

**IAS BABA**



**60**



**60 DAY RAPID REVISION**

**(RARE) SERIES**

**UPSC/IAS Prelims 2023**

**SCIENCE AND TECHNOLOGY**

**PART -1 COMPILATION**



**Q.1) Consider the following statements**

1. Exoplanets are the planets that orbit stars other than sun and are beyond our solar system.
2. LHS 475 b is a new terrestrial rocky exoplanet discovered recently by the Indian Space Research Organisation.
3. Exoplanets cannot be seen directly through telescopes from the Earth due to their distance
4. The study of exoplanets helps in determining the habitable zone of the discovered space.

Choose the correct code:

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

Q.1) Solution (c)

**Explanation:**

- **Exoplanets are planets that orbit other stars and are beyond our solar system.** They come in a host of different sizes. They can be **gas giants bigger than Jupiter or as small and rocky as Earth.** They are also known to have **different kinds of temperatures** from boiling hot to freezing cold. **Hence, statement 1 is correct.**
- LHS 475 b is a new terrestrial rocky exoplanet **discovered by the National Aeronautics and Space Administration (NASA).** It is roughly the same size as Earth, its diameter is 99% the same as Earth. LHS 475 b is about 41 light-years away from Earth in the constellation Octans and differs from the Earth in that it completes an orbit in just two days and is hundreds of degrees hotter than Earth. According to NASA, more than 5,000 exoplanets have been discovered. **Hence, statement 2 is incorrect.**
- **Exoplanets cannot be seen directly through telescopes from the Earth because they are hidden by the bright glare of the stars they orbit.** So scientists rely on indirect methods, such as the transit method, which is measuring the dimming of a star that happens to have a planet pass in front of it, and gravitational microlensing in which light from a distant star is bent and focused by gravity as a planet passes between the star and Earth. **Hence, statement 3 is correct.**



- The study of exoplanets **helps in determining the habitable zone of the discovered space and helps us piece together information about our planetary system and origin. Hence, statement 4 is correct.**

**Q.2) Consider the following statements about the Lower Earth Orbit (LEO)**

1. It is an orbit around the earth with an altitude between 1600 to 8000 km.
2. Unlike geosynchronous satellite, satellites in LEO have a small field of view and so can observe and communicate with only a fraction of the Earth at a time.
3. It has applications in the field of satellite imaging and earth-observing satellites.

Choose the correct code:

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

Q.2) Solution (b)

**Explanation:**

- The Lower Earth Orbit is an orbit around the earth with an altitude between **160 – 2000 km**. the satellites placed in LEO can have a tilted plane and the majority of human space flights land in LEO. **Hence, statement 1 is incorrect.**
- Unlike geosynchronous satellite, satellites in LEO have a small field of view and so can observe and communicate with only a fraction of the Earth at a time. That means that a network (or "constellation") of satellites is required to provide continuous coverage. Satellites in lower regions of LEO also suffer from fast orbital decay and require either periodic re-boosting to maintain a stable orbit or launching replacement satellites when old ones re-enter. **Hence, statement 2 is correct.**
- It has applications in the field of satellite imaging, communication satellites, remote-sensing satellites, and earth-observing satellites. The International Space Station is located in LEO. **Hence, statement 3 is correct.**

**Q.3) Consider the following statements**



1. Space debris refers to man-made objects in Earth's orbit that no longer serve a useful purpose.
2. Project NETRA is an early warning system in space launched by the Indian Space Research Organisation to detect debris and other hazards to Indian satellites.
3. Kessler Syndrome refers to a phenomenon where humans on earth might get physically hurt by increasing density of space debris
4. European Space Agency has launched the Clean Space initiative, aimed at reducing the amount of space debris.

Choose the correct code:

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

Q.3) Solution (b)

**Explanation:**

- **Space debris** refers to **man-made objects in Earth's orbit** that no longer serve a useful purpose. This includes defunct satellites, spent rocket stages, and fragments of debris from collisions or other events. Of known and tracked space junk 70 percent is in low-Earth orbit, which extends about 1,250 miles (2,000 km) above the Earth's surface. **Hence, statement 1 is correct.**
- **Project NETRA** is an **early warning system in space** launched by the **Indian Space Research Organisation (ISRO)** to detect debris and other hazards to Indian satellites. ISRO has also set up a Centre for Space Debris Research to monitor and mitigate the threat of space debris and the **System for Safe and Sustainable Operations Management (IS 4 OM)** to continually monitor objects posing collision threats, predict the evolution of space debris, and mitigate the risk posed by space debris. **Hence, statement 2 is correct.**
- The Kessler syndrome (also called the Kessler effect, [1][2] collisional cascading, or ablation cascade), proposed by NASA scientist Donald J. Kessler in 1978, is a scenario in which the density of objects in low Earth orbit (LEO) due to space pollution is high enough that collisions between objects could cause a cascade in which each collision generates space debris that increases the likelihood of further collisions. **Hence, statement 3 is incorrect.**
- The **European Space Agency has launched the Clean Space initiative**, aimed at reducing the amount of space debris. **Hence, statement 4 is correct.**



**Q.4) Consider the following statements about Communication Satellites**

1. These are natural satellites present in the earth's orbit to send and receive communication data between a source and a destination.
2. They use microwaves and radiowaves for transmitting signals.
3. Communications satellites are often placed in geostationary orbit.

Choose the correct code:

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

Q.4) Solution (d)

**Explanation:**

- **Communication Satellite is an artificial satellite that is placed in the earth's orbit to send and receive communication data between a source and a destination.** They are mostly placed in **High-Earth Orbit**. These satellites support telecommunication. Telecasting, phone calls, internet connectivity, radio, and much remote connectivity are typical applications. **Hence, statement 1 is incorrect.**
- They use **microwaves and radiowaves** for transmitting signals. **Hence, statement 2 is correct.**
- Communications satellites are often in **geostationary orbit**. At the high orbital altitude of 35,800 kilometers, a geostationary satellite orbits the Earth in the same amount of time it takes the Earth to revolve once. From Earth, therefore, the satellite appears to be stationary, always above the same area of the Earth. The area to which it can transmit is called a satellite's footprint. **Hence, statement 3 is correct.**

**Q.5) Consider the following statements**

1. A Dark Sky Reserve is a designation given to a place that has policies in place to ensure that a tract of land or region has minimal artificial light interference.
2. India's first dark sky reserve, the Indian Astronomical Observatory (IAO) is located in Hanle, Ladakh.
3. Himalayan Chandra Telescope (HCT) is an optical-infrared telescope located at IAO.



4. The International Dark Sky Association is a U.S.-based non-profit organisation that designates places as International Dark Sky Reserves

Choose the correct code:

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

Q.5) Solution (d)

**Explanation:**

- A **Dark Sky Reserve** is a designation given to a place that has policies in place to ensure that a tract of land or region has minimal artificial light interference. It is a public or private land of substantial size that possess an exceptional quality of starry nights that is specifically protected for its scientific, natural, educational, cultural heritage, and public enjoyment. **Hence, statement 1 is correct.**
- **India's first dark sky reserve, the Indian Astronomical Observatory (IAO) is located in Hanle, Ladakh.** Hanle is one of the world's highest-located sites for optical, infrared, and gamma-ray telescopes. **Hence, statement 2 is correct.**
- Indian Astronomical Observatory is situated at an altitude of 4500 meters atop Mt. Saraswati in the vast Nilamkhul Plain in the Hanle Valley of Changthang. The site is a dry, cold desert with a sparse human population and the ancient Hanle monastery is its nearest neighbor. It has the advantages of more clear nights, minimal light pollution, background aerosol concentration, extremely dry atmospheric conditions, and uninterrupted monsoon. Such conditions are considered crucial for astronomers to build huge telescopes and plan for future observatories and predict how they will vary with time.
- Himalayan Chandra Telescope (HCT) is an optical-infrared telescope located at IAO. Also GROWTH-India Telescope is the country's first fully robotic research telescope located at IAO. **Hence, statement 3 is correct.**
- **The International Dark Sky Association is a U.S.-based non-profit** organisation that designates places as International Dark Sky Places, Parks, Sanctuaries and Reserves, depending on the criteria they meet. Several such reserves exist around the world but none so far in India. (Before Hanle). **Hence, statement 4 is correct.**



**Q.6) Consider the following statements regarding the NASA's Space Missions**

1. Artemis I is a crewed space mission to the satellite moon.
2. Perseverance Rover is a space mission to planet Mars.
3. Messenger is a space mission to planet Venus.
4. Mariner 2 is a space mission to planet Mercury.

Choose the correct code:

- a) Only one statement is correct
- b) Two statements are correct
- c) Three statements are correct
- d) Four statements are correct

Q.6) Solution (a)

**Explanation:**

- The **National Aeronautics and Space Administration (NASA)** is an independent agency of the executive branch of the United States federal government responsible for the civilian space program, as well as aeronautics and aerospace research. It was established under the National Aeronautics and Space Act of 1958 and is headquartered in Washington, DC, USA
- **Artemis I is an uncrewed space mission to the moon. Hence, statement 1 is incorrect.**
- **Perseverance Rover is a space mission to Mars. Hence, statement 2 is correct.**
- **Messenger is a space mission to Mercury. Hence, statement 3 is incorrect.**
- **Mariner 2 is a space mission to Venus. Hence, statement 4 is incorrect.**

**Q.7) Consider the following statements about Small Satellite Launch Vehicles (SSLV)**

1. It is specially designed to carry smaller commercial satellites into the low-earth orbit (LEO) from 200-2,000 km above the Earth's surface.
2. It is a three-stage Launch Vehicle and can carry a payload capacity of up to 500 kg.
3. It currently has the capacity to launch only nano-satellites.

Choose the correct code:

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



d) 1, 2 and 3

Q.7) Solution (a)

**Explanation:**

- **Small Satellite Launch Vehicles (SSLV)** are specially designed to carry smaller commercial satellites into **low-earth orbit (LEO)** from 200-2,000 km above the Earth's surface. **Hence, statement 1 is correct.**
- It is a **three-stage Launch Vehicle** and can carry a **payload capacity of up to 500 kg.** Hence, **statement 2 is correct.**
- **Nanosatellites, micro, and minisatellites** can be launched through SSLV. **Hence, statement 3 is incorrect.**

**Q.8) Consider the following statements about the LASER INTERFEROMETER GRAVITATIONAL-WAVE OBSERVATORY (LIGO) PROJECT**

1. It is an observatory for detecting COSMIC GRAVITATIONAL WAVES
2. The LIGO project operates THREE GRAVITATIONAL-WAVE (GW) DETECTORS.
3. The LIGO concept is built to test a component of Sir Isaac Newtons theory on 'law of motions.

Choose the correct code:

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

Q.8) Solution (c)

**Explanation:**

- **LASER INTERFEROMETER GRAVITATIONAL-WAVE OBSERVATORY (LIGO) PROJECT** is an observatory for detecting COSMIC GRAVITATIONAL WAVES AND FOR CARRYING OUT EXPERIMENTS IN ASTRONOMICAL STUDIES. **Hence, statement 1 is correct.**
- The LIGO project operates **THREE GRAVITATIONAL-WAVE (GW) DETECTORS AMONG WHICH** Two are at Hanford, Washington, and one is at Livingston in Louisiana. **Hence, statement 2 is correct.**





- The LIGO concept built upon early work by many scientists to test a component of Albert Einstein's theory of general relativity. **Hence, statement 3 is incorrect.**

**Q.9) Consider the following statements about Neutrinos**

1. They are the most abundant particles in the Universe.
2. The fruit Banana emits neutrinos due to radioactive decay.
3. The study of neutrinos helps in studying the origin of the universe.

Choose the correct code:

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

Q.9) Solution (d)

**Explanation:**

- **Neutrinos** are the **second most abundant particles in the Universe after photons**. They are produced in the **cores of stars**. **Hence, statement 1 is incorrect.**
- Every time atomic nuclei come together (like in the sun) or break apart (like in a nuclear reactor), they produce neutrinos. Even a banana emits neutrinos—they come from the natural radioactivity of the potassium in the fruit. **Hence, statement 2 is correct.**
- **The study of neutrinos helps in studying the origin of the universe** by understanding the oscillations of neutrinos and their relations with mass. **Hence, statement 3 is correct.**

**Q.10) Consider the following statements**

1. Unlike normal matter, dark matter does not absorb, reflect or emit light, making it extremely hard to spot.
2. The dark matter is more in abundance as compared to the dark energy in the universe
3. While dark matter attracts and holds galaxies together, dark energy repels and causes the expansion of the universe.

Choose the correct code:

- a) 1 and 2
- b) 1 and 3



- c) 2 and 3
- d) 1, 2 and 3

Q.10) Solution (b)

**Explanation:**

- **Dark matter is made up of particles that do not interact through electromagnetic interactions i.e. they do not have any charge.** So, these are dark particles, namely because they do not emit light, which is an electromagnetic phenomenon, and matter because they possess mass like normal matter and hence interact through gravity. Dark energy is an unknown form of energy that affects the universe on the largest scales. The first observational evidence for its existence came from measurements of supernovae, which showed that the universe does not expand at a constant rate and rather, the expansion of the universe is accelerating. **Hence, statement 1 is correct.**
- The universe is made of about **27% dark matter and 68% dark energy.** Hence, **statement 2 is incorrect.**
- While **dark matter attracts and holds galaxies together, dark energy repels and causes the expansion of the universe.** Hence, **statement 3 is correct.**

**Note:** Despite both components being invisible, we know a lot more about dark matter, since its existence was suggested as early as the 1920s, while dark energy wasn't discovered until 1998.

**Q.11) Consider the following statements**

1. The cosmic microwave background (CMB) is a faint cosmic background radiation filling all space that dates back to about 400,000 years after the Big Bang.
2. It is sometimes in rare conditions visible to the naked human eye.
3. CMB-Bharat is a proposal for comprehensive next-generation Cosmic Microwave Background (CMB) mission.

Choose the correct code:

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



Q.11) Solution (c)

**Explanation:**

- The **cosmic microwave background (CMB)** is a faint cosmic background radiation filling all space that dates back to about 400,000 years after the Big Bang. The CMB is useful to scientists because it helps us learn how the early universe was formed. It is at a uniform temperature with only small fluctuations visible. By studying these fluctuations, cosmologists can learn about the origin of galaxies. **Hence, statement 1 is correct.**
- **Today, the CMB radiation is very cold, only 2.725° above absolute zero, thus this radiation shines primarily in the microwave portion of the electromagnetic spectrum, and is invisible to the naked eye.**Hence, **statement 2 is incorrect.**
- **CMB-Bharat** is a proposal for comprehensive next-generation Cosmic Microwave Background (CMB) mission in international collaboration with major Indian contributions to revealing the first clear sign of quantum gravity in the very early universe. **Hence, statement 3 is correct.**

Q.12) Consider the following statements about the 'Large Hadron Collider(LHC)'

1. It is a giant, complex machine built to study particles that are the smallest known building blocks of all things.
2. In its operational state, it fires two beams of electrons almost at the speed of light in opposite directions inside a ring of superconducting electromagnets.
3. ATLAS is the largest general-purpose particle detector experiment at the LHC.
4. In the LHC's first run, the Higgs boson was discovered.

Choose the correct code:

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

Q.12) Solution (d)

**Explanation:**

- **The Large Hadron Collider** is a giant, complex machine built to study particles that are the smallest known building blocks of all things. It is **the world's most powerful particle collider.** **Hence, statement 1 is correct.**



- In its operational state, it **fires two beams of protons** almost at the speed of light in opposite directions inside a ring of superconducting electromagnets. The magnetic field created by the superconducting electromagnets keeps the protons in a tight beam and guides them along the way as they travel through beam pipes and finally collide.
- Just before the collision, another type of magnet is used to 'squeeze' the particles closer together to increase the chances of collisions. The particles are so tiny that the task of making them collide is akin to firing two needles 10 km apart with such precision that they meet halfway. **Hence, statement 2 is incorrect.**
- **ATLAS** is the largest general-purpose particle detector experiment at the LHC. **Hence, statement 3 is correct.**
- In the LHC's first run, the Higgs boson was discovered. The **Higgs boson** is the fundamental particle associated with the Higgs field, a field that gives mass to other fundamental particles such as electrons and quarks. **Hence, statement 4 is correct.**

**Q.13) Consider the following statements about the Hyperspectral Imaging Satellite (HysIS)**

1. It was launched by the National Aeronautics and Space Administration (NASA) to study the atmosphere of Earth.
2. Its primary goal is to study the Earth's surface in visible, near-infrared, and shortwave infrared regions of the electromagnetic spectrum.

Choose the correct code:

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

Q.13) Solution (b)

**Explanation:**

- **The Hyperspectral Imaging Satellite (HysIS)** was launched by the **Indian Space Research Organisation**. **Hence, statement 1 is incorrect.**
- Its primary goal is to study the **Earth's surface in visible, near-infrared, and shortwave infrared regions** of the electromagnetic spectrum. It can see in 55 spectral or colour bands from 630 km above the ground. Hyperspectral imaging allows the distinct identification of objects, materials, or processes on Earth by reading the spectrum for each pixel of a scene from space. It can be highly useful in marking out a suspect object or person and



separating it from the background. This could aid in detecting transborder or other stealthy movements. **Hence, statement 2 is correct.**

**Q.14) Recently in news, the term 'Tycho' refers to**

- a) Comet
- b) Meteoid
- c) Supernova
- d) Exoplanet

Q.14) Solution (c)

**Explanation:**

**Tycho is a Type Ia supernova**, which occurs when a white dwarf star shreds its companion star, triggering an explosion and sending debris hurtling into space at tremendous speeds. It released as much energy as the Sun would emit over ten billion years and blasted particles out into space near the speed of light. **Hence, option c is correct.**

**Note:** Imaging X-ray Polarimetry Explorer (IXPE) Space Observatory is a joint effort of NASA and the Italian Space Agency. It studies the **most extreme and mysterious objects in the universe – supernova remnants, supermassive black holes, and dozens of other high-energy objects.**

**Q.15) Consider the following statements about the Atacama Large Millimetre/submillimetre Array (ALMA) Telescope**

1. It is a state-of-the-art radio telescope that studies celestial objects at millimeter and submillimeter wavelengths.
2. It is built with an international partnership between India and Chile.

Choose the correct code:

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

Q.15) Solution (a)

**Explanation:**



- The **Atacama Large Millimetre/submillimetre Array (ALMA) Telescope** is a **state-of-the-art radio telescope** that studies celestial objects at **millimeter and submillimetre wavelengths**. they can penetrate through dust clouds and help astronomers examine dim and distant galaxies and stars out there. Ex: In 2015, the ALMA telescope helped scientists observe the **Einstein ring phenomenon**. **Hence, statement 1 is correct.**
- ALMA is an international partnership of the **European Southern Observatory (ESO)**, the **U.S. National Science Foundation (NSF)**, and the National Institutes of Natural Sciences (NINS) of **Japan**, together with NRC (**Canada**), MOST, and ASIAA (**Taiwan**), and KASI (Republic of **Korea**), in cooperation with the Republic of **Chile**. **Hence, statement 2 is incorrect.**

**Q.16) Consider the following statements**

1. Meteoroids are objects in space that range in size from dust grains to small asteroids and when they enter the Earth's atmosphere, they are called a meteorite.
2. If a meteoroid enters the Earth's atmosphere and hits the ground, it is called a meteor.

Choose the *incorrect* code:

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

Q.16) Solution (c)

**Explanation:**

The question asks for "incorrect code"

- **Meteoroids** are objects in space that range in size from dust grains to small asteroids and when they enter the Earth's atmosphere, they are called a **meteor**. **Hence, statement 1 is incorrect.**
- If a meteoroid enters the Earth's atmosphere and hits the ground, it is called a **meteorite**. **Hence, statement 2 is incorrect.**

**Note:** Aubrite meteorite was recently in news , is a **coarse-grained igneous rock that formed in oxygen-poor conditions and contains exotic minerals not found on Earth.**

**Q.17) Consider the following statements about Aditya-L1 Mission**

1. It is India's second solar mission after the first was partially successful in 2010.



2. It will study the Sun's corona, photosphere, chromosphere, solar emissions, solar winds and flares, and Coronal Mass Ejections (CMEs).
3. It will be launched using the most powerful launch vehicle, GSLV MK III of ISRO.

Choose the correct code:

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

Q.17) Solution (b)

**Explanation:**

- **Aditya-L1 Mission is India's first solar mission. Hence, statement 1 is incorrect.**
- It will study the **Sun's corona, photosphere, chromosphere, solar emissions, solar winds and flares, and Coronal Mass Ejections (CMEs)**. It will carry out round-the-clock imaging of the Sun. Hence, **statement 2 is correct.**
- It will be launched using the **Polar Satellite Launch Vehicle (PSLV)** with **seven payloads**. They are –
  - ✓ **Visible Line Emission Coronagraph (VELC)**
  - ✓ Solar Ultraviolet Imaging Telescope (SUIT)
  - ✓ Solar Low Energy X-ray Spectrometer (SoLEXS)
  - ✓ Aditya Solar wind Particle Experiment (ASPEX)
  - ✓ High Energy L1 Orbiting X-ray Spectrometer (HEL1OS)
  - ✓ Plasma Analyser Package for Aditya (PAPA)
  - ✓ Advanced Tri-axial High-Resolution Digital Magnetometers

Hence, **statement 3 is incorrect.**

**Q.18) Consider the following statements about the term 'Local Bubble'**

1. It is a large, low-density region in the interstellar medium (ISM) of our galaxy, the Milky Way.
2. It's a cavity is thought to have been created by a series of supernovae explosions that occurred about 30 to 50 million years ago.

Choose the correct code:

- a) 1 only
- b) 2 only



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

Q.18) Solution (c)

**Explanation:**

- The **Local Bubble** is a large, **low-density region in the interstellar medium (ISM) of our galaxy, the Milky Way**. It's a **1,000-light-year-wide** cavity that is thought to have been created by a series of supernovae explosions that occurred about 30 to 50 million years ago. **Hence, statement 1 is correct.**
- It's a cavity that is thought to have been **created by a series of supernovae explosions** that occurred about 30 to 50 million years ago. A supernova is a powerful and luminous explosion that occurs at the end of the life of a massive star. It is caused by the collapse of the core of the star, which can trigger a massive release of energy and are important for the enrichment of the interstellar medium with heavy elements and for the propagation of cosmic rays. **Hence, statement 2 is correct.**

**Q. 19) Consider the following statements**

1. The Kuiper Belt is a region of the solar system that exists beyond the inner planets, extending from the orbit of Jupiter.
2. The Asteroid Belt has the maximum number of known asteroids and is found between Mars and Jupiter in the solar system.

Choose the correct code:

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

Q.19) Solution (b)

**Explanation:**

- The **Kuiper Belt** is a region of the solar system that **exists beyond the eight major planets, extending from the orbit of Neptune**. **Hence, statement 1 is incorrect.**





- The **Asteroid Belt** has the maximum number of known asteroids and is found **between Mars and Jupiter** in the solar system. **Hence, statement 2 is correct.**

**Q.20) Consider the following statements about the Indian Data Relay Satellite System (IDRSS)**

1. It helps to track and be constantly in touch with Indian satellites, in particular to those in the low earth orbits.
2. Currently, only the US and Russia have their own data relay satellite systems.

Choose the correct code:

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

Q.20) Solution (a)

**Explanation:**

- The **Indian Data Relay Satellite System (IDRSS)** helps to track and be constantly in touch **with Indian satellites**, in particular those in **low-earth orbits**. It is an Indian geostationary data relay satellite system consisting of two geostationary satellites. IDRSS will facilitate the relay of information between various Indian spacecraft, in-flight launch vehicle monitoring, and assist Indian Human Spaceflight Programme. **Hence, statement 1 is correct .**
- Currently, the **US, Russia, China, and Europe** have their data relay satellites. **Hence, statement 2 is incorrect.**

**Q. 21) Consider the following statements about Multiple Independent Reentry Vehicle (MIRV)**

1. It is an exoatmospheric ballistic missile payload containing several warheads.
2. Each warhead is capable of being aimed to hit a different target
3. The Soviet Union was the first country to develop MIRV technology

Which of the statements given above are correct?

- a) 1 and 2
- b) 2 and 3
- c) 1 and 3



d) 1, 2 and 3

Q.21) Solution (a)

**Explanation:**

- A multiple independently targetable reentry vehicle (MIRV) is an exoatmospheric ballistic missile payload containing several warheads, each capable of being aimed to hit a different target. **Hence statement 1 and 2 are correct .**
- The United States was the first country to develop MIRV technology, deploying a MIRVed Intercontinental Ballistic Missile (ICBM) in 1970 and a MIRVed Submarine-Launched Ballistic Missile (SLBM) in 1971. The Soviet Union quickly followed suit and by the end of the 1970s had developed their own MIRV-enabled ICBM and SLBM technology. **Hence statement 3 is incorrect.**

**Q. 22) Consider the following statements**

1. Israel has become a major supplier of defence equipment to India
2. Barak 8 a long range surface to air missile was jointly developed by India's Defence Research & Development Organisation (DRDO) and Israel Aerospace Industries (IAI).

Choose the correct code:

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

Q.22) Solution (c)

**Explanation:**

- Israel has become a major supplier of defence equipment to India, standing second to Russia on a few occasions. As per the data furnished by the Indian Ministry of Defence (MoD) Israel was ahead of Russia in the year 2013–2014 and 2015–2016, in terms of signing defence contracts with India. **Hence statement 1 is correct .**
- Barak 8 was jointly developed by India's Defence Research & Development Organisation (DRDO) and Israel Aerospace Industries (IAI). The Barak 8 missile defence system is produced by Israel's Directorate of Research and Development (DDR&D), Elta Systems, Rafael Advanced Defense Systems and India's Bharat Dynamics limited (BDL). **Hence statement 2 is correct.**

**Q. 23) Consider the following statements regarding Light Combat Aircraft Tejas Mk2**

1. It's mission endurance for fighting a war is 300 minutes
2. It is specifically designed to carry only air-to-air weapons.



Choose the correct code:

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

Q.23) Solution (d)

**Explanation:**

- The Tejas Mk2 is a fighter aircraft developed in India that can carry **eight Beyond-Visual-Range (BVR) missiles simultaneously**. It is an upgraded version of the LCA Tejas Mk1, which has improved range and mission endurance. The mission endurance for fighting a war was 57 minutes for LCA Tejas Mk1, but it is 120 minutes for LCA Tejas Mk2. **Hence statement 1 is incorrect.**
- The Light Combat Aircraft is designed to carry only air-to-air **air-to-surface, precision-guided**, weapons. It has the air-to-air refuelling capability. **Hence statement 2 is incorrect.**
- The **LCA** programme was started by the Government of India in 1984 and the **Aeronautical Development Agency (ADA)** manages it.

**Q. 24) Consider the following statements about the Kalashnikov AK 203 Rifle**

1. It is the **most advanced version** of the AK-47 rifle.
2. It cannot be used in high altitudes.
3. It is jointly produced by India and Ukraine.

Choose the correct code:

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

Q.24) Solution (a)

**Explanation:**

- AK 203 Rifle is the **most advanced version** of the AK-47 rifle. **Hence statement 1 is correct.**
- It is expected to replace the Indian Small Arms System (INSAS) 5.56×45 mm assault rifle, which is presently being used by Army, Navy and Air Force besides other security forces. INSAS rifles are not suitable for use at high altitudes. Several other issues with these rifles include gun jamming, oil leakage etc. Thus AK 203 will replace them as they can be used in high altitudes. **Hence statement 2 is incorrect.**



- It is jointly produced by India and Russia. They had inked an agreement in **2021 for the procurement of AK 203 assault rifles** through Korwa Ordnance Factory in Uttar Pradesh's Amethi district. The deal has a clause for complete technology transfer and the rifles will also be exported to friendly foreign nations. **Hence statement 3 is incorrect.**

**Q. 25) Consider the following statements**

1. The S-400 Triumf is a mobile, air-to-air missile system (SAM) designed by Russia.
2. The Terminal High Altitude Area Defense (THAAD) is a transportable, ground-based anti-ballistic missile defence system designed by the USA.
3. Iron dome air defence system was developed by USA and is deployed in Israel

Choose the correct code:

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

Q.25) Solution (b)

**Explanation:**

- The S-400 Triumf is a mobile, surface-to-air missile system (SAM) designed by Russia. **Hence statement 1 is incorrect.**
- The S-400 Triumf is the most dangerous operationally deployed modern long-range SAM (MLR SAM) in the world. **can engage all types of aerial targets** including aircraft, unmanned aerial vehicles (UAV), and ballistic and cruise missiles within a range of 400km, at an altitude of up to 30km.
- **The Terminal High Altitude Area Defense (THAAD) is a transportable, ground-based anti-ballistic missile** defence system designed by the USA. **Hence statement 2 is correct.**
- It was developed by the state-run Rafael Advanced Defense Systems and Israel Aerospace Industries and was deployed in 2011. Rafael claims a success rate of over 90%, with more than 2,000 interceptions, however experts agree the success rate is over 80%. **Hence statement 3 is incorrect**

**Q. 26) Consider the following statements about iDEX**

1. It aims to support projects requiring support beyond Rs. 10 crores up to Rs. 100 crores.
2. It is an ecosystem to foster innovation & technology development in defence and aerospace by engaging innovators & entrepreneurs.
3. It provides funding/grants to Micro Small and Medium Enterprises (MSMEs), start-ups, individual innovators, R&D institutes, and academia.



Choose the correct code:

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

Q.26) Solution (b)

**Explanation:**

- iDEX aims to support projects requiring support beyond Rs. 1.5 crores up to Rs. 10 crores. Hence statement 1 is incorrect.
- iDEX was launched to provide wider publicity and better visibility of iDEX activities and enable more efficient running of future challenges through better information management.
- It is an ecosystem to foster innovation & technology development in defence and aerospace by engaging innovators & entrepreneurs. Hence statement 2 is correct.
- It provides funding/grants to Micro Small and Medium Enterprises (MSMEs), start-ups, individual innovators, R&D institutes, and academia. Hence statement 3 is correct.

**Q. 27) Consider the following statements regarding the Integrated Guided Missile Development Programme (IGMDP)**

1. Prithvi is a short-range surface-to-surface ballistic missile.
2. Trishul is a long-range surface-to-air missile.
3. Akash is air to surface ballistic missile
4. Agni is an intermediate-range surface-to-surface ballistic missile.

Choose the correct code:

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

Q.27) Solution (d)

**Explanation:**

The Integrated Guided Missile Development Programme (IGMDP) brought together the country's scientific community, academic institutions, R&D laboratories, industries and the three defence services in giving shape to the strategic, indigenous missile systems. It formally got the approval of the Indian government on July 26, 1983. It was the brainchild of renowned scientist Dr APJ Abdul Kalam and was intended to attain self-sufficiency in the field of missile technology.



The missiles developed under IGMDP are -

- Prithvi is a short-range surface-to-surface ballistic missile. **Hence statement 1 is correct.**
- Trishul is a short-range low-level surface-to-air missile. **Hence statement 2 is incorrect.**
- Akash is a medium-range surface-to-air missile. **Hence statement 3 is incorrect.**
- Agni is an intermediate-range surface-to-surface ballistic missile. **Hence statement 4 is correct.**

**Q. 28) Consider the following statements**

1. The Defence Research and Development Organisation (DRDO) was established in 1958.
2. The Indian Space Research Organisation (ISRO) was established in 1947.
3. The Department of Space (DoS) was established in 1972.

Choose the correct code:

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

Q.28) Solution (c)

**Explanation:**

- DRDO is the **Research and Development wing of the Ministry of Defence** with a vision **to empower India with cutting-edge defence technologies**. DRDO was formed in 1958 from the amalgamation of the then-already functioning Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) with the Defence Science Organisation (DSO). **Hence statement 1 is correct.**
- The Indian Space Research Organisation (ISRO) was established in 1969. ISRO is the space agency under the Department of Space of the Government of India, headquartered in the city of Bengaluru, Karnataka. ISRO's vision is to harness space technology for national development while pursuing space science research and planetary exploration. **Hence statement 2 is incorrect.**
- The Department of Space was established in 1972. Its primary objective of promoting the development and application of space science and technology to assist in the all-around development of the nation. **Hence statement 3 is correct.**

**Q. 29) Consider the following statements**

1. Ballistic missile travel in projectile motion whereas Cruise missile travel in a straight line.
2. Ballistic missiles are short-range missiles whereas Cruise missiles are long-range missiles.
3. Cruise missiles are easy to detect as compared to Ballistic missiles due to their trajectory



Choose the correct code:

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

Q.29) Solution (a)

**Explanation:**

- **Ballistic** missile travel in projectile motion whereas Cruise missile travel in a straight line. **Hence statement 1 is correct.**
- Ballistic missiles are long-range missiles (300km to 12,000km) whereas Cruise missiles are short-range missiles (up to 1000km). **Hence statement 2 is incorrect.**
- Cruise missiles remain within the atmosphere for the duration of their flight and can fly as low as a few meters off the ground. Flying low to the surface of the earth expends more fuel but makes a cruise missile very difficult to detect. On other hand ballistic missiles as they fly at very high altitude are easy to detect. **Hence statement 3 is incorrect.**

**Q. 30) Consider the following statements about the Biological Weapons Convention 1975**

1. It prohibits the development, production, acquisition, transfer, stockpiling, and use of biological and toxin weapons.
2. India is not a signatory to this convention as it seen as discriminatory in nature
3. It was the first multilateral disarmament treaty banning an entire category of Weapons of Mass Destruction (WMD).

Choose the correct code:

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

Q.30) Solution (c)

**Explanation:**

- The Biological Weapons Convention prohibits the development, production, acquisition, transfer, stockpiling, and use of biological and toxin weapons. **Hence statement 1 is correct.**

- India is a signatory to the Convention. Rather India is not a signatory to Non Proliferation Treaty as it is seen as discriminatory to developing nations. **Hence statement 2 is incorrect.**
- It was the first multilateral treaty banning weapons of mass destruction. It is in force since 1975. **Hence statement 3 is correct.**

**Q. 31) Which of the following is/are applications of drones?**

1. Mapping of landslide areas
2. Aerial photography of journalism
3. Disaster management
4. Border control surveillance
5. Forecasting storms and hurricanes
6. Crop damage assessment
7. Inspection of active volcanoes

Choose the correct code:

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

Q.31) Solution (d)

**Explanation:**

Applications of drones -

- Mapping of landslide areas
- Aerial photography of journalism
- Disaster management
- Border control surveillance
- Forecasting storms and hurricanes
- Crop damage assessment
- Inspection of active volcanoes

**Hence option d is correct.**

**Q. 32) Consider the following statements about the Agni IV Missile**

1. It is a nuclear-capable intercontinental ballistic missile.
2. It is a surface-to-air missile with a strike range of 10000 km

Choose the correct code:

- a) 1 only





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

Q.32) Solution (d)

**Explanation:**

- The Agni IV Missile is a nuclear-capable but not an intercontinental ballistic missile. It is developed by DRDO. **Hence statement 1 is incorrect.**
- It is a surface-to-surface missile with a strike range of 4,000km. It is a two-stage missile and its re-entry heat shield can withstand the temperature of over 4,000°. **Hence statement 2 is incorrect.**

**Q. 33) Consider the following statements Mission Shakti Anti Satellite Weapons Test**

1. It was a joint collaboration of the DRDO and ISRO.
2. It struck a predetermined target orbiting at a distance of 30000 km from the Earth's surface.
3. India became only the fourth country to carry out an anti-satellite missile test.

Choose the correct code:

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

Q.33) Solution (c)

**Explanation:**

- Mission Shakti is a joint programme of the Defence Research and Development Organisation (DRDO) and the Indian Space Research Organisation (ISRO). **Hence statement 1 is correct.**
- It struck a predetermined target which was a redundant Indian satellite that was orbiting at a distance of 300 km from the Earth's surface. As per official sources, the satellite that had been knocked out was Microsat R, a micro-satellite launched by ISRO in January, 2019. **Hence statement 2 is incorrect.**
- The first anti-satellite test (ASAT) was carried out by the US military way back in 1959. The then Soviet Union followed a year later. Thereafter, the two countries carried out a series of such tests up till early 1980s. After that there was a lull, broken only by the Chinese test in 2007. India became only the fourth country to carry out an anti-satellite missile test. **Hence statement 3 is correct.**



**Q. 34) Consider the following statements about the 'DUSTLIK'**

1. It is a naval exercise between India and Sri Lanka.
2. It focuses on joint counter-terrorist operations in mountainous areas.
3. The first edition of this exercise was held in 2019.

Choose the correct code:

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

Q.34) Solution (b)

**Explanation:**

- The DUSTLIK is a military exercise between India and Uzbekistan. **Hence statement 1 is incorrect.**
- It's a 14-day long joint exercise that focuses on joint counter-terrorist operations in the mountainous and semi-urban scenario under the UN mandate and will include field training exercises, combat discussions, lectures, and demonstrations and culminate with a validation exercise. **Hence statement 2 is correct.**
- Both sides will jointly train, plan and execute a series of tactical drills for the neutralisation of likely threats while learning to exploit new-generation equipment and technology for conducting joint operations.
- The first edition of this exercise was held in 2019. It was held in Uzbekistan. **Hence statement 3 is correct.**
- It recently took place in Foreign Training Node, Pithoragarh (Uttarakhand).

**Q. 35) Consider the following statements**

1. India has conducted one nuclear test since independence.
2. India adopted a doctrine of 'No First Use' (NFU) in 1975 after its first test.
3. India is yet to achieve its nuclear triad

Choose the correct code:

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

Q.35) Solution (d)

**Explanation:**



- India has conducted two nuclear tests since its independence. Its **first nuclear test was in 1974** and the **second nuclear test was in 1998. Hence statement 1 is incorrect.**
- India adopted a **doctrine of 'No First Use' (NFU)** of nuclear weapons in January 2003. **Hence statement 2 is incorrect.**
- It states that **India will use the weapon only in retaliation to a nuclear attack on Indian territory or against Indian forces anywhere.**
- The nuclear triad is a three-sided military-force structure consisting of land-launched nuclear missiles, nuclear-missile-armed submarines, and strategic aircraft with nuclear bombs and missiles. India has achieved its nuclear triad in 2018. **Hence statement 3 is incorrect.**

**Q. 36) Consider the following statements**

1. The project BOLD-QIT under the CIBMS (Comprehensive Integrated Border Management System) aims to install technical systems on Indo-Bangla border.
2. The CIBMS is a robust system which seamlessly integrates human resources, weapons, and high-tech surveillance equipment.

Choose the correct code:

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

Q.36) Solution (c)

**Explanation:**

- The project **BOLD-QIT** under the **CIBMS (Comprehensive Integrated Border Management System)** aims to install technical systems in Indo-Bangla borders. **Hence statement 1 is correct.**
- It equips with **different kinds of sensors in the unfenced riverine area of the Brahmaputra and its tributaries.**
- The CIBMS is a robust system which seamlessly integrates human resources, weapons, and high-tech surveillance equipment. **Hence statement 2 is correct.**
- CIBMS is being implemented since 2016 and has three components which are using several different devices for surveillance, efficient and dedicated communication network and data storage for a composite picture.

**Q. 37) Consider the following statements about Multilateral Export Control Regimes (MECR)**

1. These are independent of the United Nations and their regulations apply only to members.
2. The Nuclear Suppliers Group and the Australia Group are two such MECRs.



3. India is a member of Nuclear Supplier Group and Australia Group .

Choose the correct code:

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

Q.37) Solution (b)

**Explanation:**

- Multilateral Export Control Regimes (MECR) are independent of the United Nations and their regulations apply only to members. **Hence statement 1 is correct.**
- The Nuclear Suppliers Group and the Australia Group are two of the four such MECRs. The other two are the Wassenaar Agreement and the Missile Technology Control Regime. **Hence statement 2 is correct .**
- India is a member of the three MECRs. India is not a member of the Nuclear Suppliers Group. **Hence statement 3 is incorrect.**
- The Nuclear Suppliers Group (NSG), for the control of nuclear-related technology.
- The Australia Group (AG) for control of chemical and biological technology that could be weaponized.
- The Missile Technology Control Regime (MTCR) for the control of rockets and other aerial vehicles capable of delivering weapons of mass destruction.
- The Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies.

**Q. 38) Consider the following statements about Operation Namkeen**

- 1. It was launched to interdict narcotic drugs.
- 2. It was launched by the Directorate of Revenue Intelligence (DRI).

Choose the correct code:

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

Q.38) Solution (c)

**Explanation:**

- **Operation Namkeen** was launched to interdict narcotic drugs. **Hence statement 1 is correct.**
- **It was launched by the Directorate of Revenue Intelligence (DRI). Hence statement 2 is correct.**
- DRI is an Indian intelligence agency, an anti-smuggling intelligence, investigations and operations agency. It Functions under Ministry of Finance. DRI is run by officers from the Central Board of Indirect Taxes and Customs (CBIC).
- DRI works to secure India's national and economic security by preventing the outright smuggling of contraband such as firearms, gold, narcotics, fake Indian Currency notes, antiques, wildlife and environmental products.

**Q. 39) Consider the following statements about the 'Thermonuclear Bomb'**

1. Its primary stage is a nuclear fusion reaction while secondary stage is of nuclear fission reaction.
2. They are less powerful when compared to atomic bombs.
3. The first full-scale thermonuclear test was carried out by the United States.

Choose the correct code:

- a) 1 only
- b) 2 only
- c) 3 only
- d) None

Q.39) Solution (c)

**Explanation**

- Modern fusion weapons consist essentially of two main components: a nuclear fission primary stage and a separate nuclear fusion secondary stage containing thermonuclear fuel: the heavy hydrogen isotopes deuterium and tritium, or in modern weapons lithium deuteride. For this reason, thermonuclear weapons are often colloquially called hydrogen bombs or H-bombs **Hence statement 1 is incorrect.**
- The uncontrolled chain reaction that is self-sustaining under high temperatures takes place through a **process known as nuclear fusion.**
- Thermonuclear bombs are also called hydrogen bombs as the fuel used is isotopes of hydrogen.
- The atomic bomb gets its destructive property from nuclear fission reactions or the combination of nuclear fission or fusion reactions.
- **Nuclear fission** is a process in which the nucleus of an atom splits into two or smaller nuclear fission products and usually some by-product particles.
- They are more powerful when compared to atomic bombs. **Hence statement 2 is incorrect.**



- The first full-scale thermonuclear test was carried out by the United States in 1952; the concept has since been employed by most of the world's nuclear powers in the design of their weapons. **Hence statement 3 is correct.**

**Q. 40) Consider the following statements**

1. INS Tarkash is a Talwar-class frigate.
2. INS Vikrant is India's second indigenously developed aircraft carrier.
3. INS Vishal is India's first indigenously developed aircraft carrier.

Choose the correct code:

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

Q.40) Solution (a)

**Explanation:**

- INS Tarkash is a Talwar-class frigate. **Hence statement 1 is correct.**
- INS Vikrant is India's first indigenously developed aircraft carrier. **Hence statement 2 is incorrect.**
- INS Vishal is India's second indigenously developed aircraft carrier. **Hence statement 3 is incorrect.**

**Q. 41) Consider the following statements**

1. A genome contains all the information needed for an individual to develop and function.
2. Humans have 22 pairs of autosomes and 1 pair of sex chromosomes
3. Gene is the basic physical and functional unit of heredity.

Choose the correct code

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

Q.41) Solution (d)

**Explanation:**



- The genome is the entire set of DNA instructions found in a cell. In humans, the genome consists of 23 pairs of chromosomes located in the cell's nucleus, as well as a small chromosome in the cell's mitochondria. A genome contains all the information needed for an individual to develop and function. **Hence statement 1 is correct.**
- Chromosomes are long molecules of DNA found in the nucleus. Chromosomes are structures that look like thread, which live in the nucleus (center) of cells. One molecule of DNA and one protein make up one chromosome. Chromosomes are different sizes, and proteins called histones allow them to pack up small enough to fit in a nucleus.
- Humans have 23 pairs of chromosomes (46 total). Chromosomes divide into 22 numbered pairs (autosomes) and one pair of sex chromosomes (X and Y). You receive one chromosome from each parent to make a pair. **Hence statement 2 is correct.**
- Gene is the basic physical and functional unit of heredity. Genes are hereditary markers from which we derive various characteristics like skin color, height, etc. More technically, each DNA molecule consists of sequences of Genes. Each gene is a particular set of instructions for specific functions. **Hence statement 3 is correct.**

**Q. 42) Consider the following statements**

1. Eukaryotes have a unicellular cell structure, while prokaryotes have a multicellular cell structure
2. Prokaryotes have circular DNA, while eukaryotes have linear DNA
3. Prokaryotes do not have a nucleus, while eukaryotes have a nucleus
4. Eukaryotes have cell organelles, while in prokaryotes these are absent

Choose the correct code:

- a) Only one statement is correct
- b) Two statements are correct
- c) Three statements are correct
- d) Four statements are correct

Q.42) Solution (b)

**Explanation:**

| Characteristics | Prokaryotes | Eukaryotes           |
|-----------------|-------------|----------------------|
| Cell Structure  | Unicellular | Multicellular (most) |



|                 |        |          |
|-----------------|--------|----------|
| Cell Organelles | Absent | Present  |
| DNA             | Linear | Circular |
| Nucleus         | Absent | Present  |
| Cell Size       | Small  | Large    |

Hence option b is correct.

**Q. 43) Consider the following statements**

1. Gene Therapy involves altering genes inside one's body to treat diseases.
2. Gene Doping refers to altering medical reports of athletes without any genetic changes
3. Jumping genes are sequences of DNA that move from one location in the genome to another.

Choose the correct code:

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

Q.43) Solution (a)

**Explanation:**

- Gene Therapy involves altering genes inside one's body to treat diseases.
- It can work by several mechanisms:
  - ✓ Replacing a disease-causing gene with a healthy copy of the gene
  - ✓ Inactivating a disease-causing gene that is not functioning properly
  - ✓ Introducing a new or modified gene into the body to help treat a disease
- There are two types of gene therapy:
  - ✓ **Somatic Gene Therapy:** Effects will not be transferred to next generation
  - ✓ **Germline Gene Therapy:** Effects transferred to next generation

Hence statement 1 is correct.





- Gene or cell doping is defined by the World Anti-Doping Agency (WADA) as "the non-therapeutic use of genes, genetic elements and/or cells that have the capacity to enhance athletic performance". **Hence statement 2 is incorrect.**
- Transposable elements (TEs), also known as "jumping genes" or transposons, are sequences of DNA that move (or jump) from one location in the genome to another. Maize geneticist Barbara McClintock discovered TEs in the 1940s, and for decades thereafter, most scientists dismissed transposons as useless or "junk" DNA. McClintock, however, was among the first researchers to suggest that these mysterious mobile elements of the genome might play some kind of regulatory role, determining which genes are turned on and when this activation takes place **Hence statement 3 is correct .**

**Q. 44) Which of the following are the uses of DNA fingerprinting?**

1. Anthropological Studies
2. Pedigree Analysis
3. Forensic Analysis
4. DNA Barcoding
5. Personal Identification

Choose the correct code:

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

Q.44) Solution (d)

**Explanation:**

- DNA fingerprinting is a procedure that shows the hereditary cosmetics of living things. It is a strategy for finding the distinction between the satellite DNA areas in the genome.
- Sources of DNA:
  - hair
  - bone
  - teeth
  - saliva
  - blood



Uses of DNA Fingerprinting:

- ✓ **Forensic analysis:** It can be used in the identification of a  
(1) a person involved in criminal activities,  
(2) for settling paternity or maternity disputes, and  
(3) in determining relationships for immigration purposes.
- ✓ **Pedigree analysis:** It can be used for the inheritance pattern of genes through generations and for detecting inherited diseases such as Cystic Fibrosis, Haemophilia, Huntington's Disease, Sickle Cell Anaemia, etc.
- ✓ **Personal Identification:** DNA fingerprints can be used as a genetic barcode to identify individuals.
- ✓ **Anthropological studies:** It is useful in determining the origin and migration of human populations and genetic diversities.
- ✓ **DNA Barcoding:** A technique for specifying the organisms' species using a short sequence of DNA situated in the genome is termed DNA bar-coding. The barcode DNA sequences are too short concerning the complete genome and hence cheaper.

Hence option d is correct.

**Q. 45) Consider the following statements about Intentional Genomic Alteration (IGA)**

1. It refers to making specific changes to the genome of the organism using modern molecular technologies.
2. Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) is one of the technologies used in it.

Choose the correct code:

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

Q.45) Solution (c)

**Explanation:**

- **Intentional Genomic Alteration (IGA)** refers to making specific changes to the genome of the organism using modern molecular technologies which are popularly referred to as "genome editing" or "genetic engineering".



- **Genome editing** is a group of technologies that give scientists the ability to change an organism's **Deoxyribonucleic Acid (DNA)**.
- An IGA is inserted into an animal to change or alter its structure and function.
- These technologies allow genetic material to be **added, removed, or altered at particular locations** in the genome. **Hence statement 1 is correct.**
- **Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)** is one of the technologies used in it.
- It replicates natural defence mechanisms in bacteria to fight virus attacks, using a **special protein called Cas9. Hence statement 2 is correct**

**Q. 46) Consider the following statements about genetic disorders**

1. Thalessemia is a blood disorder that reduces the production of haemoglobin.
2. Cystic fibrosis is characterized by weakness and wasting in muscles.
3. Sickle cell anaemia is a genetic disease of the red blood cells (RBCs).
4. Spinal muscular atrophy is characterized by severe damage to the lungs and digestive system.

Choose the correct code:

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

Q.46) Solution (c)

**Explanation:**

- **Thalassemia** is a blood disorder that reduces the production of haemoglobin.
- It is a genetic blood disorder that causes the body to have less haemoglobin than normal. Haemoglobin enables red blood cells to carry oxygen. Thalassemia can cause anaemia, leading to fatigue. **Hence statement 1 is correct.**
- **Cystic fibrosis** is characterized by severe damage to the lungs and digestive system.
- Cystic fibrosis is an inherited disease characterized by the buildup of thick, sticky mucus that can damage many of the body's organs. The disorder's most common signs and symptoms include progressive damage to the respiratory system and chronic digestive system problems. **Hence statement 2 is incorrect.**
- **Sickle cell anaemia** is a genetic disease of the red blood cells (RBCs).



- It is an inherited disease caused by defects, called mutations, in the beta globin gene that helps make haemoglobin. The red blood cells become hard and sticky and look like a C-shaped farm tool called a “sickle”. The sickle cells die early, which causes a constant shortage of red blood cells. **Hence statement 3 is correct.**
- **Spinal muscular atrophy** is characterized by weakness and wasting in muscles.
- It is a rare genetic disease. The person suffering from this disease cannot control the movement of their muscles.
- It is caused by the loss of nerve cells that carry electrical signals from the brain to the muscles. **Hence statement 4 is incorrect.**

**Q. 47) With reference to three-parent baby, consider the following statements**

1. It replaces faulty DNA in the mother’s egg with healthy DNA from the second woman.
2. It helps in prohibiting certain genetic diseases from being passed on to children.
3. World’s first three parent baby was given birth in Mexico in year 2016.

Choose the correct code:

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

Q.47) Solution (c)

**Explanation:**

- A three-parent baby refers to when a baby is born from the DNA of two mothers and one father.
- It replaces faulty DNA in the mother’s egg with healthy DNA from the second woman through the use of assisted reproductive technologies, specifically mitochondrial manipulation technologies and in-vitro fertilization.
- It is also known as Maternal Spindle Transfer. **Hence statement 1 is correct.**
- It helps in prohibiting certain genetic diseases from being passed on to children.
- This technique specifically helps mothers who are suffering from mitochondrial disorders. **Hence statement 2 is correct.**
- The world’s first three-parent baby boy was born in Mexico in 2016 to a Jordanian couple with the help a controversial new fertility technique that incorporates DNA from three people in the embryo. The ‘three-parent’ technique also known as Mitochondrial donation



(Mitochondrial Replacement Therapy) allows parents with rare genetic mutations to have healthy babies. **Hence statement 3 is correct.**

**Q. 48) Consider the following statements**

1. Nuclear Fusion is the fusing of two or more lighter atoms into larger ones.
2. Nuclear Fission is the splitting of a large atom into smaller ones.
3. The energy released by the fission reaction is more than the fusion reaction.
4. Nuclear fusion occurs readily in nature, however natural nuclear fission is a rare event.

Choose the correct code:

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

Q.48) Solution (d)

**Explanation:**

- Nuclear Fusion is the fusing of two or more lighter atoms into larger ones. **Hence statement 1 is correct.**
- Nuclear Fission is the splitting of a large atom into smaller ones. **Hence statement 2 is correct.**
- The energy released by the fusion reaction is more than the fission reaction.
- The energy released by the nuclear fusion reaction is three to four times greater than the energy released by the nuclear fission reaction. **Hence statement 3 is incorrect.**
- Both nuclear fusion and fission occur in nature. Nuclear fusion powers stars, including our sun, while nuclear fission occurs in some radioactive isotopes, such as uranium-235 and plutonium-239, which decay by fission. However, natural nuclear fission is a rare event, and most fission reactions occur as a result of human activity, such as in nuclear power plants or nuclear weapons. **Hence statement 4 is correct .**
- Nuclear fission requires little energy to split two atoms whereas the nuclear fusion reaction requires extremely high energy to fuse two or more atoms.
- A nuclear fusion reaction is used in nuclear plants whereas nuclear fusion is still an experimental technique used for producing power.



**Q. 49) Consider the following statements about the Genetic Engineering Appraisal Committee (GEAC)**

1. It is the apex body in India that allows for the commercial release of GM crops.
2. It functions under the Ministry of Science and Technology, Government of India.
3. It is chaired by the Prime Minister and co-chaired by a representative from the Department of Biotechnology (DBT).
4. It is responsible for the appraisal of activities involving large-scale use of hazardous microorganisms and recombinants.

Choose the correct code:

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

Q.49) Solution (d)

**Explanation:**

- The **Genetic Engineering Appraisal Committee (GEAC)** is the apex body in India that allows for the commercial release of GM crops. **Hence statement 1 is correct.**
- It functions under the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India. **Hence statement 2 is incorrect.**
- It is chaired by the Special Secretary/Additional Secretary of MoEF&CC and co-chaired by a representative from the Department of Biotechnology (DBT). **Hence statement 3 is incorrect.**
- It is **responsible for the appraisal of activities** involving large-scale use of hazardous microorganisms and recombinants in research and industrial production from the environmental angle. **Hence statement 4 is correct.**
- It is also responsible for the appraisal of proposals relating to the release of genetically engineered (GE) organisms and products into the environment including experimental field trials.
- It evaluates research into GM plants and recommends, or disapproves, their release into farmer fields.

**Q. 50) Consider the following statements about types of radioactivity**



1. Alpha decay is when a nucleus decays spontaneously by emitting an electron or a positron.
2. Beta decay is when a nucleus decays spontaneously by emitting a proton or a neutron.
3. Gamma decay is when a nucleus decays spontaneously by emitting electromagnetic radiation.

Choose the correct code:

- a) 1 only
- b) 2 only
- c) 3 only
- d) None

Q.50) Solution (c)

**Explanation:**

- Radioactivity is defined as a phenomenon where an element emits radiation due to an unstable nucleus.
- Alpha decay is when a nucleus decays spontaneously by emitting a proton or a neutron. **Hence statement 1 is incorrect.**
- Beta decay is when a nucleus decays spontaneously by emitting an electron or a positron.
- Two types of beta decay can occur.
  - ✓ One type (positive beta decay) releases a positively charged beta particle called a positron, and a neutrino;
  - ✓ The other type (negative beta decay) releases a negatively charged beta particle called an electron and an antineutrino.

**Hence statement 2 is incorrect.**

- Gamma decay is when a nucleus decays spontaneously by emitting electromagnetic radiation.
- In this type of radioactivity, some unstable atomic nuclei dissipate excess energy by a spontaneous electromagnetic process.
- In the most common form of gamma decay, known as gamma emission, gamma rays (photons, or packets of electromagnetic energy, of extremely short wavelength) are radiated. **Hence statement 3 is correct.**

**Q. 51) Consider the following statements about Fast Neutron Reactors**

1. They contain neutron moderator materials that cause slowdown of neutrons.



2. They use fast neutrons to cause fission in their fuel.
3. They require fuel to be more highly enriched in fissile material.

Choose the correct code:

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

Q.51) Solution (b)

**Explanation:**

- Fission reactors can be divided roughly into two classes, depending on the energy of the neutrons that sustain the fission chain reaction: thermal reactors and fast neutron reactors.
- Thermal reactors contain neutron **moderator** materials that slow neutrons. The moderator is often also the coolant, usually water under high pressure.
- **Fast Neutron Reactors do not use neutron moderator materials to slow down neutrons as they use fast neutrons (neutrons with high energy levels) to cause fission in their fuel. In Fast Neutron Reactors, the neutrons produced by fission are not slowed down, as slowing down neutrons reduces their ability to cause fission. Hence Statement 1 is incorrect**
- **Fast Neutron Reactors use fast neutrons to cause fission in their fuel. Statement 2 is correct.**
- They require fuel to be more **highly enriched in fissile material (about 20% or more) to maintain a chain reaction** due to the relatively lower probability of fission. **They have the potential to produce less radioactive waste** because all fissile is fissionable with fast neutrons as the fuel is **highly enriched in fissile material. Hence statement 3 is correct.**

**Q. 52) The function of control rods in a nuclear reactor is to**

- a) Absorb neutrons
- b) Slow down the speed of neutrons
- c) Cool down the reactor
- d) Increase the speed of neutrons

Q.52) Solution (a)





**Explanation:**

- Control rods are an essential safety feature in nuclear reactors. They are made of a material that can absorb neutrons, such as boron, cadmium, or hafnium. When inserted into the reactor core, they can help regulate the nuclear reaction by absorbing excess neutrons and slowing down the rate of fission.
- By absorbing neutrons, control rods can help prevent the reactor from overheating and potentially causing a nuclear meltdown. They can also be used to shut down the reactor entirely in case of an emergency. **Hence option a is correct.**
- **A moderator is a substance used to slow down fast-moving neutrons, making them more likely to cause fission in the fuel rods. The most commonly used moderator is water, but other materials such as graphite or heavy water (deuterium oxide) can also be used. By slowing down the neutrons, the moderator increases the likelihood of a successful fission reaction. Hence option b is incorrect.**
- **A coolant is a substance used to remove the heat generated by the fission reaction in the fuel rods. The most commonly used coolant is water, but other substances such as helium or liquid sodium can also be used. As the fuel rods undergo fission, they generate a large amount of heat. If this heat is not removed, the reactor can overheat and potentially lead to a meltdown. The coolant circulates through the reactor, absorbing the heat and carrying it away from the fuel rods to a heat exchanger, where it can be used to produce steam for generating electricity. Hence option c is incorrect.**
- **Speed of neutrons is slowed down and not increased in a reactor for effective reaction. Hence option d is incorrect.**

**Q. 53) Consider the following statements**

1. International Thermonuclear Experimental Reactor aims to build the world's largest tokamak to prove the feasibility of fission.
2. A tokamak is an experimental machine designed to harness the energy of fusion.

Choose the correct code:

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

Q.53) Solution (b)



**Explanation:**

- International Thermonuclear Experimental Reactor aims to build the **world's largest tokamak** to prove the **feasibility of fusion**.
- It is based on fusion which is also an energy source for the Sun and stars.
- Every fusion reaction in the Sun, in which two hydrogen atoms fuse into one helium atom, releases two neutrinos.
- It is a collaboration of 35 nations launched in 1985 and is located in France.
- The ITER members include China, the European Union, India, Japan, South Korea, Russia, and the United States. **Hence statement 1 is incorrect.**
- A **tokamak** is an experimental machine designed to harness the energy of fusion.
- Inside a tokamak, the energy produced through the fusion of atoms is absorbed as heat in the walls of the vessel. Like a conventional power plant, a fusion power plant uses this heat to produce steam and then electricity by way of turbines and generators. **Hence statement 2 is correct.**

**Q. 54) Consider the following statements**

1. The strong nuclear force and weak nuclear force are part of the fundamental forces of nature.
2. The strong nuclear force is strong with a long-range and is responsible for radioactive decay.

Choose the correct code:

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

Q.54) Solution (a)

**Explanation:**

- All the forces that exist in nature come under the four fundamental forces. We can differentiate the four fundamental forces based on their characteristics. The criteria of these characteristics are the force experienced by the particles, the relative strength between the force, the effectiveness of the range over the force, and dependence on the nature of the particles in which the force is acting.



- The four fundamental forces of nature are the gravitational force, the weak nuclear force, the electromagnetic force, and the strong nuclear force.
- Gravitational force is the weakest of all forces. It is weaker than a weak nuclear force, but its range is very high as it works by its masses. This force is the most intuitive and fundamental force acting on any of the bodies in this universe. If we drop a stone, it will return to its surface.
- The electromagnetic force occurs because of charges like attraction between opposite charges and repulsion between the same charges. The electromagnetic force is billions of times stronger than the gravitational force. But electromagnetic force is acting on our level by which we can tell that we live in an electromagnetic world. The attraction between opposite poles of a magnet is also caused by electromagnetic force. This force is also called the Lorentz force. **Hence statement 1 is correct.**
- The strong nuclear force is very strong but very short-range. It is responsible for holding the nuclei of atoms together. It is basically attractive but can be effectively repulsive in some circumstances.
- The weak nuclear force is very weak and has a very short range which is responsible for radioactive decay and neutrino interactions. **Hence statement 2 is incorrect.**

**Q. 55) Consider the following statements about International Atomic Energy Agency**

1. It is an organization within the United Nations family for cooperation in the nuclear field.
2. It was awarded the Nobel Peace Prize in 2005 for its work for a safe and peaceful world.
3. It is headquartered in Vienna, Austria.
4. It reports annually to the United Nation Security Council.

Choose the correct code:

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

Q.55) Solution (c)

**Explanation:**

- **International Atomic Energy Agency** is an organization within the **United Nations** family for cooperation in the nuclear field. The IAEA was created in 1957 in response to the deep fears and expectations generated by the discoveries and diverse uses of nuclear technology. **Hence statement 1 is correct.**



- It is widely known as the world's "Atoms for Peace and Development" organization.
- It was awarded the Nobel Peace Prize in 2005 for its work for a safe and peaceful world.
- The Agency works with its Member States and multiple partners worldwide to promote the safe, secure, and peaceful use of nuclear technologies. **Hence statement 2 is correct.**
- It is headquartered in Vienna, Austria. **Hence statement 3 is correct.**
- It reports annually to the **United Nation General Assembly**. When necessary, the IAEA also reports to the UN Security Council regarding instances of members' non-compliance with safeguards and security obligations. **Hence statement 4 is incorrect.**

**Q. 56) Consider the following statements about Nuclear Non-Proliferation Treaty (NPT)**

1. It defines Nuclear-weapon states as those that manufactured and exploded a nuclear weapon before 1st January 1967.
2. All the members of the United Nations are members of this treaty.

Choose the correct code:

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

Q.56) Solution (a)

**Explanation:**

- The Nuclear Non-Proliferation Treaty is a **multilateral treaty** aimed at limiting the spread of nuclear weapons including three elements:
  - ✓ non-proliferation
  - ✓ disarmament and
  - ✓ peaceful use of nuclear energy.
- According to this treaty, Nuclear-weapon states are those that manufactured and exploded a nuclear weapon before 1st January 1967.
- It requires countries to give up any present or plans to build nuclear weapons in return for access to peaceful uses of nuclear energy.
- It represents the only binding commitment in a multilateral treaty to the goal of disarmament by the nuclear-weapon States. **Hence statement 1 is correct.**
- The treaty was signed in 1968 and entered into force in 1970. Presently, it has 191 member states.



- Four UN member states have never accepted the NPT – India, Israel, Pakistan, and South Sudan. **Hence statement 2 is incorrect.**

**Q. 57) Consider the following statements about Mitochondrial DNA (mt DNA)**

1. It is double-stranded and circular.
2. It is not enveloped by a membrane.
3. It is inherited both maternally and paternally.

Choose the correct code:

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

Q.57) Solution (a)

**Explanation:**

- Mitochondrial DNA (mt DNA) is double-stranded and circular whereas Nuclear DNA is double-stranded and linear.
- Transcription of mt DNA is polycistronic whereas transcription of nuclear DNA is monocistronic. **Hence statement 1 is correct.**
- Mitochondrial DNA is not enveloped by a membrane whereas nuclear DNA is enveloped by a membrane. **Hence statement 2 is correct .**
- Its inheritance is only by maternal so mitochondrial diseases are inherited maternally whereas the nuclear DNA gets inheritance equally from both parents. **Hence statement 3 is incorrect.**

**Q. 58) Which of the following are the benefits of GM crops?**

1. Increased crop yields
2. Reduced costs for food production
3. Reduced need for pesticides
4. Decreased nutrient composition
5. Resistance to pests and disease

Choose the correct code:



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

Q.58) Solution (d)

**Explanation:**

In crops, genetic modification involves the manipulation of DNA instead of using controlled pollination— the conventional method to improve crops— to alter certain characteristics of the crop.

Soyabean, maize, cotton, and canola with herbicide tolerance and insect resistance are the most widely grown GM crops around the world.

The benefits of GM crops are -

- Increased crop yields
- Reduced costs for food production
- **Reduced need for pesticides( not decreased)**
- Enhanced nutrient composition
- Resistance to pests and disease
- Greater food security and medical benefits to the world's growing population.
- Increase the yield of animals for milk and meat production.
- Decrease susceptibility to disease in animals.
- Allowing plants to grow in conditions where they might not otherwise flourish.
- Increased shelf life and hence there is less fear of foods getting spoiled quickly.

Hence option d is correct.

**Q. 59) With reference to 3-stage nuclear program, consider the following statements**

1. The first stage consists of Pressurised Heavy Water Reactors (PHWRs) which use natural uranium as their fuel.
2. The second stage consists of fast breeder reactors which use a blend of plutonium and uranium oxide as their fuel
3. The third stage consists advanced heavy water reactors which use thorium as their fuel.

Choose the incorrect code

- a) 1 only
- b) 3 only



- c) 2 only
- d) None

Q.59) Solution (d)

**Explanation:**

India's three-stage nuclear power program was formulated by Homi Bhabha in the 1950s to secure the country's long-term energy independence, through the use of uranium and thorium reserves found in India.

**Stage 1: Pressurised Heavy Water Reactors (PHWRs)**

- The first stage comprises the setting up of Pressurised Heavy Water Reactors (PHWRs) and associated fuel cycle facilities.
- PHWRs use natural uranium as fuel and heavy water as moderator and coolant.
- **Hence statement 1 is correct .**

**Stage 2: Fast Breeder Reactors (FBRs)**

- The second stage envisages setting up of Fast Breeder Reactors (FBRs) backed by reprocessing plants and plutonium-based fuel fabrication plants.
- A breeder reactor is one that breeds more material for a nuclear fission reaction than it consumes.
- Plutonium is produced by irradiation of uranium-238
- The prototype FBR is fuelled by a blend of plutonium and uranium oxide, called MOX fuel.
- **Hence statement 2 is correct.**

**Stage 3: Advanced Heavy Water Reactor (AHWR)**

- The third stage is based on the thorium-uranium-233 cycle.
- Uranium-233 is obtained by irradiation of thorium
- India has one of the largest reserves of thorium.
- **Hence statement 3 is correct.**

**Q. 60) Consider the following statements about the Nuclear Power Corporation of India Limited (NPCIL)**

1. It is a constitutional body responsible for the design, construction, commissioning, and operation of nuclear power reactors.
2. It is under the administrative control of the Department of Atomic Energy (DAE).

Choose the correct code:



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

Q.60) Solution (b)

**Explanation:**

- Nuclear Power Corporation of India Limited (NPCIL) is a Public Sector Enterprise responsible for the design, construction, commissioning, and operation of nuclear power reactors.
- It is wholly owned by the Government of India and is responsible for the generation of electricity from nuclear power.
- It is not a constitutional body as it does not derive its powers and authorities from the Constitution of India. **Hence statement 1 is incorrect.**
- It is under the administrative control of the Department of Atomic Energy (DAE). **Hence statement 2 is correct.**

**Q. 61) Consider the following statements about carbon nanotubes**

1. They are cylindrical molecules with rolled-up sheets of single-layer carbon atoms.
2. They are always single-walled and can never be multi-walled nanotubes.
3. They can be used as artificial blood capillaries for the injured part of the body.
4. They can be used as carriers of drugs in the human body.

Which of the given statements is correct?

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

Q.61) Solution (d)

**Explanation:**

- Carbon nanotubes are cylindrical molecules with rolled-up sheets of single-layer carbon atoms. **Hence statement 1 is correct.**
- They can be single-walled or multi-walled nanotubes. Their length can reach several micrometers or even millimeters.



- Like their building block graphene, CNTs are chemically bonded with sp<sup>2</sup> bonds, an extremely strong form of molecular interaction. **Hence statement 2 is incorrect.**
- Biotechnology facilitates the making of nanodevices with blood-compatible nanomaterials as building blocks for biomedical applications such as structural tissue replacements, and artificial blood capillaries for the injured part of the body. But using carbon nanotubes as blood capillaries creates blood clotting so it is unsafe. **Hence statement 3 is incorrect.**
- Carbon nanotubes easily penetrate cells and improve the therapeutic profile and efficacy of drugs. They can be used as carriers of drugs in the human body. **Hence statement 4 is correct.**
- They can be used in electric wires to reduce losses.
- It can replace silicon-made transistors as they are small and emit less heat and it can revolutionize electronics
- They can be used in solar cell

**Q. 62) Consider the following statements**

1. Liquid Nano Urea provides phosphate to plants as an alternative to conventional urea.
2. Liquid Nano Urea has less efficacy compared to conventional nano urea.
3. Liquid Nano Urea provides a targeted supply of nutrients to crops.

Choose the correct code:

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

Q.62) Solution (c)

**Explanation:**

- Liquid Nano Urea **provides nitrogen to plants as an alternative to conventional urea.** It is aimed at reducing the unbalanced and indiscriminate use of conventional urea, increasing crop productivity, and reducing soil, water, and air pollution.
- It has been indigenously developed at Nano **Biotechnology Research Centre, Kalol, Gujarat** in line with **Atmanirbhar Bharat** and Atmanirbhar Krishi. **Hence statement 1 is incorrect.**
- Liquid Nano Urea has more efficacy compared to conventional nano urea. While conventional urea has an efficiency of about 25 %, the efficiency of liquid nano urea can be as high as 85-90 %.
- Conventional urea fails to have the desired impact on crops as it is often applied incorrectly, and the nitrogen in it is vaporised or lost as a gas. A lot of nitrogen is also washed away during irrigation. **Hence statement 2 is incorrect.**



- Liquid Nano Urea provides a targeted supply of nutrients to crops. It is sprayed directly on the leaves and gets absorbed by the plant.
- Fertilizers in nano form provide a targeted supply of nutrients to crops, as they are absorbed by the stomata, and pores found on the epidermis of leaves. **Hence statement 3 is correct.**

**Q. 63) Consider the following statements about different types of biosensors**

1. Amperometric Biosensor provides exact quantitative analytical information based on current flow.
2. Voltammetric Biosensors is a response indicator used for indicating physical and chemical properties.

Choose the correct code:

- a) 1 only
- b) 2 only
- c) Both 1 and 2
- d) Neither 1 or 2

Q.63) Solution (a)

**Explanation:**

- A biosensor can be defined as a device that measures biological or chemical reactions by producing certain signals which would be proportional to the concentration of the analyte in the reaction.
- Amperometric Biosensor provides exact quantitative analytical information based on current flow.
- It works on the basis of the quantity of current released during oxidation. It also uses the Redox response during its operation. The uses of the biosensor are medical screening, quality control, etc. **Hence statement 1 is correct.**
- Impedimetric Biosensors is a response indicators used for indicating physical and chemical properties.
- Currently, this type of biosensor is trending. It is used for recording the catalysed response of enzyme lectins, receptors, etc. **Hence statement 2 is incorrect.**
- Voltammetric Biosensors are the type of biosensor used for observing acrylamide.
- It is made using a carbon glue electrode which has haemoglobin.
- Electrochemical biosensors follow the enzymatic catalysis of a reaction that either produces or consumes electrons. These enzymes are called redox enzymes.
- Optical biosensors follow the phenomenon of surface plasmon resonance (SPR) techniques. It works by using other materials' properties This utilises certain properties of the other materials, for example, a thin layer of gold placed on a glass with a very high



refractive index, and the surface can absorb laser light, which produces electron waves or surface plasmons on the gold surface.

**Q.64) Consider the following statements about nanoparticles**

1. They are tiny particles between 1 and 1000 nm.
2. They are not naturally found.
3. They are used in the making of cosmetics.
4. They cause lung problems and cardiovascular disease.

Which of the given statements is correct?

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

Q.64) Solution (b)

**Explanation:**

- Nanoparticles are tiny particles between 1 and 100 nm. Due to their ultrafine size, they can be suspended in the atmosphere for a long time and can travel larger distances.
- They possess very little mass but are many. **Hence statement 1 is incorrect.**
- They are found naturally, in incidental and manufactured processes.
- **Nanoparticles occur widely in nature** and are objects of study in many sciences such as chemistry, physics, geology, and biology.
- A significant fraction (by number, if not by mass) of interplanetary dust, that is still falling on the Earth at the rate of thousands of tons per year, is in the nanoparticle range; and the same is true of atmospheric dust particles.
- Many viruses have diameters in the nanoparticle range. Iron oxides/sulfides, silver, and gold are some representative examples of naturally-occurring nanoparticles in the environment. **Hence statement 2 is incorrect.**
- They are used in the making of cosmetics. Many cosmetic products used in our daily life are made with the assistance of nanotechnologies.
- Among metal and metal oxide nanoparticles (NPs) potentially present in cosmetics, those containing titanium dioxide and zinc oxide are common ingredients added to obtain sufficient sun protection.
- The addition of silver and gold NPs is also mentioned to increase the antimicrobial and healing properties of some cosmetic formulations. **Hence statement 3 is correct.**
- They cause lung problems and cardiovascular disease. Long exposures to high concentrations of nanoparticles cause lung problems and cardiovascular disease.
- One of the key reasons for their negative health impact is their toxicity and large total surface area per unit mass.



- This increases their potential chemical reactivity and ability to be absorbed.
- They can pass deep into the respiratory system, reacting with the lung tissues and potentially entering the bloodstream. **Hence statement 4 is correct.**

**Q. 65) Consider the following statements about Zeolites**

1. They are naturally found but cannot be manufactured.
2. They are very stable solids that resist a variety of environmental conditions.
3. They don't get dissolved in water or other inorganic solvents.
4. They are used as ion exchange beds in domestic and commercial water purification.

Choose the correct code:

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

Q.65) Solution (d)

**Explanation:**

- Zeolites are microporous, aluminosilicate minerals commonly used as commercial adsorbents and catalysts.
- Zeolites are naturally found but can be manufactured industrially on a large scale.
- Natural zeolites form where volcanic rocks and ash layers react with alkaline groundwater.
- However, naturally occurring zeolites are rarely pure and are contaminated to varying degrees by other minerals.
- For this reason, naturally occurring zeolites are excluded from important commercial applications. **Hence statement 1 is incorrect.**
- They are very stable solids that resist a variety of environmental conditions. The melting point of zeolite is very high (over 1000°C), and they don't burn.
- They also resist high pressures. **Hence statement 2 is correct.**
- They don't get dissolved in water or other inorganic solvents and don't oxidize in the air.
- Since zeolites are not reactive and are obtained from naturally occurring minerals, they do not have any harmful environmental effects. **Hence statement 3 is correct.**
- They are used as ion exchange beds in domestic and commercial water purification.
- They have the potential of providing precise separation of gases. This includes the removal of H<sub>2</sub>O, CO<sub>2</sub>, and SO<sub>2</sub> from low-grade natural gas streams.
- Zeolites are also marketed as dietary supplements to treat cancer, diarrhoea, autism, herpes, and hangover. It is also used to balance pH and remove heavy metals in the body. **Hence statement 4 is correct.**



**Q. 66) Consider the following statements about the All India Council for Robotics and Automation**

1. It is a statutory body.
2. It sets up standards in robotics and automation.
3. It organises Technoxian, an Edutech expo.

Choose the correct code:

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

Q.66) Solution (b)

**Explanation:**

- The **All India Council for Robotics and Automation** is a **not-for-profit organization** established in **2014**.
- A Statutory body is established by an act of parliament. **Hence statement 1 is incorrect.**
- It sets up **standards in robotics and automation**.
- It helps organizations and professionals to solve difficult technical problems while enhancing their leadership and personal career capabilities.
- It is engaged in various activities and has launched several programs to promote and build an ecosystem for robotics and automation in India. **Hence statement 2 is correct.**
- It organises Technoxian, an Edutech expo.
- Technoxian provides a global opportunity to participate in different competitions related to innovation, robotics, automation, and many other fascinating challenge-based engineering competitions. **Hence statement 3 is correct.**

**Q. 67) Which of the following sectors can benefit from Generative Artificial Intelligence?**

1. Healthcare
2. Music
3. Robotics
4. Art

Choose the correct code:

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



Q.67) Solution (d)

**Explanation:**

- GAI is a rapidly growing branch of AI that focuses on generating new content (such as images, audio, text, etc.) based on patterns and rules learned from data.
  - The rise of GAI can be attributed to the development of advanced generative models, such as Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs).
  - The applications of GAI are
  - Healthcare: By generating new medical images and simulations, improving the accuracy and efficiency of medical diagnoses and treatments.
  - Music: It can help musicians and music producers explore new sounds and styles, leading to more diverse and interesting music.
  - Robotics: It can help optimize manufacturing processes, improving the efficiency and quality of these processes.
  - Art: It can be used to generate new works of art that are unique and innovative, helping artists and creatives explore new ideas and push the boundaries of traditional art forms.
- Hence option d is correct.**

**Q. 68) Consider the following statements about Vyommitra**

1. It is a female-looking spacefaring humanoid robot.
2. It is developed by NASA to function on board of the Gaganyaan.
3. It will generate warnings, replace carbon dioxide canisters, and operate switches.

Choose the correct code:

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

Q.68) Solution (a)

**Explanation:**

- Vyommitra is a female-looking spacefaring humanoid robot.
- A humanoid is a robot with the appearance of a human being. **Hence statement 1 is correct.**
- It is developed by ISRO to function on board the Gaganyaan.
- It will test the ground for human spaceflight and will be a very basic version of a TARS-type, artificial-intelligence-and-robotics system. **Hence statement 2 is incorrect.**
- The activities that Vyom mitra will be able to perform, once fully developed for the unmanned flight, will include:



- ✓ procedures to use the equipment on board the spacecraft's crew module such as safety mechanisms and switches,
- ✓ receiving and acting on commands sent from ground stations
- ✓ attaining launch and orbital postures,
- ✓ responding to the environment,
- ✓ generating warnings,
- ✓ replacing carbon dioxide canisters,
- ✓ operating switches,
- ✓ monitoring of the crew module,
- ✓ receiving voice commands,
- ✓ responding via speech (bilingual). **Hence statement 3 is correct.**

**Q. 69) Consider the following statements about Xenobots**

1. They are synthetic life forms that are designed by computers.
2. They have been named after the species of aquatic frog *Xenopus laevis*.
3. They help in finding cancer cells in the human body.

Choose the correct code:

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

Q.69) Solution (d)

**Explanation:**

- Xenobots are synthetic life forms that are designed by computers to perform desired functions and built by combining different biological tissues. **Hence statement 1 is correct.**
- They have been named after the species of **aquatic frog *Xenopus laevis***, found across sub-Saharan Africa from Nigeria and Sudan to South Africa. **Hence statement 2 is correct.**
- They help in finding cancer cells in the human body. They can move toward a target, perhaps pick up a payload (like a medicine that needs to be carried to a specific place inside a patient) — and heal themselves after being cut.
- Many useful applications of these living robots include searching out nasty compounds or radioactive contamination, gathering microplastic in the oceans, travelling in arteries to scrape out plaque, etc. **Hence statement 3 is correct.**

**Q. 70) Consider the following statements**



1. A nanotech-based contamination sensor can reveal the presence of E-coli.
2. Nanotech-based wearables can record medical data such as heartbeat, sweat components, and blood pressure.
3. Nanotechnology can improve the display screens of electronic devices.
4. Nanoscience has produced stain and wrinkle-resistant clothes.

Choose the correct code:

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

Q.70) Solution (c)

**Explanation:**

- Nanotechnology provides the potential for safe and better quality food and improved texture and taste of the food.
- A contamination sensor, using a flash of light can reveal the presence of E-coli.
- Antimicrobial packaging made out of cinnamon or oregano oil or nanoparticles of zinc, calcium, etc., can kill bacteria. **Hence statement 1 is correct.**
- Nanotech-based wearables have embedded nanosensors in the cloth that record medical data such as heartbeat, sweat components, and blood pressure. It helps save lives by alerting the wearer and medical professionals of any adverse changes faced by the body. **Hence statement 2 is correct.**
- Nanotechnology has greatly improved the capacity of electronic components by:
  - ✓ Reducing the size of the transistors of the integrated circuit
  - ✓ Improving the display screens of the electronic devices
  - ✓ Reducing power consumption, weight, and thickness of electronic devices. **Hence statement 3 is correct.**
- Nanoscience has now produced stain and wrinkle-resistant cloths and may further improve upon the existing innovations. **Hence statement 4 is correct.**

**Q. 71) Consider the following statements**

1. Ai-Da Robot is the world's first ultra-realistic humanoid artist.
2. Sophia is the first robot to be given legal personhood anywhere in the world.

Choose the correct code:

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



Q.71) Solution (c)

**Explanation:**

- Ai-Da Robot is the world's **first ultra-realistic humanoid artist**. It can draw creatively due to in-built artificial intelligence (AI) technology.
- Ai-Da is named after Ada Lovelace, the English mathematician and writer often called the world's first computer coder. **Hence statement 1 is correct.**
- Sophia is a humanoid robot designed to respond to questions.
- It is developed by Hong Kong-based company Hanson Robotics.
- It uses artificial intelligence, visual data processing and facial recognition to make simple conversations on predefined topics (e.g. on the weather).
- In 2017, Sophia was confirmed as a citizen of Saudi Arabia. By this, Saudi Arabia has become the first country to give a robot citizenship. **Hence statement 2 is correct.**

**Q. 72) Consider the following statements about Nano Mission**

1. It focuses on funding individual scientist-centric nano-research projects.
2. It does not promote public-private partnerships (PPPs).
3. It focuses on promoting foreign collaboration.

Choose the correct code:

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

Q.72) Solution (c)

**Explanation:**

- The Government of India launched the Nano Mission in 2007 as an umbrella capacity-building programme. As a result of the efforts led by the Nano Mission, today, India is amongst the top five nations in the world in terms of scientific publications in nanoscience and technology.
- The mission focuses on the funding of basic research in nanotechnology by individual scientists and groups of scientists and the creation of centres of excellence for pursuing studies. The mission is funding about 235 individual scientist-centric research projects on fundamental research in Nanosystems. This will lead to the fundamental understanding of matter that enables control and manipulation at the nanoscale. **Hence statement 1 is correct.**
- The mission aimed at establishing a chain of shared facilities across the country with sophisticated equipment required for Nano research. It also focuses on establishing

linkages between industry and research and educational institutions and promoting public-private partnerships (PPPs). **Hence statement 2 is incorrect.**

- Apart from exploratory visits of scientists, organization of joint workshops and conferences, and joint research projects. It focuses on promoting foreign collaboration in nanotechnology programmes. **Hence statement 3 is correct.**

**Q. 73) Consider the following statements about the basic components of robots**

1. Actuators allow the parts of the robot to operate together.
2. Controller converts stored energy into movement in robots.
3. Sensors are what allow a robot to gather information about its environment.
4. End-Effectors directly interact with objects in the world.

Choose the correct code:

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

Q.73) Solution (b)

**Explanation:**

- The controller is the “brain” of the industrial robotic arm and allows the parts of the robot to operate together. It works as a computer and allows the robot to also be connected to other systems.
- The robotic arm controller runs a set of instructions written in code called a program. **Hence statement 1 is incorrect.**
- Actuators are like the “muscles” of a robot, the parts which convert stored energy into movement. By far the most popular actuators are electric motors that spin a wheel or gear, and linear actuators that control industrial robots in factories. **Hence statement 2 is incorrect.**
- Sensors are what allow a robot to gather information about its environment. This information can be used to guide the robot’s behaviour. Some sensors are relatively familiar pieces of equipment.
- Cameras allow a robot to construct a visual representation of its environment. This allows the robot to judge attributes of the environment that can only be determined by vision, such as shape and color, as well as aid in determining other important qualities, such as the size and distance of objects.
- Microphones allow robots to detect sounds. Some robots come equipped with thermometers and barometers to sense temperature and pressure. **Hence statement 3 is correct.**



- End-Effectors are the tools at the end of robotic arms that directly interact with objects in the world. The effectors are the parts of the robot that do the work. **Hence statement 4 is correct.**

**Q. 74) Consider the following statements about the India Innovation Centre for Graphene**

1. It is a cross-functional plan that incentives new ideas.
2. It is the country's first Graphene Innovation Centre.
3. It would come up in the Indian state of Karnataka.

Choose the correct code:

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

Q.74) Solution (a)

**Explanation:**

- The **India Innovation Centre for Graphene** is a **cross-functional plan that creates a haven for new ideas.**
- With opportunities for individual and group collaboration across time zones and continents, it's a place that fosters a culture of innovation through the creation, sharing, and testing of ideas. **Hence statement 1 is correct.**
- It is the **country's first Graphene Innovation Centre.** The project would give a major fillip for scientific research as well as the state's industrial sector. **Hence statement 2 is correct.**
- It would come up in the Indian state of Kerala.
- The India Innovation Centre for Graphene would come up in Thrissur at Rs 86.41 crore.
- Of the 86.41 crores, the Union Government would provide Rs 49.18 crore, and private business houses Rs 11.48 crore.
- The state government would provide the basic infrastructure for the project. The Centre would help attract investors to develop graphene products. **Hence statement 3 is incorrect.**

**Q. 75) Which of the following are ethical challenges associated with Artificial Intelligence?**

1. Increased Inequalities
2. Risk of Unemployment
3. Data Privacy Concerns
4. Technological addiction

Choose the correct code:



- a) 1 and 2
- b) 3 and 4
- c) None
- d) 1, 2, 3 and 4

Q.75) Solution (d)

**Explanation:**

- Using artificial intelligence, a company can drastically cut down on relying on the human workforce, and this means that revenues will go to fewer people.
- Consequently, individuals who have ownership in AI-driven companies will make all the money. Also, AI could compound digital exclusion.
- Further, investment is likely to shift to countries where AI-related work is already established, widening gaps among and within countries.
- Therefore, without clear policies on reskilling workers, the promise of new opportunities will create serious new inequalities.
- The hierarchy of labour is concerned primarily with automation. Robotics and AI companies are building intelligent machines that perform tasks typically carried out by low-income workers: self-service kiosks to replace cashiers, fruit-picking robots to replace field workers, etc.
- AI also presents serious data privacy concerns. The algorithm's never-ending quest for data has led to our digital footprints being harvested and sold without our knowledge or informed consent. Ex: Cambridge Analytica Case
- Technological addiction is the new frontier of human dependency. AI has already become effective at directing human attention and triggering certain actions. **Hence option d is correct.**

**Q. 76) Consider the following statements about Graphene**

1. It is the most electrically and thermally conductive material in the world.
2. It could bring down the cost of OLED (organic light-emitting diode) screens in smartphones.
3. It has applications in anti-corrosion coatings and paints.

Choose the correct code:

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

Q.76) Solution (d)



**Explanation:**

- Graphene is a one-atom-thick layer of carbon atoms arranged in a hexagonal lattice.
- It is the building block of Graphite, but graphene is a remarkable substance on its own with a multitude of astonishing properties.
- It is the **most electrically and thermally conductive material in the world. It is flexible, transparent, and incredibly strong. Hence statement 1 is correct.**
- It could **bring down the cost of OLED** (organic light-emitting diode) screens in smartphones as it can **replace Indium which is more costly . Hence statement 2 is correct.**
- It has applications in anti-corrosion coatings and paints, efficient and precise sensors, faster and efficient electronics, flexible displays, efficient solar panels, faster **DNA sequencing**, and drug delivery. **Hence statement 3 is correct.**

**Q. 77) Consider the following statements about self-cleaning fabrics**

1. Hydrophobicity and hydrophilicity are two principal ways of self-cleaning.
2. The photocatalytic process will decompose the dirt molecules by utilizing sunlight.
3. Titanium Dioxide (TiO<sub>2</sub>) is used for self-cleaning surfaces.
4. They have applications in medical textiles, sports tech, defense textiles, and smart textiles.

Choose the incorrect code:

- a) 2 and 3
- b) 1 and 2
- c) None
- d) 1, 2, 3 and 4

Q.77) Solution (c)

**Explanation:**

Here the question asks for 'incorrect code'. **So option c is correct.**

- **The self-cleaning fabric has massive potential for improvement of products not only in the clothing industry but also in the health industry due to time, material, and energy reduction and consequently cost-efficiency during production.**
- Hydrophobicity and hydrophilicity are two principal ways of self-cleaning.
- Both types of coating clean themselves with the action of water by rolling droplets for hydrophobic and sheeting water for hydrophilic that carries dirt away. Nevertheless, hydrophilic has an additional property, which can chemically break down the adsorbed dirt in sunlight through the help of a photocatalyst also known as the hydrophilic photocatalytic coating. **Hence statement 1 is correct.**



- The photocatalytic process is the acceleration of a photoreaction in the presence of a catalyst. It will decompose the dirt molecules by utilizing sunlight.
- By utilizing the photoreaction induced by the photocatalyst, the organic contaminants will be degraded into air and water. The mechanism of photocatalytic reaction begins when a photocatalyst is irradiated by light, usually ultraviolet light. **Hence statement 2 is correct.**
- Titanium Dioxide (TiO<sub>2</sub>) is a semiconductor material that acts as a photocatalyst and has been proven to be an excellent catalyst in the photodegradation of colorants and other organic pollutants. It is widely used because of its various advantages, such as non-toxicity, availability, cost-effectiveness, chemical stability, and favorable physical and chemical properties.
- TiO<sub>2</sub> is used in paint and cosmetics as pigment and as a food additive. It is also used in anti-pollution applications and for water purification. **Hence statement 3 is correct.**
- They have applications in medical textiles, sports tech, defense textiles, and smart textiles. **Hence statement 4 is correct.**

**Q. 78) Which of the following sectors have the applications of drones?**

1. Defence
2. Healthcare
3. Agriculture
4. Law enforcement

Choose the correct code:

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

Q.78) Solution (d)

**Explanation:**

- Drones can be used as a symmetric weapon against terrorist attacks.
- It can be integrated into the national airspace system. **Hence option 1 is correct.**
- **Drone technology has uses in healthcare as it can be used to deliver vaccines** in remote areas. **Hence option 2 is correct.**
- In the agriculture sector, micronutrients can be spread with the help of drones.
- It can also be used for performing surveys for identifying the challenges faced by the farmers. **Hence option 3 is correct.**
- Drones are also significant for law enforcement agencies, the fire, and emergency services wherever human intervention is not safe. **Hence option 4 is correct.**

**Q. 79) Which of the following statement is incorrect about Self Driving Cars?**

- a) It is a vehicle capable of sensing its environment and operating without human involvement.
- b) It helps in reducing traffic congestion and cutting transportation costs.
- c) It cannot go everywhere a traditional car goes.
- d) It can reduce urban CO2 emissions.

Q.79) Solution (c)

**Explanation:**

- A self-driving car is a vehicle capable of sensing its environment and operating without human involvement.
- A human passenger is not required to take control of the vehicle at any time, nor is a human passenger required to be present in the vehicle at all.
- It helps in reducing traffic congestion and cutting transportation costs.
- A self-driving car can go anywhere a traditional car goes and do everything that an experienced human driver does. **Hence option c is incorrect.**

**Q. 80) Consider the following statements about FINAL EXPERIMENTAL DEMONSTRATION OBJECT RESEARCH (FEDOR)**

1. It was the first robot to be sent to space.
2. It is used in operations that are dangerous for humans onboard spacecraft.
3. It was sent by Russia on an unmanned rocket.

Choose the correct code:

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

Q.80) Solution (c)

**Explanation:**

- FINAL EXPERIMENTAL DEMONSTRATION OBJECT RESEARCH (FEDOR) is not the first robot to go into space in 2019
- In 2011, NASA sent up ROBONAUT 2, a humanoid robot developed with General Motors that had a similar aim of working in high-risk environments.
- In 2013, Japan sent up a small robot called KIROBO along with the ISS's first Japanese space commander. **Hence statement 1 is incorrect.**
- It is used in operations that are dangerous for humans onboard spacecraft.



- It copies human movements, a key skill that allows it to remotely help astronauts or even people on Earth to carry out tasks while the humans are strapped into an exoskeleton.
- Fedor is described as potentially useful on Earth for working in high radiation environments, demining, and tricky rescue missions. **Hence statement 2 is correct.**
- It is sent by Russia on an unmanned rocket. It is the first humanoid robot to be sent to space by Russia. **Hence statement 3 is correct.**

**Q. 81) Consider the following statements regarding the evolution of mobile networks over the various generations**

1. 1G worked on analog radio signals and supported only voice calls.
2. 2G can transmit telephone signals including digitised voice, video calls, and conferencing.
3. 3G uses digital radio signals and supports voice and data transmission but not video calls.
4. 5G has lower latency when compared to 4G.

Which of the following statements is correct?

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

Q.81) Solution (c)

**Explanation:**

The evolution of mobile networks over the various generations

- "G" stands for "GENERATION". While connected to the internet, the speed of the connection depends upon the signal strength that is shown in abbreviations like 2G, 3G, 4G, 5G, etc. on any mobile device.
- Each generation of wireless broadband is defined as a set of telephone network standards that describe the technical implementation of the system.
- 1G worked on analog radio signals and supported only voice calls. It was launched in the 1980s. It has a bandwidth of up to 2.4 kbps. **Hence statement 1 is correct.**
- 2G uses digital radio signals and supported both voice and data transmission but cannot do video calls . It was launched in the 1990s. It has a bandwidth of 64 Kbps. **Hence statement 2 is incorrect.**





- 3G can transmit telephone signals including digitised voice, video calls, and conferencing. It was launched in the 2000s with a speed of 1 Mbps to 2 Mbps. **Hence statement 3 is incorrect.**
- 4G was launched in 2009 with a peak speed of 100 Mbps to 1 Gbps and it also enables 3D virtual reality.
- 5G uses utilises much higher radio frequencies of 28 GHz. 4G uses lower reading frequencies of 700 MHz to 2500 MHz.
- 5G transfers more data over the air at faster speeds than 4G.
- 5G uses a millimeter wave spectrum which enables more devices to be used within the same geographic area supporting around one million per square kilometer whereas 4G support a lesser number of devices about 4,000 devices per square kilometer.
- 5G has a wider area in the frequency spectrum and lower latency when compared to 4G. Latency refers to the delay before a transfer of data begins following an instruction. **Hence statement 4 is correct.**

**Q. 82) Consider the following statements about DarkNet**

1. It refers to unindexed sites which are unsearchable by search engines.
2. It constitutes around 4-6% of the World Wide Web (WWW).
3. It offers a level of identity security that the surface net does not.
4. It includes places such as academic databases as well as black markets.

Which of the following statements is correct?

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

Q.82) Solution (b)

**Explanation:**

- DarkNet refers to encrypted networks on the Internet that are not indexed by search engines. DarkWeb refers to unindexed sites which are unsearchable by search engines because those sites are protected by passwords. The terms "dark net" and "dark web" are occasionally used interchangeably, but with subtle differences in meaning. The dark net is a network built over the Internet whereas the dark web refers to websites on a darknet. **Hence statement 1 is incorrect.**



- Darknet constitutes around 85-90% of the World Wide Web (WWW).
- The surface web is that portion of the World Wide Web that is readily available to the general public and searchable with standard web search engines. It is the opposite of the deep web. It only constitutes 4-6% of the whole web. **Hence statement 2 is incorrect.**
- It offers a level of **identity security** that the surface net does not. It protects their identities in order to evade detection and capture are drawn to this aspect of the dark net. **Hence statement 3 is correct.**
- DarkNet is a network that is only available to a select group of people and not to the general Internet public, and only accessible via authorization, specific software, and configurations.
- This includes harmless places such as academic databases and corporate sites, as well as those with shadier subjects such as black markets, fetish communities, and hacking and piracy. **Hence statement 4 is correct.**

**Q. 83) Consider the following statements**

1. LTE only supports data whereas VoLTE supports both calls and data.
2. LTE is not widely used like VoLTE.
3. LTE is the services offered on the network whereas VoLTE is a type of network.

Which of the following statements is correct?

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

Q.83) Solution (a)

**Explanation:**

- **Long Term Evolution (LTE)** is a standard for high-speed cellular data communication systems. It provides a download speed of about 100 Mbps and an upload speed of about 50 Mbps. It does not provide good-quality voice calls while using the data services.
- **Voice over Long Term Evolution (VoLTE)** is a much-standardized system to make high-definition voice calls. It allows the users to make voice calls while using the data services without changing the quality of the voice.
- LTE only supports data whereas VoLTE supports both calls and data.
- LTE may or may not support data and voice call services at the same time.



- VoLTE always supports data and voice call services at the same time.
- In LTE if it supports data and voice calls together the quality of voice calling is not good.
- VoLTE supports HD-quality voice calling while using data services. **Hence statement 1 is correct.**
- VoLTE is more widely used than LTE. **Hence statement 2 is correct.**
- LTE turns off the data connection while making voice calls.
- VoLTE does not turn off the data connection while making voice calls.
- In LTE, external applications like Skype or WhatsApp are required to make video calls.
- In VoLTE no external applications are required to make video calls.
- LTE is a type of network whereas VoLTE is the services offered on the network. **Hence statement 3 is incorrect.**

**Q. 84) Consider the following statements about the advantages of End-to-End Encryption**

1. It ensures that user data is protected from unwarranted parties.
2. It can reveal the encrypted data if the endpoints are not defined properly.
3. It can help organizations protect that data by making it unreadable.

Which of the following statements is correct?

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

Q.84) Solution (c)

**Explanation:**

- End-to-End Encryption is a communication process that encrypts data being shared between two devices.
- It prevents third parties like cloud service providers, internet service providers (ISPs), and cybercriminals from accessing data while it is being transferred.
- The cryptographic keys used to encrypt and decrypt the messages are stored on the endpoints.
- The process of end-to-end encryption uses an algorithm that transforms standard text into an unreadable format.



- This format can only be unscrambled and read by those with the decryption keys, which are only stored on endpoints and not with any third parties including companies providing the service.
- It is used when **transferring business documents**, financial details, legal proceedings, and personal conversations.
- It ensures that user **data is protected from unwarranted parties** including service providers, cloud storage providers, and companies that handle encrypted data. **Hence statement 1 is correct.**
- Some E2EE implementations allow the encrypted data to be encrypted and re-encrypted at certain points during transmission.
- Hence it makes it important to clearly define and distinguish the endpoints of the communication circuit.
- It reveals the encrypted data if the endpoints are not defined properly. This is one of the disadvantages of E2EE. **As the question asks for advantages, Hence statement 2 is incorrect.**
- Many industries are bound by regulatory compliance laws that require encryption-level data security.
- It can help **organizations protect that data** by making it unreadable. **Hence statement 3 is correct.**

**Q. 85) Consider the following statements about the National Supercomputing Mission**

1. It aims to indigenise the development and manufacturing of powerful computers.
2. It is implemented by the National Informatics Centre (NIC).
3. Under this mission, the supercomputer 'Param Pravega' has been installed.

Choose the correct code:

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

Q.85) Solution (d)

**Explanation:**



- A supercomputer is a computer that performs at or near the currently highest operational rate for computers.
- Generally, PETAFL0P is a measure of a Supercomputer's processing speed and can be expressed as a thousand trillion floating point operations per second.
- FLOPS (floating point operations per second) are typically used to measure the performance of a computer's processor.
- They are primarily designed to be used in enterprises and organizations that require massive computing power.
- Examples: Weather forecasting, scientific research, intelligence gathering, and analysis.
- The National Supercomputing Mission aims to **indigenise the development and manufacturing of powerful computers**.
- It was launched in 2015 to enhance the research capacities and capabilities in the country by connecting them to form a Supercomputing grid, with National Knowledge Network (NKN) as the backbone.
- The NKN project is aimed at establishing a strong and robust Indian network that will be capable of providing secure and reliable connectivity. **Hence statement 1 is correct.**
- The Mission is being jointly steered by the Department of Science and Technology (DST) and the Ministry of Electronics and Information Technology (MeitY).
- It is implemented by the Centre for Development of Advanced Computing (C-DAC), Pune, and the IISc, Bengaluru. **Hence statement 2 is incorrect.**
- The Indian Institute of Science (IISc) Bengaluru installed the supercomputer 'Param Pravega' with a supercomputing capacity of 3.3 petaflops which has been installed under the government's National Supercomputing Mission. **Hence statement 3 is correct.**

**Q. 86) Consider the following statements about the Internet of Things (IoT)**

1. It is a system in which devices are connected to a network of information without any human intervention.
2. Accessibility to data and digitization plays an integral part in the working of IoT.
3. It may lead to an increase in the cyber fraud and cyber crimes.

Which of the following statements is correct?

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



Q.86) Solution (d)

**Explanation:**

- The Internet of Things (IoT) is an integrated system in which devices are connected to a network of information in such a way that they can communicate with each other without any human intervention.
- It creates an intelligent system of systems that can manage multiple activities of human concern like traffic control, health management, optimal use of electricity and inventory management, etc.
- It is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices.
- It is one of the fastest emerging technologies across the globe, providing enormous beneficial opportunities for society, industry, and consumers. **Hence statement 1 is correct.**
- Accessibility to data and digitization plays an integral part in the working of IoT.
- Digitization is a process that interconnects the world into an integrated network enabling sharing of data and information across systems. Thus, IoT connects devices but this connectivity is provided by the digitization of information. In brief, digitization is an enabler of IoT. **Hence statement 2 is correct.**
- It may lead to the tracking of large amounts of data for surveillance and also for intrusion into personal matters.
- It may lead to an increase in the digital divide, cyber fraud, and cyber crimes.
- Factors such as low literacy and income levels, geographical restrictions, lack of motivation to use technology, lack of physical access to technology, and digital illiteracy contribute to the digital divide.
- One of the biggest risks associated with IoT is insecure communications. Data transmissions between devices are susceptible to interception by third parties. This could allow threat actors to gain access to sensitive information, like user passwords or credit card numbers. **Hence statement 3 is correct.**

**Q. 87) Consider the following statements about Big Data**

1. It refers to a large amount of structured data only.
2. It is characterized by three V's which are Volume, Vagueness and Veracity

Choose the correct code:

- a) 1 only



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

Q.87) Solution (d)

**Explanation:**

- Big data is a combination of structured, semistructured and unstructured data collected by organizations that can be mined for information and used in machine learning projects, predictive modeling and other advanced analytics applications. **Hence statement 1 is incorrect.**
- Big data is often characterized by the three V's:
  - ✓ the large volume of data in many environments;
  - ✓ the wide variety of data types frequently stored in big data systems; and
  - ✓ the velocity at which much of the data is generated, collected and processed.

**Hence statement 2 is incorrect .**

- Applications of Big Data:
- In security agencies and police forces, big data is used to prevent cyber-attacks, enhance security systems and detect card-related fraud cases.
- In disaster management, big data helps in understanding and mitigating the risks of disasters.
- In Insurance Sector, big data is used to improve customer experience & ensure their right to claim
- In Banking Sector, big data is used in managing financial data
- Big Data is used in health care for predicting diseases, prescribing medicines, optimizing treatment, and using clinical data to improve patient care
- In agriculture and food, big data helps in seed selection, geo-tagging to keep track of records of agricultural assets in the country, weather forecasting, and irrigation & effective water management.
- In the telecom sector- connecting the hinterland areas and bringing them to the mainstream and on social media for targeting platform users.

**Q. 88) Consider the following statements**

1. An edge computing network reduces the amount of data that travels over the network.
2. In edge computing, remote servers hosted on the Internet store and process data.



3. In edge computing, the latency issues are virtually non-existent.

Which of the following statements is correct?

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

Q.88) Solution (c)

**Explanation:**

- In Cloud computing, all data of the Internet of Things (IoT) system is computed in the cloud using data centres whereas in edge computing data generated by IoT devices are stored and processed locally.
- Data is not sent over a network as it is processed soon, therefore, an edge computing network reduces the amount of data that travels over the network. **Hence statement 1 is correct.**
- Cloud computing is a technology by which remote servers hosted on the Internet store and process data, rather than local servers or personal computers.
- Edge computing enables data to be analyzed, processed, and transferred at the edge of a network.
- The concept of edge computing is that instead of getting the data close to the data center, the data center is brought close to the data. The storage and computing resources from the data center are deployed as close as possible (ideally in the same location) to where the data is generated. **Hence statement 2 is incorrect.**
- Latency refers to the time required to transfer data between two points on a network. Large physical distances between these two points coupled with network congestion can cause delays. As edge computing brings the points closer to each other, latency issues are virtually nonexistent. **Hence statement 3 is correct.**

**Q. 89) Consider the following statements regarding blockchain**

- 1. It is a public ledger that everyone can inspect, but no single user controls it.
- 2. In India, blockchain is regulated by the Department of Science .
- 3. Blockchain requires intermediaries to regulate unlike traditional transactions

Choose the correct code:





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

Q.89) Solution (a)

**Explanation:**

- Blockchain is a public ledger that everyone can inspect, but no single user controls it.
- It is a distributed database or ledger that is shared among the nodes of a computer network.
- As a database, a blockchain stores information electronically in a digital format.
- Blockchains are best known for their crucial role in cryptocurrency systems, such as Bitcoin, for maintaining a secure and decentralized record of transactions. **Hence statement 1 is correct.**
- In India, cryptocurrencies are currently unregulated. However, historically the Reserve Bank of India (the RBI) and the Government of India have banned dealing in cryptocurrency.
- In 2022, the Ministry of Finance released a report proposing the creation of a digital rupee, a state-backed cryptocurrency, as well as a framework for regulating private cryptocurrencies. The report also recommended the establishment of a Digital Currency Regulatory Authority (DCRA) to oversee the use of cryptocurrencies in India. It has not been established yet. Also department of space doesn't regulate it. **Hence statement 2 is incorrect.**
- In fact, one of the main advantages of blockchain technology is that it can eliminate the need for intermediaries in transactions.
- Traditional transactions often require intermediaries, such as banks, to verify and process transactions. These intermediaries can add costs, delays, and potential security vulnerabilities to the transaction process. Blockchain technology, on the other hand, allows for peer-to-peer transactions that can be verified and recorded on a decentralized, distributed ledger without the need for intermediaries. **Hence statement 3 is incorrect.**

**Q. 90) Consider the following statements regarding the Global Cybersecurity Index (GCI)**

1. It is published by the International Telecommunication Union (ITU).
2. India has been ranked 5<sup>th</sup> in the index.
3. The United States topped the index followed by the United Kingdom.



Choose the correct code:

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

Q.90) Solution (c)

**Explanation:**

- The Global Cybersecurity Index (GCI) is published by the **International Telecommunication Union (ITU)**.
- **The GCI** is based on five parameters of cybersecurity, which are - legal measures, technical measures, organisational measures, capacity development, and cooperation. The performance is then aggregated into an overall score.
- **ITU** is the United Nations' specialized agency for information and communication technologies.
- It was founded in 1865 to facilitate international connectivity in communications networks. It is Headquartered in Geneva, Switzerland. **Hence statement 1 is correct.**
- **India has been ranked 10th in the index.** India scored a total of 97.5 points from a possible maximum of 100 points, to make it to the tenth position worldwide in the GCI 2020. India secured the fourth position in the Asia Pacific region. **Hence statement 2 is incorrect.**
- The **United States topped the index** followed by the United Kingdom.
- Even Saudi Arabia was placed in the second position together with the UK.
- Estonia was ranked 3rd in the index. **Hence statement 3 is correct.**

**Q. 91) Consider the following statements**

1. A QR code is a black-and-white square that is machine-readable.
2. Barcode is a square or rectangular shape that has parallel black lines and white spaces that are machine-readable.
3. QR codes include more information than barcodes.
4. Both QR codes and barcodes can be scanned only horizontally.

Choose the correct code:

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



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

Q.91) Solution (d)

**Explanation:**

- A QR code is a black-and-white square that is machine-readable.
- It contains a lot of information about products or items. Digital devices can extract this information from the code. Nowadays, even smartphones can scan QR codes. **Hence statement 1 is correct.**
- Barcode is a square or rectangular shape that has parallel black lines and white spaces that are machine-readable.
- Machines can read this data representation. Barcodes are very helpful in shops for purchase processing. They help to identify products within seconds. They can also be used to track inventories in warehouses. Barcodes help with the accounting process in many shops and companies. There are various barcodes depending on their application for various purposes. **Hence statement 2 is correct.**
- QR codes include more information about products than barcodes. Barcodes may only include information like the type, size, and color of products, whereas QR codes may include additional information like the price, the condition of the product as well as the date of manufacturing. In addition, QR codes can also store multimedia data. **Hence statement 3 is correct.**
- Barcodes can be scanned vertically.
- There are two types –
- One-dimensional (1-D) barcodes: It contains information data in the horizontal direction and can hold up to 25 characters.
- Two-dimensional (2-D) matrix codes: It contains information both vertically and horizontally and can hold significantly more—up to 2,000 characters.
- QR codes are scanned both vertically and horizontally and do not require the orientation positioning required of linear barcodes. **Hence statement 4 is incorrect.**

**Q. 92) Consider the following statements about quantum computing**

1. Quantum computers carry out calculations using binary code
2. It can carry out exponentially larger calculations to solve complex problems.

Choose the correct code:



- a) 1 only
- b) 2 only
- c) Both 1 and 2
- d) Neither 1 or 2

Q.92) Solution (b)

**Explanation:**

- Quantum computing is a rapidly-emerging technology that harnesses the laws of quantum mechanics to solve problems too complex for classical computers.
- Quantum mechanics is a subfield of physics that describes the behavior of particles — atoms, electrons, photons, and almost everything in the molecular and submolecular realm.
- While today's classical computers store information as binary 0 and 1 states, quantum computers draw on the fundamental laws of nature to carry out calculations using quantum bits. **Hence statement 1 is incorrect .**
- Unlike a bit that has to be a 0 or a 1, a qubit can be in a combination of states, which allows for exponentially larger calculations and gives them the potential to solve complex problems which even the most powerful classical supercomputers are not capable of. **Hence statement 2 is correct.**
- Qiskit is an open-source software development kit built by IBM for the quantum developer community. IBM regularly organizes India-focused programmes such as Qiskit India Week of Quantum, which celebrated women in quantum to kickstart their journeys in quantum and was attended by almost 300 students.

**Q. 93) Consider the following statements about Web 3.0**

1. It has recently got a universally accepted definition agreed by all the technology companies
2. It has been invented by Tim Berners-Lee

Choose the correct code:

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



Q.93) Solution (d)

**Explanation:**

- World Wide Web, which is also known as the Web, is a collection of websites or web pages stored in web servers and connected to local computers through the internet.
- Web3 or Web3.0 refers to the next generation of the world wide web, which is supposed to take over from Web2.0.
- Web 3.0 is a **decentralized internet** where users control their own data.
- The spirit of Web 3.0 is Decentralized Autonomous Organization (DAO).
- DAO is all about the business rules and governing rules in any transaction are transparently available for anyone to see and software will be written conforming to these rules.
- There is no universally accepted definition of Web 3.0, and different companies and organizations may have different interpretations of what Web 3.0 entails. Generally, Web 3.0 is seen as an evolution of the current web, which will involve the integration of technologies such as blockchain, artificial intelligence, and decentralized systems to create a more secure, decentralized, and user-centric web experience. **Hence statement 1 is incorrect**
- While Tim Berners-Lee is widely credited with inventing the World Wide Web, he did not invent Web 3.0. Web 3.0 is a term that has emerged in recent years to describe the next generation of the web, which is still being developed and defined by various technology companies and organizations. **Hence statement 2 incorrect**

**Q. 94) Consider the following statements about Organic Light Emitting Diode (OLED) and Quantum Dots Light Emitting Diode (QLED)**

1. Both OLED and QLED achieve deeper blacks without backlight behind an LCD panel.
2. OLED has a clear view from all angles without compromising the color contrast as compared to QLED.

Choose the correct code:

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

Q.94) Solution (b)

**Explanation:**

- The OLEDs use organic glowing materials for their illumination, thus eliminating the need for an LED backlight as with LCDs.

The organic light-emitting diode in which the emissive electroluminescent layer is a film of an organic compound, which emits light in response to an electric current. As a result, they deliver superior, pristine, and vibrant picture quality and amazingly wide viewing angles for an exceptional viewing experience.

Quantum Dot LED, simply called a QLED, displays are based on quantum-dots light-emitting diodes. The technology is quite similar to OLED display technology, but with a quantum dot layer instead of the OLED emitting layer.

The ability to produce deeper blacks is one of the most important factors in achieving a near-perfect picture quality and which also allows for vibrant colors and higher contrast. As every pixel in an OLED display panel illuminates the light of its own, it achieves a near-perfect black level resulting in much brighter images without compromising dark areas surrounding them.

- QLED displays, on the other hand, suffer a little from light bleed, as it still relies on a backlight behind an LCD panel. OLED is the winner in terms of achieving deeper blacks as it achieves deeper black without backlight behind the LCD panel. **Hence statement 1 is incorrect.**
- While both OLED and QLED televisions deliver exceptional viewing experience when you're sitting in the center exactly in front of your television, QLED displays tend to lose significant color and luster, losing a significant amount of contrast when you're looking at the television from far off-center. OLED televisions offer an excellent viewing experience from all angles without compromising the color contrast and with no luminance degradation whatsoever. OLED has a clear advantage over QLED when it comes to drastic viewing angles. **Hence statement 2 is correct.**

**Q. 95) Consider the following statements about Light Fidelity (LiFi) Technology**

1. It is a unidirectional fully networked wireless communication technology.
2. It uses radio frequencies as a medium to carry data.
3. It can easily operate in harsh weather conditions.

Choose the incorrect code:

- a) 1 and 2
- b) 2 and 3
- c) 1 and 3



d) 1, 2 and 3

Q.95) Solution (d)

**Explanation:**

Here the question asks to find an 'incorrect' code.

- Light Fidelity (LiFi) Technology is a **bidirectional fully networked wireless communication** technology.
- An improvised LED bulb functions as a router.
- It can offer greater security, data rates, and densities to support more robust and reliable wireless networks that complement and enhance existing cellular and Wi-Fi networks.
- It provides ultra-fast data connections and is especially useful in urban areas where radio spectra are congested and also very useful in rural areas wherein Fiber Optic Cables or networks are not reachable. **Hence statement 1 is incorrect.**
- An ordinary off-the-shelf LED bulb is connected to a device, which in turn is connected to the Internet.
- The Internet data flows in via the device into the bulb and is carried by light waves.
- At the other end, light waves carrying Internet data fall on a receiver or a dongle that is connected to the computer.
- It uses visible light instead radio frequencies as a medium to carry data. **Hence statement 2 is incorrect.**
- It requires specialized LEDs to work flawlessly and might not work during the night.
- It is difficult to operate in harsh weather conditions. **Hence statement 3 is incorrect.**

Q. 96) Consider the following

| Malware types | Names     |
|---------------|-----------|
| 1. Ransomware | BadRabbit |
| 2. Worm       | Morris    |
| 3. Bots       | Zeus      |
| 4. Virus      | Mirai     |

How many pairs are correctly matched?

- a) Only one pair is correctly matched
- b) Two pairs are correctly matched
- c) Three pairs are correctly matched



d) Four pairs are correctly matched

Q.96) Solution (b)

**Explanation:**

- Malware, short for malicious software, is used by threat actors to intentionally harm and infect devices and networks. The umbrella term encompasses many subcategories, including the following:
  - ✓ Viruses
  - ✓ Worms
  - ✓ Ransomware
  - ✓ Bots
  - ✓ Trojan Horses
  - ✓ Keyloggers
  - ✓ Rootkits
  - ✓ Spyware
  - ✓ Cryptomining Malware
  - ✓ Adware
- Ransomware encrypts files or devices and forces victims to pay a ransom in exchange for re-entry. While ransomware and malware are often used synonymously, ransomware is a specific form of malware. BadRabbit is a classic example of ransomware. **Hence pair 1 is correct.**
- A computer worm **self-replicates and infects other computers without human intervention**. Morris is a classic example of a worm. **Hence pair 2 is correct.**
- A computer virus infects devices and replicates itself across systems. **Viruses require human intervention to propagate.**
- The Zeus virus, **first detected in 2006**, is still used by threat actors today. **Hence pair 3 is incorrect.**
- A bot is a **self-replicating malware that spreads itself to other devices**, creating a network of bots, or a **BOTNET**. **Once infected, devices perform automated tasks commanded by the attacker**. Mirai is a classic example of a botnet. **Hence pair 4 is incorrect.**

**Q. 97) Consider the following statements about Bluebugging**

1. It is a hack where attackers access a device through its Bluetooth connection.
2. Once a device is blue-bugged, a hacker can listen to the calls and send messages.
3. The most secure smartphones like iPhones are not vulnerable to such attacks.





4. Turning off Bluetooth when not in use can prevent such attacks.

Choose the correct code:

- a) Only one statement is correct
- b) Two statements are correct
- c) Three statements are correct
- d) Four statements are correct

Q.97) Solution (c)

**Explanation:**

- **Bluebugging** is a hack where attackers access a device through its Bluetooth connection.
- A hacker can gain unauthorized access to these apps and devices and control them as per their wish through blue bugging.
- Any Bluetooth-enabled device including True Wireless Stereo (TWS) devices or earbuds is susceptible to blue bugging. **Hence statement 1 is correct.**
- Once a device or phone is blue-bugged, a hacker can listen to the calls, read and send messages and steal and modify contacts. **Hence statement 2 is correct.**
- Even the most secure smartphones like iPhones are vulnerable to such attacks. **Hence statement 3 is incorrect.**
- Turning off Bluetooth and disconnecting paired Bluetooth devices when not in use, making Bluetooth devices undiscoverable from Bluetooth settings, updating the device's system software to the latest version, and limiting the use of public Wi-Fi can prevent such attacks. **Hence statement 4 is correct.**

**Q. 98) Consider the following statements**

1. A digital signature is a digital code that is created and validated by public key encryption.
2. A digital certificate is an electronic certificate that is issued to verify the authenticity of a user.
3. A digital signature helps in verifying the authenticity of a specific document.
4. A digital certificate helps in creating an identity for a website.

Choose the correct code:

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



d) 1, 2, 3 and 4

Q.98) Solution (d)

**Explanation:**

- A digital signature is a digital code that is created and validated by public key encryption.
- The digital signature creation process includes encryption and decryption using asymmetric keys. **Hence statement 1 is correct.**
- A digital certificate is an electronic certificate that is issued to verify the authenticity of a user.
- A digital certificate can be issued by a trusted agency known as the CA. The CA follows specific steps such as key generation, registration, verification, and creation. **Hence statement 2 is correct.**
- A digital signature helps in verifying the authenticity of a specific document.
- It also helps in verifying the source of a specific document.
- It helps provide authentication, non-repudiation, and integrity. **Hence statement 3 is correct.**
- A digital certificate helps in creating an identity for a website. It also improves the trustworthy nature of the website. It helps provide authentication and security. **Hence statement 4 is correct.**

Q. 99) Consider the following statements

1. IPv4 has a 32-bit address length whereas IPv6 has a 128-bit address length.
2. In both IPv4 and IPv6 end-to-end, connection integrity is achievable.
3. The address representation of IPv4 can be decimal and IPv6 can be hexadecimal.

Choose the correct code:

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

Q.99) Solution (c)

**Explanation:**



- IPv4 address consists of two things that are the network address and the host address. It stands for **Internet Protocol version four**. It was introduced in 1981 by DARPA and was the first deployed version in 1982 for production on SATNET and the ARPANET in January 1983.
- IPv6 is based on IPv4 and stands for Internet Protocol version 6. It was first introduced in December 1995 by Internet Engineering Task Force. IP version 6 is the new version of Internet Protocol, which is way better than IP version 4 in terms of complexity and efficiency.
- IPv4 has a 32-bit address length whereas IPv6 has a 128-bit address length.
- IPv4 can generate  $4.29 \times 10^9$  address space.
- The address space of IPv6 is quite large it can produce  $3.4 \times 10^{38}$  address space. **Hence statement 1 is correct.**
- IPv4 supports manual and DHCP address configuration whereas IPv6 supports Auto and renumbering address configuration.
- Only in IPv6 end-to-end, connection integrity is achievable. **Hence statement 2 is incorrect.**
- The address representation of IPv4 is in decimal and IPv6 is in hexadecimal. **Hence statement 3 is correct.**

**Q. 100) Consider the following statements about Optical Fibre**

1. It provides lesser bandwidth compared to copper wires.
2. In this, data can move at higher speeds and greater distances.
3. It works on the principle of total internal reflection (TIR).

Choose the correct code:

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

Q.100) Solution (b)

**Explanation:**

- Optical fibre is the backbone of the digital infrastructure — the data is transmitted by light pulses travelling through long strands of thin fibre.



- **Optical** fiber provides more bandwidth and has standardized performance up to 10 Gbps and beyond, something that is impossible to achieve when using copper.
- More bandwidth means that fiber can carry more information with far greater efficiency than copper wire. **Hence statement 1 is incorrect.**
- Since data travels in the form of light in fiber-optic cables, very little signal loss occurs during transmission, and data can move at higher speeds and greater distances. **Hence statement 2 is correct.**
- The optical fibre works on the principle of total internal reflection (TIR).
- Total internal reflection is the complete reflection of a ray of light within a medium such as water or glass from the surrounding surfaces back into the medium. **Hence statement 3 is correct.**