorana
- (b) C.N.R. Rao
- (c) Satyendra Nath Bose
- (d) C.V. Raman

Ans: b

- C.N.R. Rao is best known for his work in solid-state and structural chemistry. C.N.R Rao is the first Indian to reach the H-index (The H-index measures the productivity and impact of the published work of a scientist or scholar) of 100. He has also made immense contributions to nano-materials research besides working on hybrid materials including nanotubes and graphene. On 16 November 2013, the Government of India announced his selection for Bharat Ratna, the highest civilian award in India, making him the third scientist after C.V. Raman and A. P. J. Abdul Kalam to receive the award.
- So option (b) is correct.

48. Oil spills are a significant threat to the marine ecosystem and require immediate removal from the oceanic environment. In what ways can we remove the pollution caused by oil spills in the oceans?

- 1. Using Gelator
- 2. Using Oilzapper
- 3. Using Dry ice

# Select the correct answer using the code given below:

- (a) Only 1 and 2
- (b) Only 2 and 3
- (c) Only 1 and 3
- (d) 1, 2 and 3

# Ans (d)

**Explanation:** 

- Gelator is an inexpensive and efficient way to clean up marine oil spills by using marble-sized balls made of wood pulp. The gelator repels water and only absorbs the oil.
- The absorbed oil could be recovered by applying pressure or through distillation
- Oilzapper is used to get rid of oil from a surface.
- Oil Zapping is a bio-remediation technique involving the use of 'oil zapping' bacteria.
- Dry ice can be used to solidify oil spills. Then this solidified oil is removed from the water. So, option (d) is correct.

# 49. Recently the US Government decided to phase out Compact Fluorescent Lamps (CFLs) by 2025 and slowly replace them with Light Emitting Diodes (LEDs). What are the possible reasons for the same?

1. CFLs require more electricity than LEDs.

- 2. CFLs are based on microchips for light source, while LEDs are based on ionisation of mercury vapour.
- 3. CFLs have a higher carbon footprint in comparison to LEDs.

### Select the correct answer using the code given below:

- (a) 1 Only
- (b) 1 and 3 Only
- (c) 2 Only
- (d) 1, 2 and 3

### Ans: b

- **Statement 1 is correct:** CFLs last much longer than traditional incandescents but still require more electricity than light-emitting diode bulbs, or LEDs.
- **Statement 2 is incorrect:** CFLs are based on ionisation of mercury vapour, whereas LED is based on semiconductors or microchips for light source. There is 4mg or trace amounts of mercury in CFLs that can pose a hazard if the bulbs aren't disposed of properly.

• **Statement 3 is correct:** A carbon footprint is the total amount of greenhouse gases (GHGs) emitted into the atmosphere. Since CFLs use more energy than LEDs they lead to higher carbon footprint than LEDs.

### **50.** Consider the following statements about the 5th-generation mobile network technology:

1. It is a wireless technology that increases the speed and latency in the network.

2. Vidisha district of Madhya Pradesh became the first-ever district in India for on-ground deployment of innovative 5G services.

### Which of the statements given above is/are correct?

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

#### Ans (b)

### Explanation:

• **Statement 1 is incorrect:** 5G is the fifth generation of cellular technology. It is designed to increase speed and reduce latency, thereby improving the flexibility of wireless services.

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- **Statement 2 is correct:** Vidisha, an aspirational district of Madhya Pradesh became the firstever district in India for on-ground deployment of innovative 5G services.
- 5G is much faster and more reliable than the currently popular 4G networks and has the potential to transform the way we use the internet to access applications, social networks, and information.
- 5G is based on OFDM (Orthogonal frequency-division multiplexing)

51. Who amongst the following was a renowned Indian origin biochemist and won the Nobel Prize in Physiology or Medicine for showing how genetic information is translated into proteins?

- (a) Meghnad Saha
- (b) C.N.R. Rao
- (c) Har Gobind Khorana
- (d) Jagadish Chandra Bose

#### Ans: c

#### Explanation

Har Gobind Khorana was a renowned biochemist and won the Nobel Prize (1968) in Physiology
or Medicine for showing how genetic information is translated into proteins, which carry out
the functions of a living cell. So option (c) is the correct answer.

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#### 52. The Thirty-meter telescope (TMT) project is an international partnership between which of the

- following countries?
- 1. India
- 2. Unites State of America
- 3. China
- 4. Japan
- 5. Russia
- 6. United Kingdom

# Select the correct answer using the code given below:

- (a) Only 1, 2 and 4
- (b) Only 1, 2, 3 and 4
- (c) Only 1, 2, 4 and 6
- (d) 1, 2, 3, 4, 5 and 6

Ans (b)

#### Explanation:

- The Thirty-meter telescope (TMT) project is an international partnership between CalTech, the Universities of California (USA), Canada, Japan, China, and India.
- TMT is an international project that aims at building a 30-metre diameter telescope at Mauna Kea, Hawaii, USA.
- The project seeks to advance scientific knowledge while fostering connection among the partner countries and their citizens. So, option (b) is correct.

# 53. Indian government has recently announced National Quantum Mission. In this context, consider the following statements:

1. Quantum computers store information in the form of binary numbers.

2. The main objective of the mission is to build 50-100 physical qubits in 5 years and 50-1000 physical qubits in 8 years.

3. India has become the third country, only after USA and China in the world to have a dedicated quantum mission.

### Which of the statements given above is/are correct?

- (a) Only 1
- (b) Only 2
- (c) Only 2 and 3
- (d) Only 3

#### Ans: b

Explanation

- **Statement 1 is incorrect:** Conventional computers store and process information in bits (0 and 1). However, 'qubits' or 'quantum bits' are the units of information store and process by quantum computers.
- Statement 2 is correct: The National Quantum Mission with a budget of ₹6,003.65 crore over eight years aims to develop 50 to 1,000 qubits of quantum computing hardware, and 2000 km of quantum communications network. In fact, it will target developing intermediate scale quantum computers with 50-100 physical qubits in 5 years and 50-1000 physical qubits in 8 years.
- Statement 3 is incorrect: With the launch of this mission, India has become the seventh country to have a dedicated quantum mission after the US, Austria, Finland, France, Canada and China.

#### 54. Consider the following

- 1. Adoption of Loss and Damage Fund
- 2. First Global Stocktake
- 3. "Land, Life and Legacy" Declaration

Which of the above are the outcomes from the 28th Session of the UN Climate Change Conference (COP 28)?

- (a) Only 1 and 2
- (b) Only 2 and 3
- (c) Only 1 and 3
- (d) 1, 2 and 3

#### Ans (a)

Explanation:

• The 'Loss and Damage' (L&D) fund was first proposed at Sharm el-Sheikh Climate Change Conference (COP 27) and was adopted at COP 28 or 28th Session of the UN Climate Change Conference.

- The fund is a financial mechanism designed to address the irreversible consequences of climate change. The aim is to provide financial assistance to poorer nations.
- The Global Stocktake is a periodic review mechanism established under the Paris Agreement in 2015. The stocktake takes place every five years, with the first-ever stocktake concluded at the UN Climate Change Conference (COP28) at the end of 2023.

The "Land, Life and Legacy" Declaration is part of the 15th Conference of Parties (COP15) of the United Nations Convention to Combat Desertification (UNCCD), which concluded on May 20, 2022, in Abidjan. So, option (a) is correct.

# 55. Which of the following countries are members of the International Thermonuclear Experimental Reactor (ITER)?

- 1. China
- 2. India
- 3. Japan
- 4. Russia
- 5. Australia

# Select the correct answer using the code given below:

- (a) Only 2, 3, 4 and 5
- (b) Only 1, 3, 4 and 5
- (c) Only 1, 2, 3 and 4
- (d) 1, 2, 3, 4 and 5

# Ans (c)

**Explanation:** 

- The International Thermonuclear Experimental Reactor (ITER) is an international nuclear fusion research and engineering megaproject aimed at creating energy through a fusion process similar to that of the Sun.
- The ITER Members are China, the European Union, India, Japan, Korea, Russia, and the United States.
- The primary objective of ITER is the investigation and demonstration of burning plasmas. In this process, the energy of the helium nuclei produced by the fusion reactions is enough to maintain the temperature of the plasma, without the need for external heating. So, option (c) is correct.

### 56. Consider the following statements about Navigation with Indian Constellation (NavIC):

- 1. Its positional accuracy is currently more than USA's Global Positioning System (GPS).
- 2. It is a constellation of seven satellites placed in polar orbits.

3. Not all the smartphones and navigational gadgets available in India are currently compatible with NavIC.

### Which of the statements given above are correct?

- (a) Only 1 and 3
- (b) Only 2 and 3
- (c) 1, 2 and 3
- (d) None of the above

### Ans: a

- Statement 1 is correct: GPS is owned and operated by United States government while NavIC is owned and operated by India. NavIC covers all of Indian subcontinent and offers a positional accuracy of 5 metres which is better compared to 15-20 metres of GPS.
- Statement 2 is incorrect: NavIC is a satellite-based navigation system, developed by Indian Space Research Organization (ISRO). It comprises a constellation of seven satellites orbiting high above in geostationary and geosynchronous orbits.

• Statement 3 is correct: Not all smartphones and navigational gadgets are compatible with NavIC. To use and decode NavIC signals, a navigating gadget should have a NavIC compatible chipset or microchip incorporated inside it. Ministry of Science & Technology and Ministry of Electronics & Information Technology, have recently jointly collaborated with a Hyderabad based firm, - Manjeera Digital Systems Private Limited, to facilitate the designing and commercial production of chips which when installed in mobile phones will make navigation possible through NavIC.

# 57. The Mumbai-Ahmedabad high-speed rail corridor, also known as the bullet train, will function based on which concept of physics?

- (a) Magnus effect
- (b) Gravitational lensing
- (c) Meissner effect
- (d) Coanda effect

# Ans: c

### Explanation

 When certain materials (i.e. metals and ceramic materials) are cooled to temperatures ranging from near absolute zero (0 K, -273°C) to that of liquid nitrogen temperatures (77 K, -196°C), their electrical resistance drops down to zero. The material so formed is called superconductor. Superconductors are diamagnetic materials.

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 When a magnet is placed above a superconductor, this repelling force can be stronger than gravity, allowing the magnet to levitate above the superconductor. Since diamagnetic have a magnetization that opposes any applied magnetic field, the superconductor is repelled or levitate by the magnetic field. This effect is called Meissner effect and technology is called magnetic levitation. So option (c) is correct.

### 58. The terms 'Virgin Galactic', and 'Blue Origin', sometimes seen in the news, are what?

- (a) Space tourism companies
- (b) Exoplanets
- (c) Titanic tourist submersibles
- (d) Newly discovered moons of Jupiter

#### Ans: a

#### Explanation

 "Virgin Galactic" was founded by Sir Richard Branson and "Blue Origin" is backed by Amazon's Jeff Bezos. These are space tourism companies. Space tourism refers to the commercial activity of sending people to space and bring them safely to earth. So, option (a) is correct.

59. Which one of the following types of biotechnologies involves medical processes such as getting organisms to produce new drugs, or using stem cells to regenerate damaged human tissues?

- (a) Red
- (b) Yellow
- (c) Blue
- (d) White
- Ans: a

- The science of biotechnology is broken down into sub disciplines called red, white, green, and blue.
- Red biotechnology involves medical processes such as getting organisms to produce new drugs, or using stem cells to regrow entire organs.
- White biotechnology involves industrial processes such as the production of new chemicals or new fuels for vehicles.

- Green biotechnology applies to agriculture.
- Blue biotechnology encompasses processes in marine and aquatic environments. So, option (a) is correct.

# 60. Recently, India decided to formally join the Square Kilometre Array (SKA) project. In this context, consider the following statements:

1. The project is related to the construction of a single extremely large telescope (ELT) in the Hawaiian Islands in the USA.

2. The SKA cores are being built in the Southern Hemisphere.

#### Which of the statements given above is/are correct?

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

#### Ans (b)

#### **Explanation:**

• Statement 1 is incorrect: The Square Kilometer Array (SKA) project is an intergovernmental international radio telescope project being built in Australia (low-frequency) and South Africa (mid-frequency). The Square Kilometer Array is not a single large telescope, but a collection of thousands of dish antennas operating as a single unit.

BAL

- Statement 2 is correct: The SKA cores are being built in the southern hemisphere. The reason is that the clear view of the Milky Way galaxy least radio interference in the southern hemisphere.
- India has approved Rs 1,250 crore for the project, which includes its funding contribution for the construction phase.

#### 61. Which one of the following statements best describes the term Gravitational Lensing?

- (a) A region of space where gravity is so strong that nothing, including light has enough energy to escape it.
- (b) The effect of gravity from planets or galaxies that bends light coming to earth
- (c) Interaction of plasma with magnetic fields to form space hurricanes
- (d) The energy possessed or acquired by an object due to a change in its position when it is present in a gravitational field.

#### Ans: b

#### Explanation

 Gravitational lensing occurs when a massive celestial body such as planet or galaxy cluster causes a sufficient curvature of spacetime for the path of light around it to be visibly bent, as if by a lens. The body causing the light to curve is accordingly called a gravitational lens. So, option (b) is correct.

62. The Facility for Antiproton and Ion Research (FAIR) is an international accelerator facility under construction for the research of antiprotons and ions. This project is located in which country?

- (a) USA
- (b) China
- (c) Russia
- (d) Germany

## Ans (d)

- The Facility for Antiproton and Ion Research (FAIR) is an international accelerator facility under construction.
- It is being built in Darmstadt, Germany.

- It will use antiprotons and ions to perform research in the fields of nuclear, hadron, and particle physics, atomic and anti-matter physics, and high-density plasma physics.
- At FAIR, a matter that usually only exists in the depth of space will be produced in a lab for research. So, option (d) is correct.

# 63. The famous Starlink project by SpaceX company is apprehended to lead to "Kessler Syndrome". What is "Kessler Syndrome" related to?

- (a) Mass death of marine creatures
- (b) Radiation sickness
- (c) Increase in space debris
- (d) Increase in malware attacks

### Ans: c

# Explanation

 Starlink is the world's first and largest satellite constellation using a low Earth orbit to deliver broadband internet. Currently there are 4,519 Starlink satellites in orbit. The term "Kessler Syndrome" is an orbital debris term that has become popular outside the professional orbital debris. It is a scenario in which the density of objects in low Earth orbit (LEO) is high enough that collisions between objects could cause a cascade i.e each collision generating space debris to further increase the likelihood of collisions. So, option (c) is correct.

# 64. Consider the following statements with reference to CERN's the Large Hadron Collider (LHC):

- 1. It is the world's largest and most powerful particle accelerator.
- 2. It consists of a 27-kilometre ring of superconducting magnets.
- 3. India is an associate member state of CERN.

# How many of the statements given above is/are correct?

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

# Ans (c)

### **Explanation:**

- Statement 1 is correct: The Large Hadron Collider (LHC) is the world's largest and most powerful particle accelerator. It first started up on 10 September 2008 and remains the latest addition to CERN's accelerator complex.
- **Statement 2 is correct:** The LHC consists of a 27-kilometer ring of superconducting magnets with several accelerating structures to boost the energy of the particles along the way.
- Statement 3 is correct: India and CERN signed a Cooperation Agreement in 1991. India ratified CERN in 2016 and became an Associate Member of CERN.

# 65. Millimetre waves is the backbone for the 5G or 5th Generation of the cellular technology. Which Indian scientist is acknowledged for his landmark discoveries related to millimetre waves?

- (a) Subrahmanyan Chandrasekhar
- (b) Meghnad Saha
- (c) C V Raman
- (d) Jagadish Chandra Bose

### Ans: d

### Explanation

• The first science experiment with millimetre waves was conducted by Indian scientist Jagadish Chandra Bose in 1897. He was the first to demonstrate radio communication with millimetre wavelengths falling in the 30GHz to 300GHz spectrum. He generated 5mm electromagnetic waves, 60GHz, before instruments even evolved to measure frequencies that low. The millimetre wave that Jagadish Chandra Bose worked on is the backbone of 5G technology we use today. So, option (d) is correct.

### 66. Consider the following statements about AstroSat:

1. It enables the simultaneous multi-wavelength observations of various astronomical objects with a single satellite.

2. It is the first dedicated Indian Astronomy Mission for studying celestial sources.

#### Which of the statements given above is/are correct?

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

### Ans (c)

**Explanation:** 

 Statement 1 is correct: It allows to study of sources in X-ray, optical, and UV spectral bands simultaneously. The payloads cover the energy bands of Ultraviolet (Near and Far), and limited optical and X-ray regimes. The mission enables the simultaneous multi-wavelength observations of various astronomical objects with a single satellite.

• Statement 2 is correct: AstroSat is the first dedicated Indian astronomy mission for studying celestial sources.

Other Scientific objectives of AstroSat:

- To understand high energy processes in binary star systems containing neutron stars and black holes.
- Estimate magnetic fields of neutron stars.
- Study star birth regions and high energy processes in star systems lying beyond our galaxy. Detect new briefly bright X-ray sources in the sky.
- Perform a limited deep-field survey of the Universe in the Ultraviolet region.

#### 67. Consider the following statements with reference to the Gaganyaan Mission:

- 1. Under this mission, ISRO has planned to send three humans to an orbit of 400 km.
- 2. If successful, India will become the fourth country in the world to do so.

### Which of the statements given above is/are correct?

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

### Ans (c)

#### **Explanation:**

- Statement 1 is correct: Under the Gaganyaan Mission, ISRO has planned to send three humans to an orbit of 400 km for a 3-day mission. This will be India's first Human Space Mission. LVM-3 rocket will be used during the Gaganyaan mission.
- **Statement 2 is correct:** With the accomplishment of this mission, India will become only the fourth country to send a human into space after the Soviet Union, the US, and China.
- Also, Vyommitra is a female-looking spacefaring humanoid robot being developed by the Indian Space Research Organisation to function on board the Gaganyaan.

# 68. Over the past few years, many groups and communities in India have witnessed the debate around birth of designer babies in near future. In this context, consider the following statements:

- 1. Designer babies are babies originated from embryos created by in-vivo fertilization (IVF).
- 2. The process through which designer babies are produced is known as transgenic technology.
- 3. Designer babies' birth can enable dark skinned Indian parents to have fair and high IQ children.

#### Which of the statements given above is/are correct?

- (a) Only 1 and 2
- (b) Only 3
- (c) Only 2 and 3
- (d) 1, 2 and 3

#### Ans: b

#### Explanation

- Statement 1 is incorrect: Designer babies are babies originated from embryos created by invitro fertilization (IVF). In In-Vivo fertilization, the fusion of sperm with egg occurs within the body of a female. Here, the male discharges the sperm into the female genital tract and the development of the embryo happens inside her uterus. In In-Vitro fertilization, mature eggs are collected from ovaries and fertilized by sperm in a lab.
- Statement 2 is incorrect: The process through which designer babies are produced is known as gene editing. Genome editing uses targeted/locus specific manipulation by knocking out or replacing targeted genes, which results in model organisms with intentionally selected and desired traits. Conversely, transgenic technology randomly integrates foreign DNA into the genome of a model organism in order to introduce new traits.
- Statement 3 is correct: Designer babies' birth can enable dark skinned Indian parents to have fair and high IQ children. Gene is the basic unit which carries inheritance information. Modification in the sequence and numbers of nucleotides bases can modify the traits of the individuals as per will. Thus, a designer baby is a Genetically Modified human embryo with appropriate qualities which have been shaped as per the instructions received from the parents. In other words, babies are being nurtured in artificial wombs and engineered through childhood indoctrination programmes into predestined categories based on their intelligence and skills. The best part of this technology is that it can make children free from any life-threatening genetic disease.

### 69. Consider the following statements about SARAL (Satellite with Argos and Altika):

- 1. It is a joint mission of ISRO and NASA.
- 2. It has placed the first radar-imaging weather satellite into polar orbits.

#### Which of the statements given above is/are correct?

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

#### Ans (d)

#### **Explanation:**

- Statement 1 is incorrect: SARAL (Satellite for ALTIKA and ARGOS) is a joint mission of ISRO with France.
- Statement 2 is incorrect: The SARAL (Satellite for ALTIKA and ARGOS) aims at studying ocean from space using altimetry. It is not the first radar imaging weather satellite.
- ALtiKa is the altimeter and prime payload of the SARAL mission. It is the first spaceborne altimeter to operate at Ka-band.
- ARGOS is related to Advanced-Data Collection System from ocean buoys and transmit the same.

# 70. The PM PRANAM scheme by the government aims to reduce the use of chemical fertilizers and promote use of biofertilizers in the country. With reference to this, consider the following statements:

1. Biofertilizers are N, P, K fertilizers in nanometre scale that promote colonization of the rhizosphere and increase the primary nutrient uptake of plants.

- 2. Algal microflora is a true bio-based fertilizer.
- 3. The scheme aims to reduce import and subsidies on chemical fertilizers.

## Which of the statements given above is/ are correct?

- (a) Only 1 and 3
- (b) Only 3
- (c) Only 2 and 3
- (d) 1, 2 and 3

# Ans: c

### Explanation

- **Statement 1 is incorrect:** Biofertilizers contains living microorganisms, which when applied to seed, plant surface, or soil, colonizes the rhizosphere and promotes growth by increasing the supply or availability of primary nutrients to the host plant. Nano fertilizers are in the nanometre scale, and are different from biofertilizers.
- **Statement 2 is correct:** Algal microflora is a true bio-based fertilizer for agricultural techniques that are both environmentally favourable and pollution-free.
- Statement 3 is correct: PM PRANAM stands for PM Promotion of Alternate Nutrients for Agriculture Management Yojana. The main objective of the scheme is to encourage the balanced use of fertilisers in conjunction with bio fertilisers and organic fertilisers. The PM PRANAM scheme focuses on reduced subsidies in states. As per the initiative, states will get 50 percent of that of subsidy savings as a grant. The savings in subsidy will be used on new technology in the fertiliser sector.

# 71. India's first national repository for life science data The Indian Biological Data Centre (IBDC) has been opened in which state?

- (a) Maharashtra
- (b) Haryana
- (c) Himachal Pradesh
- (d) Andhra Pradesh

### Ans: b

### Explanation

India's first national repository for life science data i.e the Indian Biological Data Centre (IBDC) is opened at Faridabad in Haryana. It has been established at Regional Centre of Biotechnology (RCB), Faridabad with a data 'Disaster Recovery' site at National Informatics Centre (NIC). It has a data storage capacity of about 4 petabytes and houses the 'Brahm' High Performance Computing (HPC) facility. The computational infrastructure at IBDC is also made available for researchers interested in performing computational-intensive analysis. So, option (b) is correct.

### 72. Consider the following statements:

1. Virtual reality (VR) refers to a computer-generated environment that is designed to simulate a person's physical presence in a specific environment.

2. Augmented reality (AR) combines real and computer-based scenes to deliver a unified but enhanced view of the world.

### Which of the statements given above is/are correct?

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

### Ans (c)

### Explanation:

• Statement 1 is correct: Augmented reality (AR) is a type of interactive, reality-based display environment that takes the capabilities of computer-generated display, sound, text, and

effects to enhance the user's real-world experience. Thus, Augmented reality combines real and computer-based scenes and images.

- AR works by employing computerized simulation and techniques such as image and speech recognition, animation, head-mounted and hand-held devices, and powered display environments.
- Statement 2 is correct: Virtual reality (VR) refers to computer-generated environments or realities that are designed to simulate a person's physical presence in a specific environment. The environment though is not real yet but feels so. The purpose of VR is to allow a person to experience and manipulate the environment as if it were the real world.

Other differences that exist are:

- AR users can control their presence in the real world; VR users are controlled by the system. VR requires a headset device, but AR can be accessed with a smartphone.
- AR enhances both the virtual and real world while VR only enhances a fictional reality.

# 73. Which of the following Genetically Modified (GM) crops is currently allowed for commercial cultivation in India?

- 1. Cotton
- 2. Maize
- 3. Soybean
- 4. Mustard
- 5. Brinjal
- 6. Canola

### Select the correct answer using the code given below:

- (a) Only 1
- (b) Only 1 and 6
- (c) Only 1, 4 and 5
- (d) 1, 2, 3, 4, 5 and 6

#### Ans: a

#### Explanation

• A total of 16 GM crops are cultivated in various countries out of which corn, soybean, cotton and canola are the four largest acreages. In India, Bt cotton is the only GM crop approved for cultivation. In India, only Cotton is currently commercially cultivated as a GM crop. So, option (a) is correct.

74. On which planet/celestial body, scientists have recently detected phosphine gas, thereby predicting the possibility of life on the same?

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- (a) Mars
- (b) Venus
- (c) Moon
- (d) Makemake
- Ans (b)

#### **Explanation:**

- Scientists have detected phosphine gas in the clouds of Venus. Since phosphine is a molecule associated with biological activity on Earth, the discovery of the same over Venus has led to sparking debate about the possibility of life on the planet.
- Jane Greaves and her team have detected phosphine at deeper level in Venus' atmosphere than before using the James Clark Maxwell Telescope (JCMT) at Mauna Kea Observatory, Hawaii. So, option (b) is correct.

# 75. Sodium-ion battery is considered as an alternative to lithium-ion battery. What is/are advantage(s) of sodium-ion battery over lithium ion?

1. Sodium is cheaper and nearly 500 times more abundant than lithium on earth.

2. Sodium ion battery can perform efficiently in extreme temperatures whereas lithium-ion battery cannot.

### Select the correct answer using the options given below:

- (a) Only 1
- (b) Only 2
- (c) 1 and 2
- (d) Neither 1 nor 2

# Ans: c

## Explanation

- Statement 1 is correct: Sodium is cheaper and more abundant than lithium, making it less susceptible to resource availability issues and to price volatility. Sodium makes up most of the salt in the oceans.
- Statement 2 is correct: Generally, the operating temperature range of lithium-ion batteries is 15°C to 35°C. If the temperature is too high or too low, the battery will deteriorate. However, the sodium ion batteries have the capabilities to function under extreme temperatures. Sodium ion batteries offer a major advantage in cold temperature storage, they perform really well even at such low temperatures as -10°C or -20°C. They also have high-power capabilities, while that of Lithium is scarce. Li-ion batteries, those with layered-oxide cathodes, also require cobalt and nickel; while sodium ion batteries do not.
- Recently, KPIT technologies introduced India's First Sodium-Ion Battery Technology as an alternate to Li-Ion Batteries.

# 76. Consider the following statements about the National Quantum Mission (NQM):

1. India is the seventh country in the world to have a dedicated quantum mission.

2. The PARAM 8000, the first Indian supercomputer, was built under the National Quantum Mission (NQM).

Which of the statements given above is/are correct?

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

### Ans (a)

### Explanation

- Statement 1 is correct: The Union Cabinet, chaired by the Hon'ble Prime Minister recently approved the National Quantum Mission (NQM) at a total cost of Rs.6003.65 crore from 2023-24 to 2030-31. The mission aims to seed, nurture, and scale up scientific and industrial R&D and create a vibrant & and innovative ecosystem in Quantum Technology (QT). With the launch of this mission, India has become the seventh country to have a dedicated quantum mission after the US, Austria, Finland, France, Canada, and China.
- Statement 2 is incorrect: The first Indian supercomputer, the PARAM 8000, was built in 1991, while the National Quantum Mission (NQM) was approved in the year 2023. The mission aims to develop 50 to 1,000 qubits of quantum computing hardware and 2000 km of quantum communications network.

### 77. Consider the following statements:

1. The World's first Artificial Intelligence Safety Summit was held recently in the USA.

2. The world's first graduate research university dedicated to Artificial Intelligence (AI) has been opened in UAE.

### Which of the statements given above is/are correct?

- (a) Only 1
- (b) Only 2

- (c) Both 1 and 2
- (d) Neither 1 nor 2

# Ans (b)

#### Explanation

- Statement 1 is incorrect: The World's first Artificial Intelligence Safety Summit was held recently at Buckingham in the United Kingdom. Union Minister of State for Skill Development & Entrepreneurship and Electronics & IT- Rajeev Chandrasekhar addressed the inaugural plenary session of the 'AI Safety Summit 2023'.
- Statement 2 is correct: The Mohamed bin Zayed University of Artificial Intelligence (MBZUAI) was inaugurated recently in ABU DHABI, UAE. The university offers courses for undergraduate students.

#### 78. Consider the following statements:

1. Machine Learning is the ability to learn without being explicitly programmed.

2. Deep learning involves use of Artificial Neural Network (ANN) for simulation with the human brain's neural structure.

### Which of the statements given above is/are correct?

(a) Only 1

- (b) Only 2
- (c) Both 1 and 2
- (d) Neither 1 nor 2

## Ans (c)

Explanation

- Statement 1 is correct: Machine learning is the ability to learn without being explicitly programmed." It involves the use of algorithms to parse data learn from it, and making a determination or prediction as a result. Deep Learning is a technique for implementing Machine Learning.
- Statement 2 is correct: Artificial Neural Networks (ANNs) are algorithms that are based on the biological structure of the brain. In ANNs, there are 'neurons' which have discrete layers and connections to other "neurons". Each layer picks out a specific feature to learn. Deep Learning is a subfield of Machine Learning that involves the use of these neural networks to model and solve complex problems.

### 79. Which of the following is the main objective of the UNNATI programme being run by ISRO?

- (a) Agricultural biotechnology
- (b) Internet of Things (IoT) solutions
- (c) Nanosatellite technology
- (d) Quantum computing

### Ans: c

Explanation

• UNNATI stands for the UNispace Nanosatellite Assembly & Training by ISRO. The primary objective of the programme is to provide theoretical course on nanosatellite technology. Recently, the third batch of training under the UNNATI programme has been completed. So, option (c) is correct.

### 80. Which of the following best describes the term 'Barracuda', that was in news recently?

- (a) India's first water metro
- (b) India's fastest solar electric boat
- (c) India's first hydrogen-powered train
- (d) India's first indigenous server

Ans: b Explanation

- India has unveiled 'Barracuda,' the nation's fastest solar electric boat, at the Navgathi Yard in Panavally, Alappuzha, Kerala. The Barracuda is a 14-meter-long and 4.4-meter-wide vessel. So, option (b) is correct.
- This cutting-edge vessel, named 'Saur Shakthi,' is a collaborative effort between Mazagon Dock Shipbuilders Ltd and Navalt, an eco-marine tech company. The Barracuda stands as a symbol of efficient and clean energy usage, showcasing India's commitment to a greener maritime future.

#### 81. The sub-atomic particle 'boson' has been named after which Indian personality?

- (a) Jagdish Chandra Bose
- (b) Satyendra Nath Bose
- (c) Pramath Nath Bose
- (d) Subhash Chandra Bose

#### Ans: b

#### Explanation

 Boson is one of the two fundamental classes of subatomic particle, the other being fermions. In a 'quantum' leap in physics, CERN scientists today claimed to have spotted a sub-atomic particle "consistent" with the Higgs boson or 'God particle', believed to be a crucial building block that led to the formation of the universe. The particle was earlier named Boson on the name of great Indian scientist Satyendra Nath Bose. The name later became Higgs Boson from a British scientist Peter Higgs and Bose. The work done by Bose and Albert Einstein, was later carried forward by Higgs. So, option (b) is correct.

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#### 82. Consider the following statements about the Lunar Polar Exploration Mission (LUPEX):

1. It is a planned joint lunar mission by the Indian Space Research Organisation (ISRO) and the Russian Space Agency.

2. The mission aims to send a crew of four astronauts to venture around the Moon.

#### Which of the statements given above is/are correct?

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

#### Ans (d)

Explanation

- Statement 1 is incorrect: The Lunar Polar Exploration Mission (LUPEX)[6] is a planned joint lunar mission by the Indian Space Research Organisation (ISRO) and Japan Aerospace Exploration Agency (JAXA).
- **Statement 2 is incorrect:** The mission aims to send an uncrewed lunar lander and rover to explore the south pole region of the Moon in 2026.
- In this mission, while JAXA aims to provide the launch vehicle and the rover, ISRO would be providing the lander.

#### 83. Which of the following countries have built either global or regional satellite navigation system?

- 1. Japan
- 2. Russia
- 3. India
- 4. Australia
- 5. China
- 6. Israel

Select the correct answer using the code given below:

(a) Only 2 and 5

- (b) Only 2, 3 and 5
- (c) Only 1, 2, 3 and 5
- (d) 1, 2, 3, 4, 5 and 6

# Ans: c

#### Explanation

 As of 2023, four global systems are operational: the United States's Global Positioning System (GPS), Russia's Global Navigation Satellite System (GLONASS), China's BeiDou Navigation Satellite System, and the European Union's Galileo. The Quasi-Zenith Satellite System (QZSS) is a regional navigation satellite system commissioned by the Japanese government. Similarly, India has NavIC as a Regional Navigation Satellite System. Australia and Israel have not built either global or regional navigation satellite systems, as of now. So, option (c) is correct.

#### 84. Consider the following statements:

Assertion (A): All satellites and missiles are launched from east coast of earth and towards the east direction.

**Reason (R):** Earth's revolution around Sun is the main reason for the launch from the east coast. Which one of the following is correct in respect of the above statements?

- (a) Both Assertion and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A).
- (b) Both Assertion and Reason (R) are the true but Reason (R) is not a correct explanation of Assertion (A).
- (c) Assertion is true and Reason (R) is false.
- (d) Assertion is false and Reason (R) is true.

# Ans: c

#### Explanation

- Assertion (A) is True: A launch near the equator towards the east direction provides an initial boost equal to the velocity of Earth surface. Earth's surface velocity is 1600km/hr at equator which provides the initial boost to the missile or rocket.
- Reason (R) is False: This is because it is not the revolution but rotation of the earth along its axis which is the main reason for the launch from the east coast.

# 85. Which state/UT government has recently filed an affidavit in the Supreme Court disallowing the construction of the Indian Neutrino Observatory?

- (a) Maharashtra
- (b) Ladakh
- (c) Kerala
- (d) Tamil Nadu

### Ans (d)

#### Explanation

- The Tamil Nadu government recently filed an affidavit in the Supreme Court thereby disallowing the construction of the proposed Indian Neutrino Observatory in the Theni district.
- The affidavit stated that the neutrino observatory project will affect local biodiversity and tiger species at the Periyar Tiger Reserve and the Mathikettan Shola National Park in the Western Ghats.
- The site falls exactly on the hill slopes of the Western Ghats, which align within it a significant tiger corridor, namely the Mathikettan-Periyar tiger corridor. So, option (d) is correct.

# 86. The Ministry of Mines under the Government of India has recently decided to develop five lithium blocks with an investment of 200 crores. In which country the lithium blocks are being developed?

(a) Brazil

- (b) Chile
- (c) Argentina
- (d) Bolivia

# Ans (c)

# Explanation

- The Lithium Triangle refers to an area in the Andes, straddling Argentina, Bolivia, and Chile, known for its abundant lithium deposits.
- The Ministry of Mines is responsible for the survey and exploration of all minerals, other than natural gases, petroleum and atomic minerals.
- Recently, the Ministry of Mines has decided to develop five lithium blocks in Argentina with an investment of 200 crores.
- So, option (c) is correct.

# 87. Which of the following are the features of the blockchain technology?

- 1. Peer-to-peer Network
- 2. Distributed ledger
- 3. Incorruptible and Immutable
- 4. Low energy consumption

# Select the correct answer using the code given below:

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

# Ans (c)

# Explanation

- Blockchain technology is software for the secure transfer of unique instances of value (e.g. money, property, contracts, and identity credentials) via the Internet without requiring a third-party intermediary such as a bank or government.
- Blockchain is a decentralized or distributed ledger where each node in the network has access to the data or records stored in a blockchain.
- Distributed ledger technology (DLT) is a digital system for recording the transaction of assets. In this, the transactions and their details are recorded in multiple places at the same time. In traditional databases, we have central data store or administration functionality, while in distributed ledgers we do not have any central data store or administration functionality.
- A peer-to-peer (P2P) network is based on the concept of decentralization, which allows the participants to conduct transactions without needing a central server. Blockchain technology is based on peer-to-peer networks.
- Incorruptible and Immutable means unchanging easily. Data cannot be removed once written. A Blockchain-based digital platform cannot be deleted after it has been used. The encryption of all the important data records in the blockchain is done using cryptographic techniques. This ensures the security of the data in the blockchain.
- Blockchain technology involves high energy consumption. The mining of Bitcoin in blockchain alone uses almost 204 TWh of electricity per year, which is comparable to the power consumption of countries like Thailand and Netherland. So, option (c) is correct.

### 88. Which of the following are submarines included under Project 75?

- 1. INS Khanderi
- 2. INS Karanj
- 3. INS Sindhughosh
- 4. INS Sumedha
- 5. INS Vagir

### 6. INS Vagsheer

#### Select the correct answer using the code given below:

- (a) Only 1, 2, 3 and 4
- (b) Only 2, 3, 4 and 5
- (c) Only 1, 2, 5 and 6
- (d) Only 3, 4, 5 and 6

### Ans (c)

### **Explanation:**

- Project 75 is a significant initiative undertaken by the Indian government in collaboration with foreign manufacturers to build advanced submarines for the Indian Navy.
- It is an ambitious submarine acquisition program of the Indian Navy.
- It aims to design and build six advanced conventional submarines
- The six submarines are namely INS Kalvari, INS Khanderi, INS Karanj, INS Vela, INS Vagir and INS Vagsheer. So, option (c) is correct.

### 89. Consider the following statements about Quasicrystals:

- 1. A quasicrystal consists of atoms that are arranged in a pattern that repeats itself regularly.
- 2. Quasicrystals are very good thermal and electrical conductors.
- 3. The world's first natural quasicrystal was found in the USA.

# How many of the statements given above is/are correct?

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

### Ans (d)

#### Explanation

- **Statement 1 is incorrect:** Quasicrystal is essentially a crystal-like substance. However, unlike a crystal, in which atoms are arranged in a repeating pattern, a quasicrystal consists of atoms that are arranged in a pattern that doesn't repeat itself regularly.
- Statement 2 is incorrect: Quasicrystals typically are very poor thermal and electrical conductors.
- Statement 3 is incorrect: The first natural quasicrystal found was as microscopic grains in a fragment of the Khatyrka meteorite lying in the Koryak mountains of Russia.
- The Nobel Prize in Chemistry 2011 was awarded 'for the discovery of quasicrystals to Dan Shechtman of the Israel.
- Quasicrystals have been used in surgical instruments, LED lights and non-stick frying pans. They have poor heat conductivity, which makes them good insulators.

# 90. In which city of India, the country's first Artificial Intelligence & Robotics Technology Park (ARTPARK) was launched recently?

- (a) Mumbai
- (b) Chennai
- (c) New Delhi
- (d) Bengaluru

### Ans (d)

- The country's first Artificial Intelligence & Robotics Technology Park (ARTPARK) was launched recently in Bengaluru, Karnataka.
- The park has the objective of channelizing innovations to create a societal impact by executing ambitious mission-mode R&D projects in healthcare, education, mobility, infrastructure,

agriculture, retail, and cyber-security aiming to solve problems unique to India. So, option (d) is correct.

# 91. 'Quorum sensing', is sometimes talked about with reference to which one of the following?

- (a) Converting crop residues into packing material
- (b) Ability of the specific viral proteins or genomes to protect themselves from any pathogen
- (c) Producing biochar from thermo- chemical conversion of biomass
- (d) Ability of bacterial communication to detect and respond to cell population density by gene regulation.

#### Ans: d

### Explanation

 Quorum sensing is also known as quorum signalling. It is a sensing mechanism of bacteria or bacterial communication ability that controls virulence gene expression. Bacteria use quorum sensing, which is a complex communication, to sense and respond to both members of their own species and that of other species. So, option (d) is correct.

# 92. India-based Neutrino Observatory (INO) is a particle physics research project under construction in which one of the following states/UTs of India?

- (a) Ladakh
- (b) Himachal Pradesh
- (c) Maharashtra
- (d) Tamil Nadu

#### Ans: d

#### **Explanation:**

- India-based Neutrino Observatory (INO) is a particle physics research project under construction to primarily study atmospheric neutrinos in a 1,200 meters deep cave under INO Peak near Theni, Tamil Nadu, India.
- The main experiment proposed at INO is the Iron-Calorimeter Detector which aims to probe the Earth matter effects on the propagation of atmospheric neutrinos and to determine neutrino oscillation parameters in the 2-3 oscillation sector. So, option (d) is correct.

### 93. Consider the following statements about Gravitational Lensing:

1. It occurs when a massive celestial body causes a sufficient curvature of spacetime for the path of light around it to bend.

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2. It was first detected by NASA's James Webb space telescope.

### Which of the statements given above is/are correct?

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

### Ans (a)

### Explanation

- **Statement 1 is correct:** Gravitational lensing occurs when a massive celestial body such as a galaxy cluster causes a sufficient curvature of spacetime for the path of light around it to bend, as if by a lens. The body causing the light to curve is accordingly called a gravitational lens.
- Statement 2 is incorrect: In 1979, gravitational lensing became an observational science when the double quasar Q0957+561 was discovered. This was the first example of a lensed object. NASA's Hubble Space Telescope (HST) discovered the gravitational lens in which the single image of a very distant galaxy has been split into six different images.

### 94. Consider the following statements about "Kilonovas", a term sometimes seen in news:

1. Burst of light created due to the clash of neutron stars is called Kilonova.

2. The Laser Interferometer Gravitational-Wave Observatory (LIGO) detected gravitational waves caused due to kilonova.

### Which of the statements given above is/are correct?

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

Ans (c)

#### Explanation

- Statement 1 is correct: A kilonova (also called a macronova) is a transient astronomical event that occurs in a compact binary system when two neutron stars or a neutron star and a black hole merge. These are considered the most violent and powerful events in the known universe.
- Statement 2 is correct: On 17 August 2017, the Laser Interferometer Gravitational-Wave Observatory (LIGO) and the Virgo Interferometer both detected gravitational waves from the collision between two neutron stars. A kilonova sent light and gravitational waves across the Universe.

# 95. The Giant Magellan Telescope is a 25.4-meter, ground-based, extremely large telescope. It is under construction in which country?

- (a) USA
- (b) China
- (c) Australia
- (d) Chile

#### Ans (d)

#### Explanation

- The Giant Magellan Telescope (Giant Magellan or GMT) is a 25.4-meter, ground-based, extremely large telescope.
- It is under construction at Las Campanas Observatory in Chile's Atacama Desert.
- The Giant Magellan Telescope is expected to have a resolving power 10 times that of the Hubble Space Telescope and four times that of the James Webb Space Telescope. So, option (d) is correct.

#### 96. Recently, Narco analysis test was in news. In this context consider the following statements:

1. Sodium pentothal is a drug which is used in narco analysis test.

2. Sodium pentothal is a fast-acting, short-duration anaesthetic used in larger doses to sedate patients during surgery.

3. Sodium pentothal is also referred to as a "truth serum". How many of the statements given above is/are correct?

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

#### Ans: c

- Statement 1 is correct: In a narco analysis test, the accused is given an injection of sodium pentothal, a substance that neutralizes their imagination and induces a hypnotic or drowsy state.
- **Statement 2 is correct:** Sodium pentothal, also known as sodium thiopental, is a short-acting, fast-acting anesthetic that is used to sedate patients during surgery at higher dosages.

- It is a member of the barbiturate class of medications, which depress the central nervous system.
- **Statement 3 is correct:** The medication is sometimes referred to as a "truth serum" since it is thought to lessen the subject's will to lie.

#### 97. Consider the following statements:

Frankia is a free-living nitrogen-fixers living in soil, but as symbionts, cannot fix atmospheric nitrogen.
 Mycorrhizae are a symbiotic association between algae and plant roots.

## Which of the statement given above is/are correct?

- (a) Only 1
- (b) Only 2
- (c) 1 and 2
- (d) Neither 1 nor 2

#### Ans: d

#### **Explanation:**

• Statement 1 is incorrect: Reduction of nitrogen to ammonia by living organisms is called biological nitrogen fixation. The nitrogen-fixing microbes could be free-living or symbiotic. The microbe, Frankia, produces nitrogen-fixing nodules on the roots of non-leguminous plants (e.g., Alnus). Frankia is free living in soil, but as symbionts, can fix atmospheric nitrogen in plant.

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• Statement 2 is incorrect: Most fungi are heterotrophic and absorb soluble organic matter from dead substrates and hence are called saprophytes. A mycorrhiza is a symbiotic association of a fungus with a root system. The fungus provides minerals and water to the roots, in turn the roots provide sugars and N-containing compounds to the mycorrhizae.

#### 98. Consider the following statements:

- 1. A plasmid is a small, circular, double-stranded RNA molecule.
- 2. Plasmid is capable of Self- replication.
- 3. Plasmid act as vectors to transfer the piece of DNA attached to it
- 4. Many plasmids carry genes that confer antibiotic resistance.

#### How many of the statements given above is/are correct?

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

#### Ans: c

#### **Explanation:**

- **Statement 1 is incorrect:** A plasmid is a small, circular, double-stranded DNA molecule that is distinct from a cell's chromosomal DNA. Plasmids naturally exist in bacterial cells, and they also occur in some eukaryotes.
- Statement 2 is correct: An essential feature of bacterial plasmids is their ability to replicate as autonomous genetic elements in a controlled way within the host.
- **Statement 3 is correct:** The desired piece of DNA is linked with the plasmid DNA. These plasmid DNA act as vectors to transfer the piece of DNA attached to it. A plasmid can be used as vector to deliver an alien piece of DNA into the host organism.
- Statement 4 is correct: Plasmids have a wide range of lengths, from roughly one thousand DNA base pairs to hundreds of thousands of base pairs. Many plasmids carry genes that confer antibiotic resistance on the host cell when the genes are expressed.

#### 99. With reference to National Green Hydrogen Mission, consider the following statements:

1. The Ministry of Science and Technology formulated the guidelines for the implementation of the mission.

2. Fuel cell electric vehicles (FCEVs) run on hydrogen fuel and have no harmful emissions.

3. Green Hydrogen is produced using electrolysis of water with electricity generated by renewable energy.

### How many of the statements given above is/are correct?

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

#### Ans (b)

Explanation:

- **Statement 1 is incorrect:** The Ministry of New and Renewable Energy formulated the guidelines for the implementation of the mission.
- Statement 2 is correct: Fuel cell electric vehicles (FCEVs) run on hydrogen fuel and have no harmful emissions. For heavy duty vehicles with longer trip range, such as buses, trucks and other commercial vehicles, FCEVs are likely to become cost competitive in the coming years.
- Statement 3 is correct: It is produced using electrolysis of water with electricity generated by renewable energy. The carbon intensity ultimately depends on the carbon neutrality of the source of electricity (i.e., the more renewable energy there is in the electricity fuel mix, the "greener" the hydrogen produced).

#### 100. Consider the following pairs:

List I	List II
1. VINBAX	Joint exercise between India, Vietnam and Bangladesh
2. AUSTRAHIND	India and Australia
3. Vajra Prahar	India and United Kingdom Army

#### How many of the pairs given above is/are correct?

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

#### Ans (a)

1.	VINBAX	Vietnam India Bilateral Army Exercise
2.	AUSTRAHIND	India and Australia
3.	Vajra Prahar	Indian Army and US Army Special Forces
4.	AJEYA WARRIOR-23	India and the United Kingdom
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