

Q.1) Which one of the following countries has its own Satellite Navigation System?

- a) Australia
- b) Canada
- c) Israel
- d) Japan

Ans) d

Exp) Option d is the correct answer.

Global navigation satellite system (GNSS) is a general term describing any satellite constellation that provides positioning, navigation, and timing (PNT) services on a global or regional basis.

Quasi-Zenith Satellite System (QZSS) **is a regional GNSS owned by the Government of Japan** and operated by QZS System Service Inc. (QSS). QZSS complements GPS to improve coverage in East Asia and Oceania. Japan declared the official start of QZSS services in 2018 with 4 operational satellites and plans to expand the constellation to 7 satellites by 2023 for autonomous capability.

Source: UPSC CSE Pre 2023

Subject:) Science and Technology

Subtopic:) Space

Q.2) The Giant Metrewave Radio Telescope (GMRT) is essential in understanding the universe. In this context, consider the following statements with regards to GMRT:

- 1. It is located in Maharashtra, India.
- 2. It is the biggest and most sensitive radio interferometer in the world at low frequencies, < 1 GHz.
- 3. It aims to search for and study rapidly rotating pulsars in milky way galaxy.

How many of the statements above are correct?

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

Ans) c

Exp) Option c is the correct answer.

The **Giant Metrewave Radio Telescope (GMRT)** is a **collection of 30 radio telescopes** in Narayangaon, Pune, India that **can fully steer, each with a diameter of 45 meters and observing at meter wavelengths**.

Statement 1 is correct: The **Giant Metrewave Radio Telescope (GMRT)**, situated near Pune in Maharashtra, India, is a **premier facility for radio astronomical research**. It is **utilized to study various celestial phenomena**, including **distant galaxies, pulsars, and quasars**, through radio waves, making significant contributions to our understanding of the universe.

Statement 2 is correct: With thirty antennas, each of diameter 45 meters, spread out over a maximum distance of 25 km, the GMRT is the biggest and most sensitive radio interferometer in the world at low frequencies, < 1 GHz. It is used for scientific observations by astronomers around the world, via competitive selection of observing proposals. It has yielded scientific results after **studying pulsars, supernovae, quasars, galaxies, and more**. The GMRT is **operated by the National Centre for Radio Astrophysics (NCRA)**, which is **part of the Tata Institute of Fundamental Research** in Mumbai.

Statement 3 is correct: Although GMRT is a **very versatile instrument for investigating** a variety of **radio astrophysical problems** ranging from nearby Solar system to the edge of the observable Universe, **two of its most important astrophysical objectives** are -

- 1) To **detect the highly redshifted spectral line of neutral Hydrogen** expected from Proto clusters or protogalaxies before they condensed to form galaxies in the early phase of the Universe.
- 2) To **search for and study rapidly rotating Pulsars** in our galaxy.

Knowledge Base:

- 1) Pulsars are a type of rapidly rotating neutron stars that are essentially embers of dead stars which are present in our galaxy. A pulsar is like a cosmic lighthouse as it emits radio beams that flashes by the Earth regularly akin to a harbour lighthouse.
- 2) There are several signals travelling through spacetime of the Universe. But, the presence of gravitational waves influences the arrival of these signals when detected from Earth. These were caused due to the presence of gravitational waves and due to signal irregularities emerging from pulsars.

Source: <http://www.ncra.tifr.res.in/ncra/research/research-at-ncra-tifr/research-areas/GMRT/GMRT#:~:text=With%20thirty%20antennas%2C%20each%20of,low%20frequencies%2C%20%3C%201%20GHz.>

<https://www.thehindu.com/news/national/other-states/indias-largest-radio-telescope-plays-vital-role-in-detecting-universes-vibrations/article67024093.ece#:~:text=India's%20Giant%20Metrewave%20Radio%20Telescope,observations%2C%20said%20scientists%20on%20Thursday.>

<https://indianexpress.com/article/india/another-eye-in-sky-on-ground-india-is-now-part-of-worlds-largest-radio-telescope-project-9092577/#:~:text=GMRT%20is%20the%20world's%20largest,time%20has%20always%20remained%20oversubscribed.>

<https://indianexpress.com/article/cities/pune/punes-gmrt-first-indian-facility-detect-gravitational-waves-8692416/>

<http://www.ncra.tifr.res.in/ncra/gmrt/about-gmrt/goals-of-gmrt>

Subject:) Science and Technology

Subtopic:) Space

Q.3) In the context of computer technology, the term "Cache" refers to:

- a) a malware designed to steal computer data without the user's knowledge.
- b) a web-based network protocol for establishing secure communication.
- c) a temporary storage mechanism facilitating faster access to data.
- d) an error in the source code that causes the program to produce unexpected results.

Ans) c

Exp) Option c is the correct answer

Option a is incorrect: Malware, or malicious software, is any program or file that is intentionally harmful to a computer, network or server. Types of malwares include computer viruses, worms, Trojan horses, ransomware and spyware.

Option b is incorrect: Transport Layer Security (TLS) is a cryptographic protocol that establishes secure communication over a network. TLS is used in applications such as email, instant messaging, and voice-over IP. It's also used to secure HTTPS.

Option c is correct: Cache is a temporary storage space that apps use to store data that they need to access quickly. At its core, cache memory is a form of random-access memory (RAM) that stores recently accessed data for quick retrieval. It sits between the main RAM and the CPU, acting as an intermediary for faster data access.

Option d is incorrect: A computer bug is an error in the source code that causes the program to produce unexpected results.

Source: <https://timesofindia.indiatimes.com/gadgets-news/how-to-clear-cache-on-your-android-phone-and-why-it-is-important/articleshow/105217612.cms>

<https://www.lenovo.com/us/en/glossary/what-is-cache-memory/?orgRef=https%253A%252F%252Fwww.google.com%252F>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.4) Polar orbit and geostationary orbit are two distinct types of orbits used in satellite systems, each with its own advantages and applications. In this context, consider the following statements:

1. Satellites in Polar orbits are usually placed at an altitude of around 3000 km whereas in geostationary orbits they are placed at an altitude of around 22,236 km.
2. Unlike the orbit of polar satellites, the orbit of geostationary satellite lies in the plane of Earth's equator.
3. Among Indian satellites, Cartosat3 is placed in polar orbit whereas GSAT 17 is placed in Geostationary orbit

How many of the above statements are correct?

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

Ans) b

Exp) Option b is the correct answer.

An artificial satellite is any man-made object that has been placed in one of several predetermined orbits around the Earth.

Statement 1 is incorrect: Polar orbits are a type of low Earth orbit, as they are at low altitudes between 200 to 1000 km. Geostationary satellites are placed at an altitude of approximately 36,000 km above the Earth's surface in high Earth orbit.

Statement 2 is correct: While polar orbits have an inclination of about 90 degrees to the equator, geostationary orbits match the rotation of the Earth. Geostationary orbits fall in the same category as geosynchronous orbits but with that one special quality of being parked over the equator.

Statement 3 is correct: Cartosat-3 satellite is a third-generation agile advanced satellite having high resolution imaging capability placed at sun synchronous polar orbit whereas GSAT 17 Communication Satellite is placed at Geo stationary orbit.

Knowledge Base: Polar satellites travelling at a speed of approximately 7.5 km per second. However, in order to perfectly match Earth's rotation, the speed of GEO satellites should be about 3 km per second at an altitude of 35 786 km

Source: <https://gisgeography.com/polar-orbit-sun-synchronous-orbit/>

https://www.esa.int/Enabling_Support/Space_Transportation/Types_of_orbits

<https://www.isro.gov.in/EarthObservationSatellites.html>

Subject:) Science and Technology

Subtopic:) Space

Q.5) With reference to Kanaklata Barua, consider the following statements:

1. She was a freedom fighter from the state of Assam.
2. She was a part of group named as Mrityu Bahini.

Which of the statements given above is/are correct?

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

Ans) c

Exp) Option c is the correct answer

Both Statements 1 and 2 are correct: Kanaklata Barua belonged to state of Assam. She was one of the youngest martyrs of the Quit India Movement. At the age of 17 she **became the leader of a group of freedom fighters known as the "Mrityu Bahini"**.

Source: Forum IAS quarterly current affairs magazine for prelims, July–September2023, Page- 62

Subject:) Current Affairs

Subtopic:) Kanaklata Barua

Q.6) In the context of "Generative AI", consider the following activities:

1. Translation of text from one language to another
2. Creation of images from the text.
3. Medical diagnosis of diseases.
4. Creation of brand messaging and logo
5. Generation of new sound effects
6. Real-time analysis of soil conditions in farmland

With the present state of development 'Generative AI' can perform how many of the above activities?

- a) Only three
- b) Only four
- c) Only five
- d) All six

Ans) d

Exp) Option d is the correct answer.

Generative AI is a cutting-edge technological advancement that utilizes machine learning and artificial intelligence to create new forms of media, such as text, audio, video, and animation.

Statement 1 is correct: Generative AI can be used to write news articles, poetry, and even scripts. It can also be used to translate text from one language to another.

Statements 2 is correct: Generative AI can quickly iterate different text by simply tweaking the prompt to effectively communicate with the audience. DALL.E, a generative image generation service, can also generate original imagery to align with the branding

Statement 3 is correct: It can also help health professionals with their medical diagnosis. AI can generate potential and alternative treatments personalized to patients' symptoms and medical history. For instance, DeepMind AlphaFold can predict the shape of the protein.

Statement 4 is correct: Generative AI can craft sales, marketing, and brand messaging. Agencies can generate personalized social media posts, blogs, and marketing text and video copies by providing a text prompt to a Generative AI service, like ChatGPT.

Statement 5 is correct: Generative AI can generate new music tracks, sound effects, and even voice-acting/voice copying.

Statement 6 is correct: Generative AI can greatly improve the accuracy of farming techniques. Analyzing vast and diverse data sets can provide farmers with real-time insights into their soil conditions, weather forecasts/patterns, and crop-specific recommendations.

Source: <https://www.weforum.org/agenda/2023/02/generative-ai-explain-algorithms-work/>
<https://www.thehindubusinessline.com/economy/agri-business/generative-ai-is-the-magic-pill-for-indias-agri-woes/article67573451.ece>

<https://www.thehindu.com/sci-tech/technology/the-potential-of-generative-ai-creating-media-with-simple-text-prompts/article66354444.ece>

Subject:) Science and Technology

Subtopic:) Robotics and Other Modern Technologies

Q.7) Small Satellite Launch Vehicle (SSLV) is developed by ISRO to cater to the demand of launch of small satellites. In this context consider the following statements:

1. It is a three stage Launch Vehicle which uses solid as well as liquid fuels.
2. It can launch payloads up to 500 kg in 500 km planar orbit.
3. It has high turnaround time, along with heavy launch infrastructure requirements.

How many of the statements given above are correct?

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

Ans) b

Exp) Option b is the correct answer.

SSLV is the **new small satellite launch vehicle** developed by ISRO to cater to the demand of **launch of small satellites** to **Low Earth Orbits** on 'launch-on-demand' basis. **Recently**, the Small Satellite Launch Vehicle (SSLV) successfully **launched three satellites** into their intended orbits.

Statement 1 is correct: Small Satellite Launch Vehicle (SSLV) is a **3 stage Launch Vehicle** configured with **three Solid Propulsion Stages** and **liquid propulsion-based Velocity Trimming Module (VTM)** as a **terminal stage**.

Statement 2 is correct: SSLV is **two meters in diameter** and **thirty-four meter in length** with lift off weight of ~120 tones. SSLV is **capable of launching ~500kg satellites in 500km orbit**. SSLV can launch **Mini, Micro, or Nanosatellites** (10 to 500 kg mass).

Statement 3 is incorrect: The **key features** of SSLV are **Low cost**, with **low turn-around time**, **flexibility in accommodating multiple satellites**, **launch on demand feasibility**, **minimal launch infrastructure requirements**, etc.

Knowledge Base:

- 1) With successful launch of SSLV, India has got a new launch vehicle which was aimed to commercialize the small satellite launches through Industry on demand basis. ISRO looks forward to catering to the increasing global need to launch smaller satellites into Space.
- 2) The Indian Space Research Organization (ISRO) will soon transfer its Small Satellite Launch Vehicle (SSLV) to the private sector, after conducting two development flights of the rocket that seeks to provide on-demand services to put satellites weighing up to 500 kg in a low-earth orbit.

Source:

<https://indianexpress.com/article/explained/explained-sci-tech/india-sslv-rocket-launch-isro-explained-8075712/>

[https://www.isro.gov.in/sslv_CON.html#:~:text=Small%20Satellite%20Launch%20Vehicle%20\(SSLV,List%20of%20SSLV%20Launches](https://www.isro.gov.in/sslv_CON.html#:~:text=Small%20Satellite%20Launch%20Vehicle%20(SSLV,List%20of%20SSLV%20Launches)

https://www.isro.gov.in/SSLV_D2_Mission_successful.html#:~:text=SSLV%20is%20the%20new%20small,t%20and%204.5%20t%20respectively.

<https://www.thehindu.com/sci-tech/science/isro-to-transfer-sslv-to-private-sector/article67060814.ece>

Subject:) Science and Technology

Subtopic:) Space

Q.8) Consider the following statements with reference to the Standard Model of Physics:

1. The model successfully integrates quantum gravity with the other three fundamental forces i.e. electromagnetic and weak & strong nuclear forces.
2. The model does not account for the phenomena of dark matter and dark energy in the universe.
3. The Higgs boson particle is a prediction of the Standard Model, and it imparts mass to other particles through the Higgs mechanism.

How many of the statements given above are correct?

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

Ans) b

Exp) Option b is the correct answer.

The **Standard Model of Particle Physics** is considered to be the **best theory** to **describe the most basic building blocks** of the universe in present times. It explains how particles called **quarks** (which **make up protons and neutrons**) and **leptons** (which **include electrons**) make up **all known matter**.

Statement 1 is incorrect: The **Standard Model does not integrate Quantum gravity** with the **other three fundamental forces** (electromagnetic, weak, and strong nuclear forces). **quantum theory of gravity is not yet part of the Standard Model**, highlighting one of the model's significant limitations.

Statement 2 is correct: The **Standard Model does not account for dark matter and dark energy**. These **components**, which **make up close to 95% of the universe's total mass-energy content**, remain some of the biggest mysteries in physics today. The search for a theory that includes these phenomena is ongoing in the field of theoretical physics.

Statement 3 is correct: The **discovery of the Higgs boson** at the **Large Hadron Collider in 2012** was a **monumental achievement** that confirmed the **existence of the Higgs field** and mechanism. Through this **mechanism, particles acquire mass by interacting with the Higgs field**, a concept that is central to the Standard Model.

Knowledge Base:

- 1) The complete Standard Model took a long time to build. Physicist J.J. Thomson discovered the electron in 1897, and scientists at the Large Hadron Collider found the final piece of the puzzle, the Higgs boson, in 2012.
- 2) The Higgs boson, as proposed within the Standard Model, is the simplest manifestation of the Brout-Englert-Higgs mechanism. In 2013, the Nobel prize in physics was awarded jointly to François Englert and Peter Higgs for this discovery.
- 3) The search for a "Theory of Everything" that can unify the Standard Model with General Relativity and explain dark matter and dark energy is one of the most significant challenges in modern physics.

Source: <https://www.energy.gov/science/doe-explainsthe-standard-model-particle-physics>

<https://home.cern/science/physics/standard-model>

<https://www.space.com/standard-model-physics>

Subject:) Science and Technology

Subtopic:) Space

Q.9) Consider the following pairs:

Objects in space	Description
1. Quasars	Super-bright cores of distant galaxies powered by supermassive black holes.
2. Magnetar	Neutron stars that are formed when massive stars run out of fuel and collapse.
3. Kilonova	Short-lived, powerful explosion from the merger of neutron stars.

How many of the above pairs are correctly matched?

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

Ans) b

Exp) Option b is the correct answer.

Astronomical events are **celestial body events** such as **planetary collisions** or **merger of black holes**, studied by the scientific discipline of **astronomy**. Here, celestial objects are natural objects located outside of the Earth's atmosphere.

Pair 1 is correct: Quasars are the **bright cores** of **active galaxies**. They are a **subclass of active galactic nuclei** (AGNs). Quasars are among the **most luminous, powerful, and energetic objects** in the universe. They typically **emit thousands of times lighter than the entire Milky Way**.

Pair 2 is incorrect: Magnetars are a **type of neutron star**, and they have a **magnetic field** that is about a **trillion times stronger than Earth's**. This strong magnetic field powers the **emission of high-energy electromagnetic radiation**, such as gamma rays and X-rays. They are **formed when a star with a mass of 10–25 times that of the Sun collapses into a neutron star**. Whereas neutron stars formed when massive stars run out of fuel and collapse are known as Pulsars.

Pair 3 is correct: A kilonova is a **powerful astronomical event** that occurs when **two neutron stars** or a **neutron star and a black hole collide and merge**. The **collision ejects** a large amount of **material** which starts to **form heavy elements**, including gold, platinum, and uranium. **Kilonovas** is considered as one of the **most violent and powerful events** in the **known universe**.

Source:

<https://esahubble.org/wordbank/quasar/#:~:text=Quasars%20are%20a%20subclass%20of,across%20the%20entire%20electromagnetic%20spectrum.>

<https://www.space.com/what-are-kilonovas>

<https://www.theweek.in/news/sci-tech/2023/11/06/what-is-a-kilonova-explosion-that-could-end-all-life-on-earth.html>

<https://indianexpress.com/article/technology/science/neutron-star-collisions-earth-gold-9086046/>

<https://www.space.com/earth-kilonova-neutron-star-collision-threat-assessment>

Subject:) Science and Technology

Subtopic:) Space

Q.10) Which among the following best describes the term "Software 2.0"?

- a) It is a software system with decentralized control, allowing multiple users to manage and interact with it.
- b) It is the process of connecting physical devices through computer software to enable communication between them.
- c) It is an interactive experience that enhances the real world with computer-generated perceptual information.
- d) It is a method of development and upgradation of software programming using machine learning techniques without human intervention.

Ans) d

Exp) Option d is the correct answer

Statement a is incorrect: It is Web 3 that is meant to be decentralized, open to everyone (with a bottom-up design) and built on top of blockchain technologies.

Statement b is incorrect: The Internet of Things (IoT) is a network of physical devices that can connect and exchange data with other devices and systems over the Internet.

Statement c is incorrect: Augmented reality is an interactive experience that enhances the real world with computer-generated perceptual information

Statement d is correct: Software 2.0 is an expression employed to designate programming that uses Machine Learning algorithms and neural networks to build autonomous systems that can study data and upgrade their operation without human input. **Software 1.0 is characterized as rule-driven software, which is written by programmers using specific instructions whereas Software 2.0 is based on deep learning, where the developer will merely gather data to feed ML systems.**

Source: <https://www.forbes.com/sites/forbestechcouncil/2023/04/20/what-the-potential-of-software-20-means-for-tech-leaders/?sh=106388f45131>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.11) Consider the following technologies:

1. Closed-circuit Television
2. Radio Frequency Identification
3. Wireless Local Area Network

Which of the above are considered Short-Range devices/technologies?

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

Ans) d

Exp) Option d is the correct answer.

Short Range Devices (SRD) are radio devices that offer a low risk of interference with other radio services, usually because their transmitted power, and hence their range, is low. The definition 'Short Range Device' may be applied to many different types of wireless equipment, including various forms of:

- 1) Access control (including door and gate openers)
- 2) Alarms and movement detectors
- 3) **Closed-circuit television (CCTV)**
- 4) Cordless audio devices, including wireless microphones
- 5) Industrial control
- 6) **Local Area Networks**
- 7) Medical implants
- 8) Metering devices
- 9) Remote control
- 10) **Radio frequency identification (RFID)**
- 11) Road Transport Telematics
- 12) Telemetry.

Source: UPSC CSE Pre 2022

Subject:) Science and Technology

Subtopic:) Robotics and Other Modern Technologies

Q.12) With reference to 'Virtual Private Network (VPN)', consider the following statements:

1. It provides protection from all malware attacks.
2. It enables high internet speed.
3. It protects against third-party tracking.
4. It enables work from home.
5. It secures data by coding and hiding browsing history.

How many of the above are advantages of Virtual Private Network (VPN)?

- a) Only two
- b) Only three
- c) Only four
- d) All five

Ans) b

Exp) Option b is the correct answer.

A **Virtual Private Network (VPN)** is a secure and encrypted connection that allows users to access the internet privately and securely. By routing internet traffic through a VPN server, it hides IP addresses and encrypts data, ensuring privacy and anonymity online. VPNs are essential for safeguarding online activities, bypassing geo-restrictions, and protecting sensitive information on public Wi-Fi networks.

Option 1 is incorrect: While VPNs can encrypt internet traffic and provide a secure connection, their primary function is not specifically to protect against all malware attacks. **A VPN can protect from some viruses and malware infections, but it cannot protect from all.** Thus, this option is incorrect.

Option 2 is incorrect: VPNs utilise an encryption process to secure data, which can **significantly reduce internet speeds**. When a VPN is activated, data undergoes encryption before transmission over the internet. Although this encryption is vital for safeguarding privacy and ensuring data security, it **introduces extra steps in the transmission process, potentially leading to slower data transfer speeds**.

Option 3 is correct: **VPN Protects against Internet service providers (ISPs) and third-party tracking.** This is a key advantage of VPNs. By encrypting internet traffic and masking IP addresses, VPNs protect online privacy by preventing ISPs and third parties from tracking browsing habits and accessing data.

Option 4 is correct: **VPN enables remote working or work from home.** VPNs play a crucial role in enabling remote work. VPN's **allow employees to securely access their company's network and resources from anywhere**, ensuring data confidentiality and maintaining network security.

Option 5 is correct: **Secures data by coding and hiding browsing history-** A VPN **encrypts data**, rendering it unreadable without an encryption key, and conceals browsing activity, **ensuring privacy and security online**. This encryption and masking of IP addresses help protect sensitive information and prevent unauthorised access to user activities.

Source: <https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-vpn>
<https://www.forbes.com/advisor/in/business/software/does-vpn-slow-down-internet/>
<https://indianexpress.com/article/explained/explained-why-vpn-providers-believe-new-rules-will-undermine-users-privacy-7905586/>

Q.13) With reference to Gaganyaan Mission, consider the following statements:

1. It is India's first mission of its kind to launch a habitable space capsule with crew members at the height of 4000km.
2. In this mission a three-stage rocket with solid-liquid-cryogenic stages will be used.
3. The mission will make India as the third nation in the world to launch a Human Spaceflight.

How many of the statements given above are correct:

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

Ans) a

Exp) Option a is the correct answer:

Statement 1 is incorrect: Gaganyaan is the first mission of its kind for India that involves the launch of a habitable space capsule with 3 crew members to an orbit of 400 km (250 miles) and to return via a landing in the Indian Ocean.

Statement 2 is correct: The Launch Vehicle Mark-3(LVM-3) is the launch vehicle of Gaganyaan mission. It is a well proven and reliable heavy lift launcher of ISRO. It consists of three stages such as a) solid stage, b) liquid stage and c) cryogenic stage.

Statement 3 is incorrect: With launch of Gaganyaan mission, India aims to become the world's fourth (not third) country to send a crewed mission into space. So far only three nations (Soviet Union/Russia, U.S., China) have launched their own crewed spacecraft to the space.

Source: <https://www.thehindu.com/sci-tech/science/what-will-gaganyaan-change-for-india-explained/article67908278.ece#:~:text=What%20is%20Gaganyaan%3F,onboard%20an%20Indian%20launch%20vehicle.>

Subject:) Science and Technology

Subtopic:) Space

Q.14) With reference to GPS Aided GEO Augmented Navigation (GAGAN) System, consider the following statements:

1. It is a satellite-based augmentation system jointly developed by Indian Space Research Organization and Defense Research & Development Organization.
 2. It can provide the seamless navigation service to the areas beyond Indian subcontinent.
 3. It is expected to offer better accuracy and integrity of navigation service than with GPS alone.
- How many of the statements given above are correct?

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

Ans) b

Exp) Option b is the correct answer

Statement 1 is incorrect: GPS Aided GEO Augmented Navigation (GAGAN) is a step by the Indian Government towards initial **Satellite-based Navigation Services** in India jointly developed by **Airports Authority of India (AAI) and Indian Space Research Organization (ISRO)**.

Statement 2 is correct: GAGAN covers the area from Africa to Australia and has expansion capability for seamless navigation services across the region.

Statement 3 is correct: It is expected to offer better accuracy and integrity of navigation service than with GPS alone by providing correction terms to the GPS signals. This is achieved by modelling a Near Real Time Grid Based Ionospheric Delay Model for correcting propagation delay.

Source: <https://economictimes.indiatimes.com/definition/gagan>

<https://nopr.niscpr.res.in/handle/123456789/2899>

Subject:) Science and Technology

Subtopic:) Space

Q.15) With reference to Flex Fuel Vehicles (FFV), consider the following statements:

1. It has an internal combustion engine designed to run on more than one fuel.
2. Electric FFV has dual benefit of higher ethanol use and much higher fuel efficiency.
3. It's cost of ownership is cheaper compared to regular vehicles.

How many of the above statements are correct?

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

Ans) b

Exp) Option b is correct answer.

Statement 1 is correct: Flex fuel Vehicles have internal combustion engines designed to run on more than one fuel.

Statement 2 is correct: An Electrified FFV has both a flex fuel engine and an electric powertrain. This gives it the ability to provide dual benefit of higher ethanol use and much higher fuel efficiency.

Statement 3 is incorrect: The cost of ownership and operation of FFVs is very high compared with regular vehicles.

Source: Forum IAS quarterly current affairs magazine for prelims, July-September2023, Page- 42-43

Subject:) Current Affairs

Subtopic:) Flex Fuel Vehicles

Q.16) In the context of Study of Universe, Schwarzschild radius is closely associated with:

- a) Heliosphere
- b) Event horizon
- c) Interstellar space
- d) Rings of Saturn

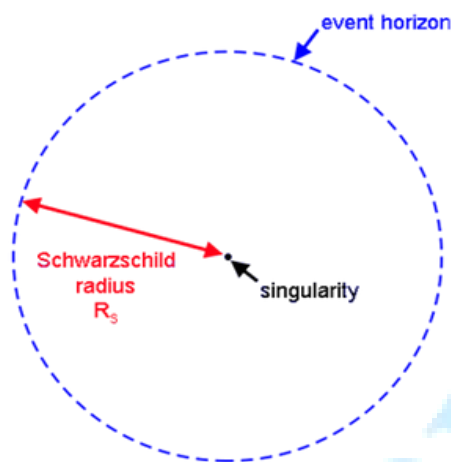
Ans) b

Exp) Option b is the correct answer

The radius at which a mass has an escape velocity equal to the speed of light is called the Schwarzschild radius.

Option a is incorrect: The heliosphere is a region of space surrounding the Sun, extending far beyond the orbit of Pluto and encompassing the solar system. It is created by the Sun's solar wind, a continuous outflow of charged particles (mainly electrons and protons) that stream outwards in all directions.

Option b is correct: The event horizon is the "point of no return", around the black hole. It is a spherical mark surrounding the black hole where the escape velocity is equal to the speed of light. The radius of the sphere is known as the Schwarzschild radius.



Option c is incorrect: Interstellar space is the area between stars and is made up of matter and radiation.

Option d is incorrect: Saturn's rings are the most complex ring system in the solar system, made up of billions of small particles of water ice and rocky material that orbit Saturn. The rings are about 30 feet thick.

Source: https://imagine.gsfc.nasa.gov/science/objects/black_holes1.html

Subject:) Science and Technology

Subtopic:) Space

Q.17) In the context of cloud computing and edge computing, consider the following statements:

1. Cloud computing involves data processing in remote data centers, while edge computing processes data closer to the source of the data.
2. Unlike cloud computing, edge computing can operate without access to the internet.
3. Cloud computing facilitates real time data processing with lower latency compared to edge computing.

How many of the statements given above are correct?

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

Ans) b

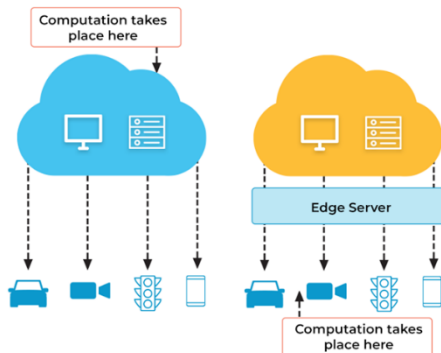
Exp) Option b is the correct answer

Statement 1 is correct: The primary difference between edge computing and cloud computing lies in where data processing occurs. In Cloud computing, the data is processed in remote servers hosted on the Internet whereas edge computing enables data to be analyzed, processed, and transferred at the edge of a network closer to the device.

Statement 2 is correct: Key advantage of edge computing is its ability to operate without access to the internet as it often relies on LAN connectivity to transmit and process information. However, cloud computing needs a strong and stable internet connection on both the server-side and the client-side to operate reliably.

Statement 3 is incorrect: Edge computing with local analysis of data provides real time data processing with lower latency compared to Cloud computing.

CLOUD COMPUTING VS. EDGE COMPUTING



Source: <https://indianexpress.com/article/explained/from-the-cloud-computing-moves-to-the-edge-6093733/>, <https://www.spiceworks.com/tech/cloud/articles/edge-vs-cloud-computing/>

Subject:) Science and Technology

Subtopic:) Robotics and Other Modern Technologies

Q.18) Consider the following statements regarding Aditya L1:

1. It provides a smooth Sun-spacecraft velocity change throughout the orbit.
2. It is placed outside of the magnetosphere of Earth, thus suitable for the "in situ" sampling of the solar wind and particles.
3. It allows unobstructed, continuous observation of the Sun.

How many of the above are the reasons for placing "Aditya L1", India's first solar mission in a halo orbit at the Lagrange point (L1) of the Sun-Earth system?

How many of the statements given above are correct?

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

Ans) c

Exp) Option c is the correct answer.

statement 1, 2 and 3 are correct: The Aditya-L1 mission is an Indian solar observatory at Lagrangian point L1 for "Observing and understanding the chromospheric and coronal dynamics of the Sun" in a continuous manner. Placing the Aditya-L1 in a halo orbit around L1 point has advantages as compared to placing in a Low Earth Orbit (LEO):

- 1) It provides a smooth Sun-spacecraft velocity change throughout the orbit, appropriate for helioseismology.
- 2) It is outside of the magnetosphere of Earth, thus suitable for the "in situ" sampling of the solar wind and particles.

- 3) It allows unobstructed, continuous observation of the Sun, and view of earth for enabling continuous communication to ground stations.

Source: <https://www.isro.gov.in/halo-orbit-insertion-aditya-11.html#:~:text=Placing%20the%20Aditya%20DL1%20in,the%20orbit%2C%20appropriate%20for%20helioseismology.>

Subject:) Science and Technology

Subtopic:) Space

Q.19) Consider the following pairs:

Cyber Threat	Description
1. Trojan	Malware that is disguised as legitimate software.
2. Rootkits	Networks of malware infected computers used to perform tasks online without the user's permission.
3. Key logger	Malicious software that logs and captures keystrokes on the system.
4. Botnet	Malware designed to conceal its own presence and activities on a compromised system.

How many of the above pairs are correctly matched?

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

Ans) b

Exp) Option b is the correct answer.

A cybersecurity threat refers to any malicious activity or potential danger that seeks to compromise the confidentiality, integrity, or availability of computer systems, networks, or data.

Pair 1 is correct. Trojans are malicious software programs that appear to be legitimate applications but actually perform unauthorized actions when executed. They can create backdoors for attackers, steal sensitive information, or harm the system by deleting files or disrupting functionality.

Pair 2 is incorrect. Rootkits are stealthy malware designed to conceal their own presence and activities on a compromised system. These Rootkits malware often grants unauthorized access and control to an attacker, allowing them to execute malicious actions while evading detection by security software.

Pair 3 is correct. Keyloggers are software or hardware devices that surreptitiously capture keystrokes made by a user on their keyboard. They can be used to steal passwords, credit card numbers, and other sensitive information typed by the user, posing a significant threat to privacy and security.

Pair 4 is incorrect. A botnet is a network of compromised computers, often referred to as "bots" or "zombies," that are controlled remotely by a single entity, typically a cybercriminal or hacker. Botnets are commonly used to launch distributed denial-of-service (DDoS) attacks, send spam emails, or carry out other malicious activities without the knowledge of the compromised computer owners.

Source: <https://niccs.cisa.gov/cybersecurity-career-resources/vocabulary>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.20) With reference to Radiation Belts, consider the following statements.

1. It is the region of highly charged and energetic particles found within a planet's magnetosphere.
2. The formation of radiation belts is a unique feature restricted to the Earth in our solar system.
3. The radiation belt is more intense over the equator compared to the polar region of the earth.
4. These belts protect the satellites in the Earth's low earth orbit from solar winds.

How many of the above statements are correct?

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

Ans) b

Exp) Option b is the correct answer

Van Allen radiation belt, doughnut-shaped zones of highly energetic charged particles trapped at high altitudes in the magnetic field of Earth.

Statement 1 is correct: A radiation belt refers to a layer of charged and energetic particles which is held by the planet's magnetic field around the planet. These belts are found in the inner part of the Earth's magnetosphere.

Statement 2 is incorrect: The Van Allen belt specifically refers to the radiation belts around the Earth. However, Planets like Jupiter and Saturn have similar belts. The Sun itself has only temporary radiation belts because it lacks a global dipole field.

Statement 3 is correct: The Van Allen radiation belts are most intense over the equator and are essentially absent above the poles. It is due to the shape and orientation of the Earth's magnetic field. The Earth's magnetic field is not perfectly aligned with its rotational axis; instead, it is slightly tilted. This tilt causes the magnetic field lines to be closer to the Earth's surface at the magnetic equator and farther away at the magnetic poles.

Statement 4 is incorrect: The radiation belt can be a danger to satellites that spend considerable time in the radiation belt. So, the delicate parts should be protected from radiation with the help of adequate shielding.

Source: <https://economictimes.indiatimes.com/definition/van-allen-radiation-belts>

Subject:) Science and Technology

Subtopic:) Space

Q.21) For the measurement/estimation of which of the following are satellite images/remote sensing data used?

1. Chlorophyll content in the vegetation of a specific location
2. Greenhouse gas emissions from rice paddies of a specific location
3. Land surface temperatures of a specific location

Select the correct answer using the code given below.

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

Ans) d

Exp) Option d is the correct answer.

Satellite-based remote sensing is invaluable for environmental assessments and resource management:

- 1) **Chlorophyll Content Estimation:** Satellite imagery and remote sensing enable the measurement of chlorophyll content in vegetation at specific locations. Chlorophyll is essential for photosynthesis and affects how plants reflect green and near-infrared light. **The Normalized Difference**

Vegetation Index (NDVI), derived from satellite data, quantifies vegetation health by analyzing these reflectance patterns. This information aids in monitoring agriculture, assessing environmental well-being, and studying ecosystems.

- 2) **Greenhouse Gas Emissions Assessment:** Satellites play a crucial role in estimating greenhouse gas (GHG) emissions, including those from rice paddies in specific areas. They **measure tropospheric concentrations of carbon dioxide (CO₂) and methane (CH₄) by analyzing reflected sunlight in specific wavelength bands**. This data helps assess GHG emissions, identify emission sources, and evaluate environmental impacts.
- 3) **Land Surface Temperature Mapping:** Satellite imagery and remote sensing techniques are widely employed to map land surface temperatures in particular regions. These technologies **capture thermal infrared radiation emitted by the Earth's surface, allowing the creation of temperature maps**. Such data is valuable for applications like weather forecasting, urban planning, agriculture, and environmental monitoring, enhancing our understanding of temperature-related phenomena and their implications.

Source: UPSC CSE Pre 2019

Subject:) Science and Technology

Subtopic:) Space

Q.22) With reference to validating blockchain transactions, consider the following statements:

1. For transaction validation, the Proof of Stake system relies on data miner's ability to solve puzzles, while in the Proof of Work system randomly selected validators verify the transactions.
2. Proof of Stake system offers a cleaner and efficient approach, whereas Proof of Work system entails high energy usage and significant carbon emissions.

Which of the statements given above is/are **incorrect**?

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

Ans) a

Exp) Option a is the correct answer.

Blockchains are decentralized transactions where no entity governs or monitors transactions, need to have a reliable way to verify each transaction. And that's where proof-of-work and proof-of-stake come in. Proof-of-work and proof-of-stake are two algorithmic methods that blockchain networks use to validate transactions. Both validate transactions by way of agreement or "consensus." That's why **proof-of-work and proof-of-stake are called consensus mechanisms**.

Statement 1 is incorrect. In a Proof of Stake system, validators are chosen to create new blocks and validate transactions based on the amount of cryptocurrency they hold and are willing to "stake" or lock up as collateral. Proof of Work relies on miners solving computationally intensive mathematical puzzles to validate and secure transactions. Miners compete to find a hash value that meets a predefined criterion, and the first miner to solve the puzzle earns the right to create a new block and receive a reward

Statement 2 is correct. Proof of Stake is generally considered more energy-efficient and environmentally friendly compared to Proof of Work, as it doesn't require vast amounts of computational power and electricity to validate transactions and secure the network. Proof of work requires high energy consumption and has a big carbon footprint.

Knowledge Base:

Proof-of-work	Proof-of-stake
Mining capacity depends upon computational power	Validating capacity depends upon the stake in the network
Miners receive block rewards to solve a cryptographic puzzles	Validators do not receive a block rewards, instead, they collect transaction fees as a reward
Hackers would need to have a computer powerful than 51% of the network to add a malicious block. Leading to 51% attack	Hackers would need to own 51% of all the cryptocurrency on the network. Which is practically impossible and therefore making 51% attacks impossible

Source: <https://www.britannica.com/money/proof-of-work-vs-proof-of-stake>

Subject:) Science and Technology

Subtopic:) Robotics and Other Modern Technologies

Q.23) Consider the following statements about Gravitational waves:

1. They were predicted by Albert Einstein's in his theory of General Relativity in 1915.
2. They are ripples in the fabric of space-time caused by the acceleration of massive objects.
3. The ripples of gravitational waves move very slowly.

How many of the statements above are correct?

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

Ans) b

Exp) Option b is the correct answer.

Einstein predicted that something special happens when two bodies—such as planets or stars—orbit each other. He believed that this kind of movement could cause ripples in space. These ripples would spread out like the ripples in a pond when a stone is tossed in. Scientists call these ripples of space as gravitational waves.

Statement 1 is correct. Albert Einstein's theory of General Relativity was published in 1915,

Statement 2 is correct. Gravitational waves are ripples in the fabric of space-time caused by the acceleration of massive objects.

Statement 3 is incorrect. Gravitational waves are incredibly fast. They travel at the speed of light i.e. 300,000 kilometers per second (186,000 miles per second). Gravitational waves squeeze and stretch anything in their path as they pass by.

Knowledge Base:

In 2015, scientists detected gravitational waves for the very first time. They used a very sensitive instrument called LIGO (Laser Interferometer Gravitational-Wave Observatory). These first gravitational waves happened when two black holes crashed into one another. The collision happened 1.3 billion years ago. But, the ripples didn't make it to Earth until 2015.

LIGO can detect this squeezing and stretching of ripples created by gravitational waves. Each LIGO observatory has two “arms” that are each more than 2 miles (4 kilometers) long. A passing gravitational wave causes the length of the arms to change slightly. The observatory uses lasers, mirrors, and extremely sensitive instruments to detect these tiny changes.

Source: <https://spaceplace.nasa.gov/gravitational-waves/en/#:~:text=The%20Short%20Answer%3A,path%20as%20they%20pass%20by.>

Subject:) Science and Technology

Subtopic:) Space

Q.24) With reference to Giant magnetoresistance, consider the following applications:

1. Data storage devices.
2. Biosensors.
3. Anti-lock braking system in automobiles.
4. Detecting abnormalities in materials and structures.
5. Electronic compasses in smartphones.

How many of the above are applications of Giant magneto resistance?

- a) Only two
- b) Only three
- c) Only four
- d) All five

Ans) d

Exp) Option d is the correct answer.

Magnetoresistance, the change in electrical resistance of a material in response to an applied magnetic field.

Option 1 is correct. Magnetoresistance is extensively used in data storage devices such as hard disk drives (HDDs) and solid-state drives (SSDs). In HDDs, magnetoresistive sensors are employed to read data from and write data to magnetic storage media, enabling high-density storage and fast data access.

Option 2 is correct. Magnetoresistive biosensors are emerging as powerful tools to detect biological molecules and biomolecular interactions. These biosensors exploit the changes in magnetic properties induced by biological processes, enabling sensitive and selective detection of biomarkers for medical diagnostics, drug discovery, and biomedical research.

Option 3 is correct Magnetoresistive sensors are utilized in various applications requiring precise detection and measurement of magnetic fields. These sensors are found to be used in magnetic compasses, automotive applications (e.g., speed and position sensing), including anti-lock brake system.

Option 4 is correct Magnetoresistance-based techniques are employed in non-destructive testing methods such as magnetic flux leakage (MFL) inspection and eddy current testing. These methods are used for detecting defects, cracks, corrosion, and other abnormalities in materials and structures, particularly in industries like aerospace, automotive, and manufacturing.

Option 5 is correct Magneto-resistive sensors are also utilized in various applications like industrial automation, and electronic compasses in smartphones and other portable devices.

Source: <https://www.thehindu.com/sci-tech/science/giant-magnetoresistance-graphene-room-temperature-andre-geim/article66728864.ece>

Subject:) Science and Technology

Subtopic:) Space

Q.25) Consider the following:

1. should allow free redistribution
2. source code is available to all.
3. possible to create further works based on it.
4. may not require an additional license.

How many of the above are necessary condition in defining open-source software?

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

Ans) d

Exp) Option d is the correct answer.

The open-source initiative (OSI) provides a commonly accepted definition of what constitute an Open Source:

- 1) Work must allow free redistribution. **(Hence option 1 is correct)**
- 2) The source code needs to be made available to all. **(Hence option 2 is correct)**
- 3) It must be possible to create further works based on it. **(Hence Option 3 is correct).**
- 4) The work must not require an additional license on top of one it comes with. **(Hence Option 4 is correct)**

Source: Forum IAS quarterly current affairs magazine for prelims, July-September 2023, Page- 44

Subject:) Current Affairs

Subtopic:) open-source software

Q.26) In the context of 'Quantum dots' consider the following statements:

1. They are nanoscale semiconductor particles.
2. They can be used in display technology due to their ability to emit light in specific wavelengths.

Which of the statements given above is/are correct?

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

Ans) c

Exp) Option c is the correct answer

Quantum dots are nanoacts, enabling precise control over their behavior. Quantum dots find applications in displays, solar cells, and biomedical imaging due to their tunable emission properties. Their potential in quantum computing and single-photon sources makes them promise for future technologies.

Statement 1 is correct: Quantum dots are nanoscale semiconductor particles, and one of their most notable properties is their size-dependent optical behavior. This means that the color of light they emit can be precisely tuned by changing their size.

Statement 2 is correct: Due to their unique luminescent properties, quantum dots are used in display technologies. They can emit light in very specific and tunable wavelengths, which makes them ideal for creating vibrant and energy-efficient displays.

Quantum dots also exhibit promising capabilities in biomedical fields, including medical imaging and targeted drug delivery, owing to their optical characteristics. Additionally, their surface can be modified for precise biological interactions, enhancing their utility in various medical applications.

Source: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9076002/>

Subject:) Science and Technology

Subtopic:) Robotics and Other Modern Technologies

Q.27) In context of 'Cell Broadcast Alert System' consider the following system:

1. The Cell Broadcast Alert System testing is a collaboration between the Department of Telecommunications (DOT) and the National Disaster Management Authority (NDMA).
2. It is used to disseminate critical and time-sensitive disaster management messages.

Which of the statements given above is/are correct?

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

Ans) c

Exp) Option c is the correct answer

Cell Broadcast Alert System is a mass notification system that delivers emergency alerts to mobile devices within a specific geographic area. Unlike SMS, it sends messages to all compatible devices in a range of designated cell towers, ensuring rapid dissemination of critical information during natural disasters, public safety threats, or emergencies.

Statement 1 is correct: The testing of the Cell Broadcast Alert System is a collaborative effort between the Department of Telecommunications (DOT) and the National Disaster Management Authority (NDMA) to enhance emergency communication during disasters.

Statement 2 is correct: The Cell Broadcast Alert System is a state-of-the-art technology designed to disseminate critical and time-sensitive disaster management messages to all mobile devices within specified geographical areas.

Source: <https://pib.gov.in/PressReleasePage.aspx?PRID=1961680>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.28) In context of Gamma-Ray Bursts (GRBs), consider the following statements:

1. They are the most powerful explosions in the known universe.
2. They can last from a few milliseconds to several hours.
3. They emit only gamma rays and no other forms of electromagnetic radiation like X rays, ultraviolet rays etc.

How many of the above statements are correct?

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

Ans) b

Exp) Option b is the correct answer

Gamma-ray bursts (GRBs) are short-lived and intense bursts of gamma-ray radiation originating from distant galaxies. They are the brightest electromagnetic events in the universe, lasting milliseconds to minutes. GRBs are likely resulting from cataclysmic events like supernovae or mergers of compact objects, offering insights into stellar evolution and the early universe.

Statement 1 is correct: GRBs are indeed the most powerful explosions observed in the universe, with a luminosity that can be a quintillion times that of our Sun.

Statement 2 is correct: The duration of GRBs can vary widely, from as short as a few milliseconds to as long as several hours, after which an afterglow of longer wavelengths is often observed.

Statement 3 is incorrect: While GRBs initially emit gamma rays, they are also followed by an afterglow that emits longer wavelengths of electromagnetic radiation, such as X-rays, ultraviolet, optical, infrared, and radio waves.

Source: <https://www.space.com/gamma-ray-burst.html>

Subject:) Science and Technology

Subtopic:) Space

Q.29) In the context of End-to-End encryption, consider the following statements:

1. It is a method of secure communication that prevents third parties from accessing data while it is being transferred from one device to another.
2. It uses symmetric key encryption, which requires both the sender and the recipient to have the same secret key.

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

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

Ans) a

Exp) Option a is the correct answer

End-to-end encryption is a secure communication method where only the communicating users can read the messages. It ensures data confidentiality by encrypting information at the sender's device and decrypting it at the recipient's device. It prevents interception and surveillance, bolstering privacy and security in digital communications.

Statement 1 is correct: End-to-End encryption is designed to prevent any third party from accessing data during its transfer from one system or device to another. The data remains encrypted and unreadable to anyone except the true sender and recipient.

Statement 2 is incorrect: It uses public key encryption (asymmetric encryption), which involves a public key for encrypting messages and a private key for decrypting them. This is different from symmetric key encryption, where the same key is used for both encryption and decryption.

Source: <https://www.thehindu.com/sci-tech/science/end-to-end-encryption-messaging-apps-explained/article67765395.ece>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.30) The term 'Bhashini' is often mentioned in the news. Which of the following correctly defines the function of 'Bhashini'?

- a) A payments platform introduced by RBI which provides payment interfaces in all Indian languages.
- b) A Government of India initiative for promoting Sanskrit education through means of the online portal e-Pathshala.
- c) A campaign launched to improve digital literacy and language proficiency of rural women and girl child.
- d) An AI-based translation tool designed to break language barriers by providing real-time translation between various Indian languages.

Ans) d

Exp) Option d is the correct answer.

Recently, **Prime Minister** of India used **Bhashini** during his **speech at Kashi Tamil Sangamam** in Varanasi. It showed the **use of new technology through Artificial Intelligence (AI)** and a **new beginning** for people across regions to interact.

Option a is incorrect: Unified Payments Interface (UPI) was officially **launched in 2016** for public use. Under **Reserve Bank of India's guidance**, **National Payments Corporation of India (NPCI)** became the **primary body tasked with developing a new payment system** that is simple, secure, and interoperable. UPI itself, as the underlying infrastructure, doesn't directly support specific languages. However, the UPI-based applications one uses to interact with it might offer multilingual interfaces. E.g.- BHIM app supports around 20 languages. This **has no connection to Bhashini**.

Option b is incorrect: The ePathshala is a joint initiative between the Ministry of Education (MoE) and the National Council of Educational Research and Training (NCERT) that **provides access to educational e-resources**. ePathshala also includes digital textbooks, videos, grade learning materials, and audiobooks. The ePathshala is **available in English, Sanskrit, Urdu, and Hindi**.

Option c is incorrect: We Think Digital is a pan-India campaign that aims to empower and improve the digital skills of women and girls. The **campaign is a collaboration** between Meta (formerly

Facebook), CyberPeace Foundation, National Commission for Women (NCW), and AutoBot Infosec. It was **previously known as Digital Shakti**.

Option d is correct: Bhashini is an AI-based language translation tool that Prime Minister Narendra Modi utilized during a speech in Varanasi. Its **primary function** is to **eliminate language barriers** by **providing real-time translation between various Indian languages**, using **artificial intelligence (AI)**, **natural language processing (NLP)**, and **crowdsourcing (where people contribute sentences in different languages, validate the text or audio transcribed by others, and translate text and label images)**. It supports the **development of native language tools and services** by providing an **open-source language database**, aiming to embrace and simplify the linguistic diversity of India.

Knowledge Base:

- 1) Bhashini's apps allow users to: Convert voice to text, translate from one Indian language to another, generate voice from text, and communicate with others who do not know their language.
- 2) An Independent Business Division (IBD), Digital India Bhashini Division (DIBD) has been set up under Digital India Corporation (DIC) to anchor the Mission Bhashini activities and to nurture the language technology ecosystem especially involving startups.

Source:

<https://timesofindia.indiatimes.com/gadgets-news/explained-what-is-bhashini-the-real-time-translation-tool-that-pm-narendra-modi-used/articleshow/106122854.cms>

<https://vikaspedia.in/education/interactive-resources/e-pathshala>

[https://www.digitalshakti.org/#:~:text=The%20campaign%20is%20a%20pan%2DIndia%20project%20aiming,\(Formerly%20known%20as%20Facebook\)%20&%20AutoBot%20Infosec.](https://www.digitalshakti.org/#:~:text=The%20campaign%20is%20a%20pan%2DIndia%20project%20aiming,(Formerly%20known%20as%20Facebook)%20&%20AutoBot%20Infosec.)

<https://innovateindia.mygov.in/bhashini-challenge/>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.31) If a major solar storm (solar flare) reaches the Earth, which of the following are the possible effects on the Earth?

1. GPS and navigation systems could fail.
2. Tsunamis could occur at equatorial regions.
3. Power grids could be damaged.
4. Intense auroras could occur over much of the Earth.
5. Forest fires could take place over much of the planet.
6. Orbits of the satellites could be disturbed.
7. Shortwave radio communication of the aircraft flying over polar regions could be interrupted.

Select the correct answer using the code given below:

- a) 1, 2, 4 and 5 only
- b) 2, 3, 5, 6 and 7 only
- c) 1, 3, 4, 6 and 7 only
- d) 1, 2, 3, 4, 5, 6 and 7

Ans) c

Exp) Option c is the correct answer.

Solar flares are intense bursts of radiation from the sun that can directly influence electronics on Earth. They are often associated with coronal mass ejections (CMEs), which are large clouds of gas that erupt from the sun's interior into its atmosphere.

Options 1 and 3 are correct: The large solar flare is projected to strike satellites in the **Earth's upper atmosphere**. Thus it affects GPS navigation, mobile phone transmissions, and satellite TV. The flares might potentially **disrupt power grids and electrical networks** in various regions of the planet.

Option 2 is incorrect: Solar flares can temporarily alter the upper atmosphere creating disruptions. But it **does not cause Tsunamis**. It only affects the upper atmosphere.

Option 4 is correct: The high-energy particles emitted by the flare could also cause **certain atoms in the Earth's atmosphere to glow, leading to auroras in Central Europe as well as North America**. The phenomenon could only be seen if the weather is clear.

Option 5 is incorrect: There is no causal link between the coronal mass ejections (CMEs) and the deadly forest fires. There is a **common misconception** that solar storms are associated with extreme geological and atmospheric effects on Earth. The sun cannot produce solar flares or CMEs that physically burn the landscape, if it did, I doubt complex life would have had much of a chance at evolving over the last few billion years if our planet was constantly being sterilized.

Option 6 is correct: The scientists found that solar flares and storms heated and expanded the atmosphere and that these effects could extend to the satellites' orbits. The density of atmospheric gases increases, slowing the satellites and causing them to lose altitude by a few kilometres per day.

Option 7 is correct: Solar flares allow **interference with the short wave radios** that are being used, emitting more rays allowing people to get more of a sun burn during this time frame.

Source: UPSC CSE Pre 2022

Subject:) Science and Technology

Subtopic:) Space

Q.32) With reference to Satellite Internet, consider the following statements:

1. Satellites providing internet service are placed only in the Lower Earth Orbit (LEO).
2. It exhibits lower latency compared to fiber optic internet.
3. 'Starlink' of SpaceX is an example of Satellite Internet network.

How many of the statements given above are correct?

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

Ans) a

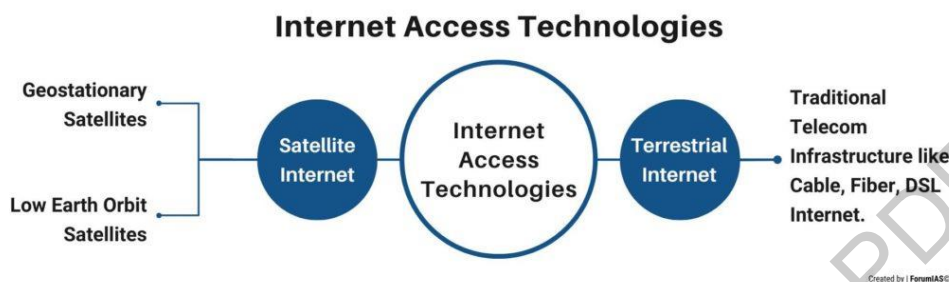
Exp) Option a is the correct answer.

Satellite internet provides an online connection powered by satellites in space. These satellites send and receive signals that route to your internet service provider and then to home's internet modem.

Statement 1 is incorrect: A satellite internet connection uses communication satellites to provide internet connectivity to the users. Both Geostationary Orbit (or GEO) Satellites and Low Earth orbit (LEO) satellites are utilized to provide Satellite Internet service.

Statement 2 is incorrect: Fiber optic internet is a type of broadband internet service that utilizes fiber optic cables to transmit data. Satellite internet has higher latency than fiber-optic internet because the data must travel to space and back whereas fiber connections are a direct line from router to the exchange.

Statement 3 is correct: Starlink is a project by SpaceX, the company founded by Elon Musk, to provide high-speed internet access to anywhere on the planet using a constellation of thousands of satellites. Starlink is expected to launch its services in India soon. This is planned to be placed in Low-Earth Orbit.



Source: <https://www.businessday.in/technology/news/story/reliance-jiospacefiber-what-is-satellite-internet-and-how-will-it-work-in-india-404433-2023-11-03>

<https://forumias.com/blog/satellite-internet-working-advantages-and-challenges-explained-pointwise/#gsc.tab=0>

<https://indianexpress.com/article/technology/tech-news-technology/what-is-starlink-8930930/>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.33) Which one of the following best describes the concept of “Kessler Syndrome”?

- a) A sudden drift of rotating asteroid causing long term risk to Earth.
- b) The ongoing sequence of events of expansion of universe after big bang explosion.
- c) Collision and merger of several supermassive black holes located within a galaxy.
- d) A chain reaction of exploding space debris eventually increasing the space junk.

Ans) d

Exp) Option d is the correct answer.

In 1978, the NASA scientist Donald J. Kessler proposed a chain reaction of exploding space debris. It can lead to an increase in the total amount of space debris and can end up making space activities and the use of satellites impossible for generations.

The Kessler Syndrome is a phenomenon in which the amount of junk in orbit around Earth reaches a point where it just creates more and more space debris, causing big problems for satellites, astronauts and mission planners.

Source:

https://www.esa.int/Enabling_Support/Space_Engineering_Technology/The_Kessler_Effect_and_how_to_stop_it

Subject:) Science and Technology

Subtopic:) Space

Q.34) With reference to “Secure Sockets Layer (SSL)”, consider the following statements:

- 1. It is a networking protocol that creates an encrypted link between a web client and a server.
- 2. Unlike Hypertext Transfer Protocol (HTTP), SSL uses both public and private key encryption over Internet Protocol network.

Which of the statements given above is/are correct?

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

Ans) c

Exp) Option c is the correct answer.

Statement 1 is correct: Secure sockets layer (SSL) is a networking protocol designed for securing connections between web clients and web servers over an insecure network, such as the internet.

Statement 2 is correct: Hypertext Transfer Protocol (HTTP) Lacks Encryption. HTTP transmits data in plain text. This means information exchanged between a web browser and a server can be intercepted by anyone on the network. This vulnerability is especially concerning when users submit sensitive data like login credentials or credit card information on websites.

Secure Sockets Layer (SSL) emerged as a solution to address the security shortcomings of HTTP. It utilizes public key cryptography to encrypt communication between devices. In this process:

- 1) A public key is available to everyone for encryption.
- 2) A private key, held only by the authorized recipient, is used for decryption.

This ensures that only the intended receiver can access the confidential information.

Source: <https://www.cloudflare.com/learning/ssl/what-is-ssl/#:~:text=SSL%2C%20or%20Secure%20Sockets%20Layer,data%20integrity%20in%20Internet%20communications>

<https://www.kaspersky.com/resource-center/definitions/what-is-a-ssl-certificate>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.35) 'Raccoon Stealer and Lock Bit, often seen in the news, are associated with which one of the following?

- a) Tools for hacking and penetration into sensitive nuclear installation's security systems.
- b) Software for disrupting digital infrastructures without a financial motive.
- c) Trojan horses that affect windows operating systems and open a backdoor in the computer.
- d) Malware used in cyber-attacks for data theft and ransom demands.

Ans) d

Exp) Option d is the correct answer.

Cybersecurity is the **practice of protecting internet-connected systems**, like hardware, software, and data, **from cyber threats**. It's important for **preserving privacy**, **protecting personal data**, and **helping to prevent fraud and online assaults**.

Option a is incorrect: Nuclear security issues relating to the **prevention and detection of theft, sabotage and unauthorized access to sensitive nuclear installations and their associated facilities** are under **greater degree of security lens** due to malicious computer worm like **Stuxnet** which **caused substantial damage** to the **nuclear program of Iran**.

Option b is incorrect: Software for **disrupting digital infrastructures** could imply a **broader range of activities**, including **those driven by ideologies or simple vandalism**, which may **not always** have a **financial motive**. While **Raccoon Stealer and LockBit do disrupt digital infrastructures**, their **primary intent is financial gain** through theft and extortion, distinguishing them from purely disruptive actions without financial motives.

Option c is incorrect: The **Storm Worm is a Trojan horse** that **affects Microsoft operating systems and allows remote control of computers**. It was **discovered in 2007** and is also known as the **Storm Botnet**. The **Storm Worm opens a backdoor in a computer** and installs a rootkit that hides the malicious program. The **compromised computer becomes a zombie in a botnet**. The **Storm Worm's activities have significantly reduced** since its peak and it is no longer considered an active threat.

Option d is correct: **Raccoon Stealer is recognized for its capability to extract sensitive information from compromised systems**, while **LockBit operates as ransomware, encrypting data and demanding ransom for its release**. Both are prime examples of malicious software targeting individuals and organizations to illicitly obtain financial gain, demonstrating the persistent threat landscape in the digital domain.

Knowledge Base:

- 1) **Raccoon Stealer** is a malware that targets sensitive data like passwords, history, cookies, credit cards, usernames, cryptocurrency wallets, and browser autofill. It's usually delivered through phishing attacks and exploit kits. Raccoon Stealer uses SQL queries to get a user's auto-login passwords, cookies, browser history, and credit card details.
- 2) **LockBit** is a ransomware group that has been responsible for more than \$144 million in ransom payments. In June 2020, U.S. federal agencies released an advisory that attributed around 1,700 ransomware attacks in the United States since 2020 to LockBit.

Source:

<https://www.blackberry.com/us/en/solutions/endpoint-security/ransomware-protection/raccoon->

[infostealer#:~:text=Raccoon%20stealer%20targets%20browser%20autofill,Ukraine%20war%20on%20its%20members](https://www.blackberry.com/us/en/solutions/endpoint-security/ransomware-protection/raccoon-infostealer#:~:text=Raccoon%20stealer%20targets%20browser%20autofill,Ukraine%20war%20on%20its%20members)

[https://www.state.gov/reward-offers-for-information-on-lockbit-leaders-and-designating-affiliates/#:~:text=More%20than%20\\$144%20million%20in,recover%20from%20LockBit%20ransomware%20events.](https://www.state.gov/reward-offers-for-information-on-lockbit-leaders-and-designating-affiliates/#:~:text=More%20than%20$144%20million%20in,recover%20from%20LockBit%20ransomware%20events.)

<https://indianexpress.com/article/india/eight-govt-entities-hit-by-info-stealing-malware-8541103/>

<https://timesofindia.indiatimes.com/gadgets-news/india-most-hit-country-by-lockbit-in-south-asia-what-makes-this-group-so-dangerous/articleshow/107948187.cms>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.36) Consider the following pairs:

Space	Objectives
Mission	
1. Artemis	To determine the rate of Martian tectonic activity and meteorite impacts.
2. Insight	To explore Saturn's rings and understand the processes of the Saturnian system.
3. Europa clipper	To study the nature of the ice shell and ocean of Jupiter's moon Europa.
4. Dawn Mission	To study two large bodies in the asteroid belt and test ion thrusters.
5. Cassini	Aims to land the first woman and the next man on the Moon by 2024

How many of the above pairs are correctly matched?

- a) Only two
- b) Only three
- c) Only four
- d) All five

Ans) a

Exp) Option a is the correct answer

Pair 1 is incorrectly matched: Artemis Mission aims to return humans to the Moon, establish a sustainable presence there, and lay the groundwork for future missions to Mars. The program includes landing the first woman and the next man on the Moon by 2024.

Pair 2 is incorrectly matched: InSight Mission studied the interior structure and composition of Mars, determined the rate of Martian tectonic activity and meteorite impacts, and understood the planet's evolution.

Pair 3 is correctly matched: Europa Clipper Mission's objective is to explore Jupiter's icy moon Europa, understand the nature of its ice shell and ocean, study the moon's composition and geology, and determine its astro-biological potential.

Pair 4 is correctly matched: Dawn Mission's objective is to study two large bodies in the asteroid belt (Vesta and Ceres), to answer questions about the formation of the Solar System and test the performance of ion thrusters in deep space.

Pair 5 is incorrectly matched: Cassini Mission's objective is to explore Saturn and its moons, study the planet's rings, atmosphere, and magnetosphere, and understand the history and processes of the Saturnian system.

Source:

<https://www.nasa.gov/feature/artemis/?ssp=1&darkschemeovr=1&setlang=en&cc=IN&safesearch=>

moderate, https://europa.nasa.gov/mission/about/?ssp=1&darkschemeovr=1&setlang=en&cc=IN&sa_fesearch=moderate

Subject:) Science and Technology

Subtopic:) Space

Q.37) With reference to Free-Space Optical communication (FSO), consider the following statements:

1. It uses laser technology to transmit data through the air.
2. It provides a higher level of security compared to contemporary Radio Frequency (RF) systems.
3. It uses line-of-sight technology to establish the communication between the transmitter and receiver.

How many of the statements given above are correct?

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

Ans) c

Exp) Option c is the correct answer.

Free-space optical communication (FSO) is a method of transmitting data using light propagating through space, without the need for physical medium such as fiber optic cables. Instead, FSO relies on the atmosphere or vacuum of space as the medium for transmitting optical signals.

Statement 1 is correct: Free Space Optical Communication (FSO) technology also known as fibre-free or fibreless optics is a technology that transports data via laser technology. FSO is designed to operate through free space as medium.

Statement 2 is correct: Free Space Optical Communication (FSO) provides high security, better data rates & fast installations, no requirement of licensed spectrum, best costs & simplicity of design as compared to contemporary Radio Frequency (RF) systems.

Statement 3 is correct: Free-Space Optics (FSO) uses line of sight technology to transport data between the transmitter and receiver through free space, such as the atmosphere, space, or vacuum.

Source: <https://www.hindustantimes.com/brand-post/optical-wireless-technology-lifi-fsoc-technologies-boon-for-the-future-101644408962252.html>

<https://core.ac.uk/download/pdf/236412639.pdf>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.38) Which of the following best describes the term Einstein ring, often seen in news?

- a) It is a type of orbit followed by comets around the Sun.
- b) It is a ring-shaped structure of gases and dust particles formed by the collision of galaxies.
- c) It is a gravitational lensing phenomenon where light is bent into a complete circle.
- d) It is a circle of natural lights display formed over North and South Pole due to interaction between solar particles and earth's magnetic field.

Ans) c

Exp) Option c is the correct answer.

An Einstein ring is a fascinating phenomenon observed in astrophysics. It stems from the principles of gravitational lensing outlined in Einstein's theory of general relativity. This occurs when a sufficiently massive celestial body, like a galaxy or galaxy cluster, distorts the trajectory of light. The distortion happens when light passes near the massive object due to the curvature of spacetime caused by its gravitational field.

The term "**Einstein ring**" refers to a **specific type of gravitational lensing phenomenon** predicted by Albert Einstein. In this phenomenon where a massive object, such as a galaxy or a galaxy cluster, acts

as a gravitational lens. When light from a background source, such as a distant galaxy or quasar, passes near the massive object, its path is bent due to the gravitational field of the massive object. **If the alignment between the observer, the massive object, and the background source is nearly perfect, the bent light can form a complete circle or ring around the massive object. This ring-shaped image is what is known as an Einstein ring.**

Knowledge Base: **Aurora Borealis** and **Aurora Australis**, commonly known as the **Northern Lights** and **Southern Lights** respectively, are natural light displays that occur in the Earth's polar regions. Both Aurora Borealis and Aurora Australis are caused by the interaction of **charged particles from the solar wind with Earth's magnetosphere**. When these charged particles enter the Earth's magnetosphere, they follow the magnetic field lines towards the poles. As they collide with gas molecules in Earth's atmosphere, particularly oxygen and nitrogen, they transfer energy, causing the molecules to emit light. This process results in the stunning displays of auroras seen near the Earth's poles.

Source: <https://indianexpress.com/article/technology/science/james-webb-space-telescope-captures-image-of-near-perfect-einstein-ring-8134542/>

<https://spaceplace.nasa.gov/aurora/en/#:~:text=These%20lights%20are%20called%20auroras,austalis%20or%20the%20southern%20lights.>

Subject:) Science and Technology

Subtopic:) Space

Q.39) With reference to 'e-Sign', consider the following statements:

1. An e-Sign user can digitally sign documents without the need of a physical digital signature dongle.
2. It does not provide the same authenticity as the signature done by physical handwriting.

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

Exp) Option a is the correct answer.

e-Sign, short form for Electronic Signature, refers to a digital method of signing documents or agreements electronically. The eSign Electronic Signature Service is an innovative initiative that enables easy, efficient, and secure signing of electronic documents. It authenticates signers using e-KYC services, which ensures a streamlined and secure digital signing process.

Statement 1 is correct: eSign users can digitally sign electronic documents **without needing a physical digital signature dongle**. Application Service Providers can integrate this service into their applications, providing users with a convenient way to sign electronic forms and documents digitally.

Statement 2 is incorrect: **Electron signature provides the same authenticity as the original signature on the data/content given by physical handwriting.** E-signs are proof that the owner has read the document/content and has no objection to the content. Electronic signatures are accepted legally and hold the same level of importance as the physical signature.

Source:

<https://ipronline.ipindia.gov.in/epatentfiling/Extras/FAQESign.aspx#:~:text=eSign%20Electronic%20Signature%20Service%20is,a%20physical%20digital%20signature%20dongle.>

<https://cca.gov.in/sites/files/pdf/esign/ESIGNFAQ.pdf>

Subject:) Science and Technology

Subtopic:) Robotics and Other Modern Technologies

Q.40) The term "Native Over The Air" often mentioned in the news, is seen in the context of:

- a) automatic updates and improvements to mobile software for BharOS.
- b) advancements in ISRO's low earth orbit satellite communication technology.
- c) development of short-range cruise missiles to cover India's territorial waters.
- d) innovations in wireless charging technologies for 5G devices manufactured in India.

Ans) a

Exp) Option a is the correct answer.

BharOS is an **indigenous mobile operating system (OS)**, like Android or iOS. These systems **help smartphone users interact with their device and access its features**, while ensuring safety. **BharOS**, in particular, is **meant to be a contribution towards the idea of a self-reliant India** or 'Atmanirbhar Bharat' by **creating a secure OS environment for India-based users**.

Option a is correct: "Native Over The Air" is a **feature of the BharOS operating system** that allows for **automatic software updates** to be **downloaded and installed**. **BharOS** is an indigenous operating system (OS) that's similar to Android, but **doesn't include Google services** and **allows users to install their own apps**. It's currently **only intended for organizations** with **strict privacy and security requirements**.

Option b is incorrect: ISRO (Indian Space Research Organization) and NASA are jointly developing the NASA-ISRO SAR (NISAR) satellite, a Low Earth Orbit (LEO) observatory. **Low Earth Orbit (LEO) satellite communication technology** is undergoing a **period of significant advancement**, driven by **factors like miniaturization, improved functionalities, and the growing demand for global connectivity**.

Option c is incorrect: Brahmos is a **supersonic cruise missile** that can be **launched from ships, submarines, fighter aircraft, or land**. The missile has **two variants, one for land attacks and one for anti-ship roles**. Brahmos has been **jointly developed by India's Defence Research and Development Organisation (DRDO) and Russia's NPO Mashinostroyenia**.

Option d is incorrect: **Wireless charging technology** has been making advances that **allow devices to charge faster and more efficiently**. **Pulse charging** allows for a **simpler charging system and minimizes the impact of the charger**. The ability to **charge devices over a distance** (far-field charging) is being explored. This **could eliminate charging pads altogether** and allow for charging on the go.

Knowledge Base:

- 1) BharOS, formerly known as IndOS, is a free, open-source mobile operating system (OS) for government and public systems in India. It was designed by IIT Madras and is funded by the Indian government.
- 2) BharOS is Linux-based, does not come with pre-installed apps, and offers Native over the Air (NOTA) updates. It also provides Private App Store Services (PASS), which offer trusted apps from specific organizations.
- 3) BharOS is a fork of the Android Open Source Project (AOSP). AOSP is a degoogled Android that doesn't contain device drivers. BharOS uses some early versions of Linux, but has its own security protocols like root of trust and chain of trust modifications.

Source:

<https://www.thehindu.com/sci-tech/technology/explained-bharos-software-how-different-from-google-android-os-iit-madras/article66423362.ece>

[https://www.hindustantimes.com/technology/bharos-india-s-indigenous-mobile-operating-system-by-iit-madras-6-key-points-](https://www.hindustantimes.com/technology/bharos-india-s-indigenous-mobile-operating-system-by-iit-madras-6-key-points-101674294992294.html#:~:text=You%20will%20be%20able%20to%20receive%20Native,Air%20(NOTA)%20patches%2C%20just%20as%20Android%20smartphones.)

[101674294992294.html#:~:text=You%20will%20be%20able%20to%20receive%20Native,Air%20\(NOTA\)%20patches%2C%20just%20as%20Android%20smartphones.](https://www.hindustantimes.com/technology/bharos-india-s-indigenous-mobile-operating-system-by-iit-madras-6-key-points-101674294992294.html#:~:text=You%20will%20be%20able%20to%20receive%20Native,Air%20(NOTA)%20patches%2C%20just%20as%20Android%20smartphones.)

<https://www.sciencedirect.com/topics/engineering/low-earth-orbit#:~:text=Such%20advances%20include%20more%20advanced,smaller%20spacecraft%20to%20be%20built.>

Subject:) Science and Technology

Subtopic:) Robotics and Other Modern Technologies

Q.41) In India, under cyber insurance for individuals, which of the following benefits are generally covered, in addition to payment for the loss of funds and other benefits?

1. Cost of restoration of the computer system in case of malware disrupting access to one's computer.
2. Cost of a new computer if some miscreant wilfully damages it, if proved so.
3. Cost of hiring a specialized consultant to minimize the loss in case of cyber extortion.
4. Cost of defence in the Court of Law if any third-party files a suit.

Select the correct answer using the code given below:

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

Ans) b

Exp) Option b is the correct answer.

Cyber insurance for individuals in India generally covers the following benefits:

Statement 1 is correct: Cost of restoration of the computer system in case of malware disrupting access to one's computer. This includes the expenses incurred for retrieving or restoring data or computer programs that are corrupted or lost due to a cyber attack.

Statement 2 is incorrect: Cyber insurance for individuals in India generally does not cover the cost of a new computer if some miscreant wilfully damages it, if proved so. This is because cyber insurance only covers losses arising from cyber-attacks, not physical damage to the computer hardware

Statement 3 is correct: Cost of hiring a specialized consultant to minimize the loss in case of cyber extortion. This includes the fees paid to a professional firm or person approved by the insurer to prevent or mitigate a cyber extortion threat.

Statement 4 is correct: Cost of defense in the Court of Law if any third-party files a suit. This includes the legal costs and expenses incurred with the insurer's consent for defending any legal action brought by a third-party against the insured person as a result of a cyber-attack.

Source: UPSC CSE Pre 2020

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.42) With reference to 'Neutrinos', consider the following statements:

1. They are electrically neutral.
2. They do not interact with matter.
3. They are produced in nuclear reactions.

How many of the statements given above are correct?

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

Ans) b

Exp) Option b is the correct answer.

Neutrinos are tiny, electrically neutral particles with very little mass. They hardly interact with matter, passing through most substances without being affected. They're produced in processes like nuclear reactions in stars and cosmic ray interactions. Neutrinos are of three types: electron neutrinos, muon neutrinos, and tau neutrinos, each associated with different particles.

Option 1 is correct: Neutrinos have no electric charge, so they are indeed electrically **neutral**. This characteristic allows them to interact primarily through the weak nuclear force and gravity, distinguishing them from charged particles like electrons.

Option 2 is incorrect: Neutrinos do interact with matter; however, they have very weak interactions with matter, often referred to as the **weak nuclear force interaction**. While they can pass through most substances without being affected, they do have some level of interaction, albeit extremely weak compared to other particles.

Option 3 is correct: Neutrinos are indeed produced in various nuclear reactions, such as beta decay, where a neutron transforms into a proton, an electron, and an electron neutrino.

Source: <https://www.thehindu.com/sci-tech/science/explained-are-neutrinos-their-own-antiparticles/article66532648.ece>

<https://neutrinos.fnal.gov/whats-a-neutrino/>

<https://www.energy.gov/science/doe-explainsneutrinos#:~:text=Neutrinos%20are%20the%20most%20abundant,the%20potassium%20in%20the%20fruit.>

Subject:) Science and Technology

Subtopic:) Space

Q.43) With reference to Information and Communication Technology (ICT), which of the following describes the concept of 'Dark Patterns'?

- a) Patterns used to represent dark-themed interfaces.
- b) A technique used to access dark web.
- c) Techniques intentionally designed to manipulate and deceive users.
- d) Money laundering pattern by international criminals using ICT.

Ans) c

Exp) Option c is the correct answer.

Dark patterns are deceptive design techniques used in digital interfaces to manipulate users into taking actions that they may not want, such as making unintended purchases, signing up for subscriptions, or sharing personal information.

Dark patterns, in the context of Information and Communication Technology (ICT), **refer to design techniques deliberately crafted to manipulate and deceive users**. These techniques are often used in user interfaces, websites, or apps to influence user behaviour, such as tricking users into making unintended purchases, subscribing to services unknowingly, or providing consent for data collection without full understanding. Dark patterns are unethical design practices that prioritise the interests of the designer or company over the user's interests and can erode trust and transparency in digital interactions.

Source: <https://www.thehindu.com/sci-tech/technology/dark-patterns-on-the-internet-how-companies-are-tricking-its-users/article66296690.ece>

<https://www.wionews.com/technology/explained-what-are-dark-patterns-and-how-they-harm-internet-users-612277>

Subject:) Science and Technology

Subtopic:) IT and Telecom

Q.44) Scramjet engines have been in the frontiers of engineering for many years. In this context, consider the following statements with regards to Scramjet engine:

1. It compresses the incoming air using the vehicle's high speed instead of mechanical compressors.
2. The combustion process in a scramjet occurs at subsonic speeds in the combustor.
3. Brahmos missile uses scramjet engine in the cruise phase to increase its speed.

How many of the above statements are correct?

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

Ans) a

Exp) Option a is the correct answer.

Indian Space Research Organisation (ISRO) has **designed** and **tested** two **scramjet engines** (**supersonic combustion ramjet**), which **use hydrogen as fuel** and **oxygen from the atmosphere as oxidizers**. These **engines** are **lighter** and **more efficient than traditional jet engines**, which **don't carry their own oxygen**. The engines are **designed to operate at hypersonic speeds**, which is **faster than Mach 5**, or five times the speed of sound.

Statement 1 is correct: Unlike traditional jet engines, which use fans and mechanical compressors to intake and compress air, **scramjets utilize the high-speed motion of the vehicle** through the atmosphere to compress the incoming air. This characteristic **allows for simpler designs** and potentially **lighter engines**, which are beneficial at high speeds.

Statement 2 is incorrect: The **key feature** of a **scramjet engine** is that **combustion** takes place in a **supersonic airflow**. Scramjets achieve **combustion at supersonic speeds**. The high speed of the vehicle itself compresses the air entering the combustor. **Fuel is injected** and **ignites** within the **supersonic airflow**. This **allows scramjets to operate efficiently at hypersonic speeds** (Mach 5 and above). On the other hand, in a **ramjet engine**, the **incoming air is slowed down to subsonic speeds before combustion** using a shock cone. This **allows for an efficient mixing of fuel and air but limits the engine's effectiveness** at very high speeds.

Statement 3 is incorrect: **BRAHMOS is a two-stage missile with a solid propellant booster engine as its first stage which brings it to supersonic speed and then gets separated**. The liquid ramjet or the second stage then takes the missile closer to 3 Mach speed in cruise phase. Stealth technology and guidance system with advanced embedded software provides the missile with special features. **It does not use scramjet engine.**

Knowledge Base:

- 1) ISRO's Advanced Technology Vehicle (ATV), which is an advanced sounding rocket, was the solid rocket booster used for the test of Scramjet engines at supersonic conditions.
- 2) Scramjet engines are an improvement over ramjet engines because they can efficiently operate at hypersonic speeds and allow supersonic combustion.
- 3) A type of jet engine called a dual mode ramjet (DMRJ) can transform into a scramjet over Mach 4–8, meaning it can operate in both subsonic and supersonic combustor modes.

Source:

<https://www.isro.gov.in/ScramjetEngine.html#:~:text=The%20Scramjet%20engine%20designed%20by,3277%20kg%20at%20lift%20Doff.>

<https://pib.gov.in/newsite/printrelease.aspx?relid=149536>

<https://www.isro.gov.in/ScramjetEngineTechnology.html>

<https://www.grc.nasa.gov/www/k-12/airplane/scramjet.html>

Subject:) Science and Technology

Subtopic:) Space

Q.45) Consider the following pairs:

- | | |
|----------------|-----------------------|
| 1. Wasting | Low height for age |
| 2. Stunting | Low weight for height |
| 3. Underweight | Low weight for age |

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

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

Ans) a

Exp) Option a is the correct answer.

Pair 1 is incorrect: Wasting - a process in which a debilitating disease causes fat and muscle tissue to "waste" away. It's defined as **low weight-for-height**, and often indicates recent and severe weight loss, although it can also persist for a long time. Wasting usually occurs when a person has not had food of adequate quality and quantity and/or they have had frequent or prolonged illnesses.

Pair 2 is incorrect: Stunting is a condition where a child is **too short for their age**, due to chronic or recurrent malnutrition. It's also known as low height-for-age, and is a result of poor nutrition, frequent illness, and/or inappropriate feeding and care in early life. Stunting can prevent children from reaching their physical and cognitive potential, and is a contributing risk factor to child mortality.

Pair 3 is correct: Underweight is defined as **low weight-for-age**. A child who is underweight may be stunted, wasted or both.

Source: Forum IAS quarterly current affairs magazine for prelims, July-September 2023, Page- 55

Subject:) Current Affairs

Subtopic:) Wasting, Stunting, Underweight

Q.46) How many pairs of letters are there in the word 'MONUMENT' which have as many letters between them as in English alphabet? Consider counting both ways from Left to right and Right to left.

- a) 2
- b) 3
- c) 4
- d) 1

Ans) a

Exp) Option a is the correct answer.

Here, we are asked to solve problem according to English alphabet. **In such problems it is a general rule to count both ways i.e. From left to right and from right to left. But this has been mentioned in the question to avoid any confusion.**

Let us see the following representation:



The above presentation makes it clear that required pairs of letters are 2:

- 1) MT (In English alphabet there are 6 alphabets in between them and also in this word)
- 2) ON (In English alphabet there are 0 alphabets in between them and also in this word)

Subject:) CSAT

Subtopic:) Logical Reasoning

Q.47) Dividing 2226 and 2529 by a certain three-digit number leaves the same remainder X in each case. Find the value of X.

- a) 9
- b) 6
- c) 5
- d) 4

Ans) d

Exp) Option d is the correct answer.

The value of the first number = 2226

The value of the second number = 2529

The difference between two number = $2529 - 2226 = 303$

Now,

Prime factorization of $303 = 101 \times 3$

The required three-digit number = 101

Now,

Dividing 2226 by 101,

$$= 2226 = (101 \times 22) + 4$$

Dividing 2529 by 101,

$$= 2529 = (101 \times 25) + 4$$

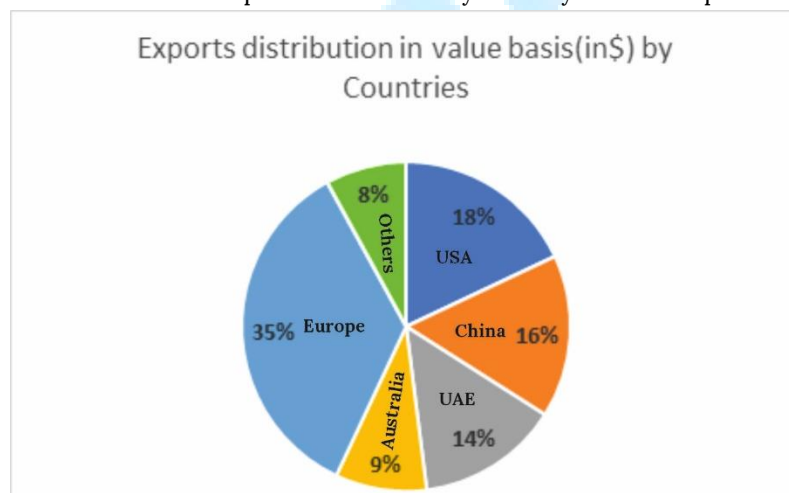
The value of remainder in each case, $X = 4$

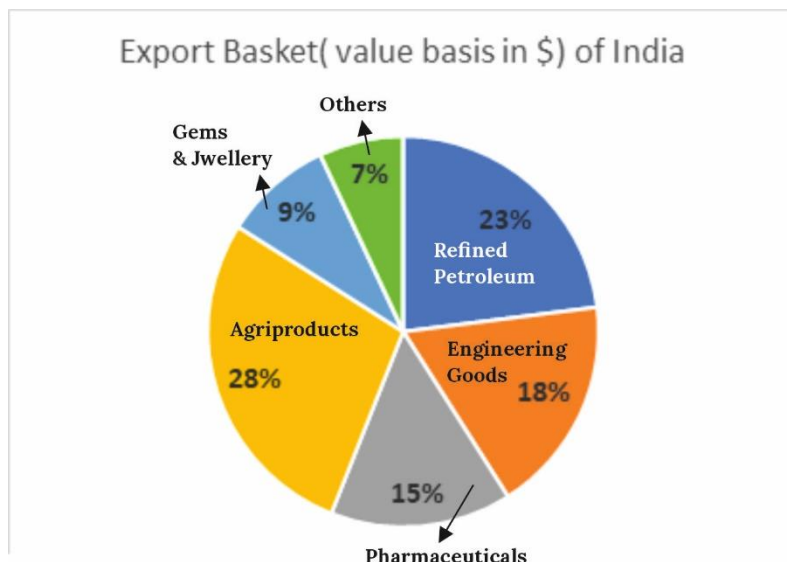
Thus, the value of X is 4.

Subject:) CSAT

Subtopic:) Quantitative Aptitude

Q. 48) The following pie charts exhibit the distribution of the exports (value basis) from India. The two charts shows the export distribution by country and the export basket of India respectively.





India exports total goods worth of \$500 billion. Europe imports only refined petroleum, engineering good, agricultural products and pharmaceutical products from India. Europe's imports from India accounts for 40% of India's total agricultural products, 40% of India's total refined petroleum exports, 40 % of India's Pharmaceutical exports. How much worth of engineering goods is imported by Europe from India?

- a) \$48 billion
- b) \$43 billion
- c) \$58 billion
- d) \$53 billion

Ans) b

Exp) Option b is the correct answer

Total Imports of Europe = 35 % of \$ 500bn = $0.35 \times 500 = \$175\text{bn}$

Total Agricultural imports of Europe from India = $0.28 \times 0.4 \times 500 = \$ 56\text{bn}$

Total Refined Petroleum imports of Europe from India = $0.23 \times 0.4 \times 500 = \$ 46\text{bn}$

Total Pharmaceutical imports of Europe from India = $0.15 \times 0.4 \times 500 = \$ 30\text{bn}$

Total Engineering goods imports of Europe from India = $175 - (56 + 46 + 30) = \$43 \text{ billion}$

Subject:) CSAT

Subtopic:) Quantitative Aptitude

Directions for the following 2 (two) items:

Read the following **two** passages and answer the items that follow the passages. Your answers to these items should be based on the passages only.

Passage-I

In considering the question, 'Can machines think?' We must first define 'machine' and 'think.' The machines we refer to are digital computers, designed to execute any operations that could be carried out by a human computer. The digital computer can be envisaged as a universal machine, capable of simulating any other machine through a process of programming. This universal capacity suggests that the question of machine intelligence, whether a machine can think, hinges not on the machine's specific form but on its functionality and the programming it receives. Alan Turing proposes an 'imitation game' as a criterion for determining a machine's capacity for thought, a test to see if a machine can exhibit intelligent behavior indistinguishable from that of a human. This test later became known as the Turing Test. The essence of this proposition lies in whether there exist conceivable digital computers whose behaviors in the game could not be differentiated from a human

by an impartial judge. Turing argues that focusing on the common usage of the words 'machine' and 'think' leads to an impasse; instead, the question should be approached through the lens of practical imitation of human behavior by a computer.

Q.49) All of the following statements, if true, would weaken Turing's proposition about the capacity for machines to think as humans do, EXCEPT:

- a) Advanced AI (Artificial Intelligence) has demonstrated proficiency in specialized tasks but shows significant limitations in understanding and replicating the breadth of human cognition.
- b) Psychological research indicates that humans can reliably identify interactions with machines, pointing to an inherent difference in the quality of machine-generated versus human thought.
- c) Philosophical arguments suggest that consciousness and emotional depth are critical to human thought, elements that machines are fundamentally incapable of replicating.
- d) In several instances, AI systems have shown the ability to learn and adapt to new challenges in ways that were not directly programmed, reflecting a form of problem-solving and creativity

Ans) d

Exp) Option d is the correct answer.

Option d statement aligns with Turing's vision by illustrating that AI can exhibit learning, adaptability, and problem-solving skills that mimic human intelligence, reinforcing the potential for machines to demonstrate thought processes akin to humans. Therefore, option d supports Turing's proposition and does not weaken it, showcasing evidence of machine behavior that could pass the Turing Test.

Options a, b, and c provide arguments that challenge Turing's assertion that machines could be considered capable of thinking by highlighting the current limitations of AI in replicating human thought, the distinguishability of machine interaction, and the philosophical requirement for consciousness in true thought. These points suggest that despite advancements, AI cannot fully replicate human cognitive processes, emotional depth, or consciousness, thus questioning Turing's criterion for machine intelligence.

Subject:) CSAT

Subtopic:) Reading Comprehension

Passage-II

As the United States government now considers the banning of TikTok, the questions have come to the fore again – what is it about TikTok that seems to trouble so many people so profoundly? The usual arguments about the brokenness of the internet – misinformation, manipulative algorithms, immersive frivolous content that shapes political decisions, rampant hate and violence, radicalization of young people on ideological grounds, exploitation of users by selling their data, targeted messaging that makes people vulnerable through AI analytics, and polarisation of societies intensified by filter bubbles – do not work. What then, can we say about the attacks, bans, and demonization of TikTok beyond the obvious geopolitics of its origins in China? Is there something more to be discussed if we accept that while the internet might seem to be a post-sovereign technology, the bordered nationalities continue to replay and reshape the digital in significant ways? The one thing that the global discourse on TikTok has to offer is perhaps the changing relationship between nations and digital platforms. For the longest time, especially driven by the neo-liberal economic rhetoric, technological platforms were presented to us as independent market entities that negotiate with different governments and authorities in their localization. What TikTok signals for us is that the platforms are not just something that governments regulate. They are ways by which governments are platformed. The extraordinarily expansive nature of digital platforms makes them more than just mediums or tools. They are, in fact, ways by which governments are being shaped and consumed on a global scale

Q.50) Based on the above passage, the following assumptions have been made:

1. The unique controversies surrounding TikTok are primarily due to its Chinese origins and the geopolitics involved.
2. The criticism of digital platforms often overlooks their role in reflecting and shaping the relationship between nations and digital space.
3. The banning of TikTok could be seen as an attempt by governments to assert control over digital spaces that challenge traditional notions of sovereignty.
4. The primary concern with digital platforms like TikTok is their content and the potential for misinformation and data exploitation.

How many of the above assumptions are correct as per the passage:

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

Ans) b

Exp) Option b is the correct answer.

Statement 1 is incorrect: While the passage acknowledges the "obvious geopolitics of its origins in China," it challenges us to consider broader implications beyond this aspect, suggesting that the usual criticisms don't fully explain the depth of the issue.

Statement 2 is correct: The passage explicitly invites a deeper examination of how digital platforms alter the dynamics between nations and digital spaces, implying that conventional critiques may miss these significant interactions.

Statement 3 is correct: The passage implies that the actions taken against TikTok by governments might reflect a broader effort to navigate and control the evolving relationship between sovereignty and the digital domain, rather than merely reacting to the platform's content or operations.

Statement 4 is incorrect: Although concerns about content, misinformation, and data exploitation are mentioned, the passage suggests these are not sufficient to explain the depth of the issue or the reasons behind TikTok's demonization and potential banning. Instead, it points towards a more complex interplay of factors involving the digital reshaping of governmental influence and sovereignty.

Subject:) CSAT

Subtopic:) Reading Comprehension