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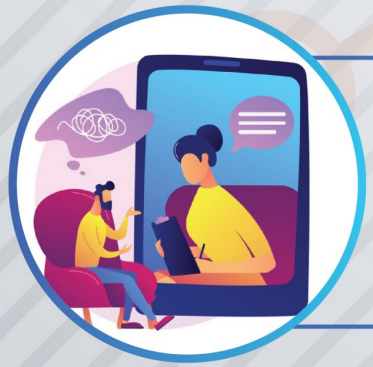

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Q.1) Consider the following statements about Big Bang Theory:

1. The model describes how the universe expanded from an initial state of extremely high density and low temperature.
2. According to this theory, Galaxies are still drifting apart.

Which of the above statements is/are correct?

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

Q.1) Solution (b)

Explanation:

The Big Bang theory is a cosmological model of the observable universe from the earliest known periods through its subsequent large-scale evolution. The model describes how the universe expanded from an initial state of extremely **high density and high temperature**, and offers a comprehensive explanation for a broad range of observed phenomena, including the abundance of light elements, the cosmic microwave background (CMB) radiation, and large-scale structure.

Detailed measurements of the expansion rate of the universe place the Big Bang at around 13.8 billion years ago, which is thus considered the age of the universe.

After its initial expansion, the universe cooled sufficiently to allow the formation of subatomic particles, and later atoms. Giant clouds of these primordial elements – mostly hydrogen, with some helium and lithium – later coalesced through gravity, forming early stars and galaxies, the descendants of which are visible today. Besides these primordial building materials, astronomers observe the gravitational effects of an unknown dark matter surrounding galaxies.

Edwin Hubble confirmed through analysis of galactic redshifts in 1929 that **galaxies are indeed drifting apart**; this is important observational evidence for an expanding universe

Statement 1	Statement 2
Incorrect	Correct

According to Big Bang Theory, in the initial stage of formation of universe, it was in the state of extremely high density and high temperature.	Edwin Hubble confirmed that galaxies are drifting apart, which was proposed by big bang theory.

Q.2) Consider the following statements about "Standard Model of Particle Physics":

1. This model does not include electromagnetic forces.
2. This theory is a complete theory of fundamental interaction.

Which of the above statements is/are correct?

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

Q.2) Solution (d)

Basic Information:

The Standard Model of particle physics is the theory describing three of the four known fundamental forces (the electromagnetic, weak, and strong interactions **and not including the gravitational force**) in the universe, as well as classifying all known elementary particles.

It was developed in stages throughout the latter half of the 20th century, through the work of many scientists around the world, with the current formulation being finalized in the mid-1970s upon experimental confirmation of the existence of quarks.

Since then, confirmation of the top quark (1995), the tau neutrino (2000), and the Higgs boson (2012) have added further credence to the Standard Model.

However, It leaves some phenomena unexplained and falls short of being a complete theory of fundamental interactions. It does not fully explain **baryon asymmetry**; incorporate the full theory of gravitation as described by general relativity, or account for the accelerating expansion of the Universe as possibly described by dark energy. The model does not contain any viable dark matter particle that possesses all of the required properties deduced from observational cosmology. It also does not incorporate neutrino oscillations and their non-zero

masses.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Incorrect**
Standard Model of Physics does not consider all fundamental forces. It includes electromagnetic, weak, and strong interactions, and does not include gravitational force.	As this theory leaves many phenomena unexplained, such as baryon asymmetry, so it falls short of being a complete theory of particle interaction.

Q.3) Which of the following is incorrect about Higgs Boson?

a) It is caused by Quantum excitation.
b) Large Hadron Collider is experiment related to Higgs Boson.
c) It is a subatomic particle.
d) Electric Charge on it is +1 e.

Q.3) Solution (d)

Explanation – Electric Charge on Higgs Boson is 0 e and not + 1 e.

Basic Information:

The Higgs boson is an **elementary particle** in the Standard Model of particle physics produced **by the quantum excitation of the Higgs field**. It is named after physicist Peter Higgs who in 1964 along with five other scientists proposed the Higgs mechanism to explain why some particles have mass. This mechanism required that a spineless particle known as a boson should exist with properties as described by the Higgs Mechanism theory.

A subatomic particle with the expected properties was discovered in 2012 by the ATLAS and CMS experiments at the Large Hadron Collider (LHC) at CERN near Geneva, Switzerland. The new particle was subsequently confirmed to match the expected properties of a Higgs boson.

Higgs Boson is an elementary particle. An elementary or fundamental particle is a subatomic particle with no substructure, i.e. it is not composed of other particles.

Q.4) Consider the following statements about 'Neutrino':

1. Neutrino has mass larger than other elementary particle.
2. Neutrino generally gets detected while passing through normal matter.

Which of the above statements is/are NOT correct?

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

Q.4) Solution (c)

Note: Incorrect statements are asked in the question.

Basic Information:

A neutrino is a fermion that interacts only via the weak subatomic force and gravity. The neutrino is so named because it is electrically neutral and because its rest mass is so small (-ino) that it was long thought to be zero. The mass of the neutrino is much smaller than that of the other known elementary particles. The neutrino was postulated first by Wolfgang Pauli in 1930 to explain how beta decay could conserve energy, momentum, and angular momentum.
The weak force has a very short range, the gravitational interaction is extremely weak, and neutrinos do not participate in the strong interaction. Thus, neutrinos typically pass through normal matter unimpeded and undetected.

Neutrinos are created by various radioactive decays.

For each neutrino, there also exists a corresponding antiparticle, called an antineutrino, which also has spin of ½ and no electric charge.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Incorrect**
The mass of the neutrino is much smaller than that of the other known elementary particles.	Neutrinos typically pass through normal matter unimpeded and undetected.

Q.5) With reference to "Gravitational Wave", consider the following statements:

1. Albert Einstein predicted the existence of gravitational waves in 1916 in his general theory of relativity.
2. Pulsar Radio emission's study has confirmed the Einstein's Prediction.

Which of the above statements is/are correct?

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

Q.5) Solution (c)

Basic Information:

Gravitational Wave

Gravitational waves are 'ripples' in space-time caused by some of the most violent and energetic processes in the Universe.

Albert Einstein predicted the existence of gravitational waves in 1916 in his general theory of relativity. Einstein's mathematics showed that massive accelerating objects (such as neutron stars or black holes orbiting each other) would disrupt space-time in such a way that 'waves' of undulating space-time would propagate in all directions away from the source. These cosmic ripples would travel at the speed of light, carrying with them information about their origins, as well as clues to the nature of gravity itself.

The strongest gravitational waves are produced by cataclysmic events such as colliding black holes, supernovae (massive stars exploding at the end of their lifetimes), and colliding neutron stars. Other waves are predicted to be caused by the rotation of neutron stars.

In year 1974, two astronomers using the Arecibo Radio Observatory in Puerto Rico discovered a binary pulsar, exactly the type of system that general relativity predicted should radiate gravitational waves (proved for first time.)

Since then, many astronomers have studied pulsar radio-emissions (pulsars are neutron stars that emit beams of radio waves) and found similar effects, further confirming the existence of gravitational waves.

Statement Analysis: Both the statements are correct.

Q.6) Consider following statements regarding Dark Matter -

1. Dark matter is an Anti-matter.
2. Universe comprises of 68% dark energy and 27% of dark matter.

Select the correct answer using the code below:

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

Q.6) Solution (b)

Basic Information:

Dark Matter

Dark matter is a form of matter thought to account for approximately 85% of the matter in the universe with Dark energy.

Its presence is implied in a variety of astrophysical observations, including gravitational effects that cannot be explained by accepted theories of gravity unless more matter is present than can be seen. For this reason, most experts think that dark matter is abundant in the universe and that it has had a strong influence on its structure and evolution.

Dark matter is called dark because it does not appear to interact with the electromagnetic field, which means it does not absorb, reflect or emit electromagnetic radiation, and is therefore difficult to detect.

Primary evidence for dark matter comes from calculations showing that many galaxies would fly apart, or that they would not have formed or would not move as they do, if they did not contain a large amount of unseen matter.

Current models favour a cold dark matter scenario, in which structures emerge by gradual accumulation of particles.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Correct**
Dark matter is not antimatter, because we do not see the unique gamma rays that are produced when antimatter annihilates with matter.	Universe comprises of 68% from Dark Energy, 27% of Dark Matter and 5% of normal matter.

Q.7) Consider the following statements about Black Hole:

1. Black Hole is very dense object through which only light can escape.
2. Astronauts observe Black holes directly by detecting X-ray or other form of Electromagnetic Radiation.

Which of the above statements is/are correct?

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

Q.7) Solution (d)

Basic Information:

Black Hole

A black hole is a place in space where gravity pulls so much that even light can not get out. The gravity is so strong because matter has been squeezed into a tiny space. This can happen when a star is dying.

Because no light can get out, people can't see black holes. They are invisible. Space telescopes with special tools can help find black holes. The special tools can see how stars that are very close to black holes act differently than other stars.

How Do Black Holes Form?
Scientists think the smallest black holes formed when the universe began. Stellar black holes are

made when the centre of a very big star falls in upon itself, or collapses. When this happens, it causes a supernova. A supernova is an exploding star that blasts part of the star into space.

A black hole cannot be seen because strong gravity pulls all of the light into the middle of the black hole. But scientists can see how the strong gravity affects the stars and gas around the black hole. Scientists can study stars to find out if they are flying around, or orbiting, a black hole.

Recently Event Horizon telescope unveiled the first image of Black Hole.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Correct**
Black hole's gravity is so strong that not even light can escape while passing through it.	Black holes are not directly observed, but observed with the help of their effect on other matter nearby.

Q.8) Consider the following statements about Space orbits:

1. Satellites in Low Earth Orbit do not have to follow a particular path.
2. Satellites have more available routes in Geo Stationary orbit than Lower Earth Orbits.
3. Satellites in Polar Earth Orbit usually travel past Earth from north to south.

Which of the above statements is/are correct?

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

Q.8) Solution (c)

Basics –

Geostationary orbit (GEO)

Satellites in geostationary orbit (GEO) circle Earth above the equator from west to east following Earth's rotation – taking 23 hours 56 minutes and 4 seconds – by travelling at exactly the same

rate as Earth. This makes satellites in GEO appear to be 'stationary' over a fixed position. In order to perfectly match Earth's rotation, the speed of GEO satellites should be about 3 km per second at an altitude of 35,786 km.

GEO is used by satellites that need to stay constantly above one particular place over Earth, such as telecommunication satellites. This way, an antenna on Earth can be fixed to always stay pointed towards that satellite without moving.

Satellites in GEO cover a large range of Earth so as few as three equally-spaced satellites can provide near global coverage.

Low Earth orbit (LEO)

A low Earth orbit (LEO) is, as the name suggests, an orbit that is relatively close to Earth's surface. It is normally at an altitude of less than 1000 km but could be as low as 160 km above Earth. LEO's close proximity to Earth makes it useful for several reasons. It is the orbit most commonly used for satellite imaging, as being near the surface allows it to take images of higher resolution. It is also the orbit used for the International Space Station (ISS).

Polar orbit and Sun-synchronous orbit (SSO)

Satellites in polar orbits usually travel past Earth from north to south rather than from west to east, passing roughly over Earth's poles.

Satellites in a polar orbit do not have to pass the North and South Pole precisely; even a deviation within 20 to 30 degrees is still classed as a polar orbit. Polar orbits are a type of low Earth orbit, as they are at low altitudes between 200 to 1000 km.

Sun-synchronous orbit (SSO) is a particular kind of polar orbit. Satellites in SSO, travelling over the Polar Regions, are synchronous with the Sun. This means they are synchronised to always be in the same 'fixed' position relative to the Sun. This means that the satellite always visits the same spot at the same local time – for example, passing the city of Paris every day at noon exactly.

Statement Analysis:

Statement 1	Statement 2	Statement 3
Correct	**Incorrect**	**Correct**
Unlike satellites in GEO that must always orbit along Earth's equator, LEO	Due to 1st statement, there are more available routes for	Satellites in polar orbits usually travel past Earth from north to south rather than from west to

satellites do not always have to follow a particular path around Earth in the same way – their plane can be tilted.	satellites in LEO, which is one of the reasons why LEO is a very commonly used orbit.	east, passing roughly over Earth's poles.

Q.9) Consider the following statements about GSLV Mk – II:

1. It is a four staged vehicle mainly used to send satellites in Geostationary Orbit.
2. First two stages uses solid rocket motor, second stage uses liquid fuel and final stage uses cryogenic engine.

Choose correct statement from the below given options:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 not 2

Q.9) Solution (d)

Basic Information:

- Geosynchronous Satellite Launch Vehicle are the satellite-launch vehicles (rockets) developed by ISRO.
- The GSLV is designed mainly to deliver the communication-satellites to the highly elliptical (typically 250 x 36000 Km) Geosynchronous Transfer Orbit (GTO). The satellite in GTO is further raised to its final destination, viz., Geo-synchronous Earth orbit (GEO) of about 36000 Km altitude (and zero degree inclination on equatorial plane) by firing its in-built on-board engines.
- Two versions of the GSLV are being developed by ISRO. The first version, GSLV Mk-II, has the capability to launch satellites of lift-off mass of up to 2,500 kg to the GTO and satellites of up to 5,000 kg lift-off mass to the LEO. GSLV MK-II is a three-staged vehicle with first stage using solid rocket motor, second stage using Liquid fuel and the third stage, called Cryogenic Upper Stage, using cryogenic engine.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Incorrect**
GSLV – Mk –II is a three staged vehicle mainly used to send satellites in Geostationary Orbits.	First stage uses solid rocket motor, second stage uses Liquid fuel and the third stage, called Cryogenic Upper Stage, uses cryogenic engine.

Q.10) Explosive death of the star which often result in star obtaining the brightness of 100 million suns for the short time is known as

a) Nova
b) Supernova
c) Nebula
d) White dwarf

Q.10) Solution (b)

Basic Information:

Supernova

- A supernova is the **explosive death of a star** and often results in the star obtaining the brightness of 100 million suns for a short time.
- The extremely luminous burst of radiation expels much or all of a star's material at a great velocity, driving a **shock wave** into the surrounding interstellar medium.
- These **shock waves trigger condensation is a nebula paving the way for the birth of a new star** — if a star has to be born, a star has to die!
- **A great proportion of primary cosmic rays comes from supernovae**.

Nova

- Nova occurs on the surface of a white dwarf in a binary system.
- If the two stars of the system are sufficiently near to one another, material (hydrogen) can be pulled from the companion star's surface onto the white dwarf.
- When enough material builds up on the surface of the white dwarf, it triggers a nuclear fusion on a white dwarf which causes a sudden brightening of the star

Nebula

- A nebula is a cloud of gas (mostly hydrogen and helium) and dust in space.
- Nebulae are the birthplaces of stars.

White dwarf

- A white dwarf is very small, hot star, the last stage in the life cycle of a star like the Sun.
- White dwarfs are the remains of normal stars, whose nuclear energy supplies have been used up.
- White dwarf consists of degenerate matter with a very high density due to gravitational effects, i.e. one spoonful has a mass of several tonnes.

Q.11) Consider the following statements about Venus:

1. It is brightest planet in the solar system.
2. Venus has no atmosphere as gravity is too weak to hold down a normal atmosphere.

Which of the above statements is/are correct?

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

Q.11) Solution (a)

Explanation:

Venus

- Venus is the **brightest planet** in the solar system and is the third brightest object visible from earth after the sun and the moon.

- It is the brightest among planets because it has the **highest albedo** due to the **highly reflective sulphuric acid** that covers its atmosphere.

- Venus is sometimes called Earth's sister planet or Earth's twin because of their similar size, mass, proximity to the Sun, bulk composition and presence of similar physical features such as high plateaus, folded mountain belts, numerous volcanoes, etc.
- Venus's Atmosphere
    - The surface of Venus is totally obscured by a thick atmosphere composed of about 96% carbon dioxide, covered with clouds of highly reflective sulfuric acid.
    - It has the **densest atmosphere of the four terrestrial planets**. The atmospheric pressure at the planet's surface is **92 times** that of Earth.
- It is also hottest planet in solar system. This is because of large greenhouse effect of highly concentrated Carbon di-oxide.
- ISRO is planning to launch Shukrayaan 1 by 2024-26 to study the surface and atmosphere of Venus.

Statement 1	Statement 2
Incorrect	**Correct**
Venus is brightest planet in the solar system due to high albedo generated through highly reflective Sulphuric Acid.	Mercury has no atmosphere due to weak gravity force, but Venus has most dense atmosphere among all four terrestrial planets.

Q.12) Consider the following statements about "Kuiper Belt".

1. It is a donut-shaped region of icy bodies closest to the orbit of Uranus.
2. First mission to explore the Kuiper belt is New Horizons.

Which of the above statements is/are correct?

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

Q.12) Solution (b)

Basic Information:

About Kuiper Belt

The Kuiper Belt is a region of leftovers from the solar system's early history. Like asteroid belt, it has also been shaped by a giant planet, although it's more of a thick disk. The inner edge of the Kuiper Belt begins at the orbit of Neptune. Most Kuiper belt objects are composed largely of frozen volatiles, such as methane, ammonia and water. The Kuiper belt is home to three officially recognized dwarf planets: Pluto, Haumea and Makemake. Some of the Solar System's moons, such as Neptune's Triton and Saturn's Phoebe, may have originated in the region.

On January 19, 2006, the first spacecraft to explore the Kuiper belt, **New Horizons**, was launched, which flew by Pluto in 2015. Beyond the Pluto flyby, the mission's goal was to locate and investigate other, farther objects in the Kuiper belt.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Correct**
Kuiper Belt is a donut-shaped region of icy bodies beyond the orbit of Neptune.	New Horizons is a NASA mission to study the dwarf planet Pluto, its moons, and other objects in the Kuiper Belt. It was launched in 2006.

Q.13) Which of the following is incorrect about Exoplanets?

a) These planets are certainly liveable.
b) Ploonets are a type of Exoplanet, which are detached moons of other planets.
c) 51 Pegasi b was the first Exoplanet discovered by Mayor and Queloz in December, 1995.
d) As of 2019, more than 4000 exoplanets are discovered.

Q.13) Solution (a)

Explanation – There is no certainty of liveability on Exoplanets.

Basic Information:

Exoplanets are planet outside our solar system. Idea of Exoplanets evolved from Nicolaus Copernicus's theory which put sun at the centre with planets like earth revolving around. Later Copernicus revolution was followed by Giardano Bruno and later by Isaac Newton shattering the uniqueness of the Sun's position by predicting that many stars could have planets orbiting them.

But they were found very lately in 1995. **51 Pegasi b was the first exoplanet to be discovered by Mayor and Queloz in December, 1995**. According to the NASA Exoplanet archive, as of October 10, 2019, there are **4,073 confirmed Exoplanets**. Today, there are not just ground-based telescopes but space missions that search for exoplanets, such as the Kepler Space Telescope.

Ploonets are defined as exomoons which have left their own planets due to angular momentum. Till now no Ploonets have been detected, yet they are believed to be exist likely around other stars.

Q.14) Consider the following statements about 'Satellite series of ISRO's':

1. Indian National Satellite (INSAT) is a type of Earth observation satellite.
2. RESOURCESAT is placed in geostationary orbit, which enable it to communicate over large distances.

Which of the above statements is/are NOT correct?

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

Q.14) Solution (c)

Note: Incorrect statements are asked in the question.

Basic Information:

Communication satellites

- They are used for communicating over large distances.
- INSAT and GSAT of India comes under this category.
- INSAT systems are placed in Geo-stationary orbits. These are one of the largest domestic communication satellite systems in Asia-Pacific region.

Earth Observation Satellites

- These satellites are used for observing the earth's surface and as a result they are often termed geographical satellites.
- India's IRS and RESOURCESAT are part of this.
- Usually these satellites are placed in lower earth orbit for better precision.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Incorrect**
INSAT series is type of communication Satellites and not earth observation satellites.	RESOURCESAT is type of Earth observation satellites, which are usually placed in Lower earth orbits, specifically in sun-synchronous zone.

Q.15) With reference to "GSAT -30", consider the following statements:

1. It is going to replace INSAT-4A with enhanced coverage.
2. Launch vehicle used to launch this mission was GSLV-Mk III.

Which of the above statements is/are correct?

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

Q.15) Solution (a)

Basic Information:

GSAT 30

India's telecommunication satellite GSAT-30 was successfully launched into a Geosynchronous Transfer Orbit (GTO) on January 17, 2020 from French Guiana **by Ariane-5 VA-251**.

GSAT-30 is configured on ISRO's enhanced I-3K Bus structure to provide communication services from Geostationary orbit in C and Ku bands. The satellite derives its heritage from ISRO's earlier INSAT/GSAT satellite series.

Weighing 3357 kg, GSAT-30 is to serve as replacement to INSAT-4A spacecraft services with enhanced coverage. The satellite provides Indian mainland and islands coverage in Ku-band and extended coverage in C-band covering Gulf countries, a large number of Asian countries and Australia.

The designed in-orbit operational life of GSAT-30 is more than 15 years.

Statement Analysis:

Statement 1	Statement 2
Correct	**Incorrect**
Telecommunication satellite GSAT-30 will replace INSAT 4A, with better coverage of Asia and Oceania.	The launch vehicle used was Ariane-5, which is operated by European space agency. ISRO wanted to save GSLV Mk III for future mission like Gaganyaan, and others.

Q.16) Hyperspectral Imaging can be used in –

1. Identification of Weeds
2. Evaluation of Ripeness of crops
3. Tracking water Quality
4. Wound Healing
5. Characterise Food quality

Select the correct answer using the code below:

a) 1, 2 and 3 only
b) 1, 2 and 5 only
c) 1, 2, 4 and 5 only

d) All of the above

Q.16) Solution (d)

Basic Information:

Hyperspectral Imaging

Hyperspectral imaging, like other spectral imaging, collects and processes information from across the electromagnetic spectrum. The goal of hyperspectral imaging is to obtain the spectrum for each pixel in the image of a scene, with the purpose of finding objects, identifying materials, or detecting processes.

Whereas the human eye sees color of visible light in mostly three bands (long wavelengths - perceived as red, medium wavelengths - perceived as green, and short wavelengths - perceived as blue), spectral imaging divides the spectrum into many more bands. This technique of dividing images into bands can be extended beyond the visible. In hyperspectral imaging, the recorded spectra have fine wavelength resolution and cover a wide range of wavelengths.

Usage of Hyperspectral Imaging (List not exhaustive)

Agriculture - Hyperspectral imaging enables identification of weeds, monitoring of plant health, and evaluation of ripeness. Early detection of crop stress is a common application.

Environment - Hyperspectral imaging is used to track forest health, water quality, and surface contamination.

Biotechnology - Hyperspectral imaging is used for a wide-range of biological and medical applications. Such as Seed viability, wound Healing.

Remote Sensing - hyperspectral imaging cameras are used in air, space, and underwater vehicles to capture detailed spectral data for a wide range of uses.

Food Analysis - hyperspectral imaging systems are used in food research and industry to identify defects, characterize product quality, and locate contaminants.

Machine Vision - Hyperspectral machine vision detects small color differences more accurately and identifies different materials more reliably than conventional imaging. Hyperspectral Imaging system can be interfaced to robots, labelling devices, or used as feedback for sorting, grading, or process control.

Q.17) Consider the following statements about IRNSS:

1. With IRNSS, India became the fourth country in the world to have its independent regional navigation satellite system recognised by the International Maritime Organisation (IMO).
2. IRNSS will replace GPS in Indian Ocean up to 5000 km from the boundaries.

Which of the above statements is/are correct?

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

Q.17) Solution (a)

Basic Information:

IRNSS

The IRNSS is an independent regional navigation satellite system developed by India. It is designed to provide accurate position information service to assist in the navigation of ships in the Indian Ocean waters. It could replace the US-owned Global Positioning System (GPS) in the Indian Ocean extending up to approximately 1500 km from the Indian boundary.

IRNSS will provide two types of services, namely, Standard Positioning Service (SPS) which is provided to all the users and Restricted Service (RS), which is an encrypted service provided only to the authorised users. The IRNSS System is expected to provide a position accuracy of better than 20 m in the primary service area.

Some applications of IRNSS are:

- Terrestrial, Aerial and Marine Navigation
- Disaster Management
- Vehicle tracking and fleet management
- Integration with mobile phones
- Precise Timing
- Mapping and Geodetic data capture
- Terrestrial navigation aid for hikers and travellers
- Visual and voice navigation for drivers

Statement Analysis:

Statement 1	Statement 2

Correct	Incorrect
India became the fourth country in the world to have its independent regional navigation satellite system recognised by the International Maritime Organisation (IMO) as a part of the World Wide Radio Navigation System (WWRNS).	The navigation system can now replace GPS in the Indian Ocean waters up to 1500 km from the Indian boundary.

Q.18) Consider the following statements about Indian Data Relay Satellite System (IDRSS):

1. IDRSS will be placed in Low Earth Orbit.
2. It is to facilitate relay of information between various Indian spacecraft, in-flight launch vehicle monitoring and assist Indian Human Spaceflight Programme.

Which of the above statements is/are correct?

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

Q.18) Solution (b)

Basics –

Indian Data Relay Satellite System or IDRSS is a planned Indian constellation of Inter-satellite communications satellites. Planned to initially comprise two satellites in GEO, it is to facilitate relay of information between various Indian spacecraft, in-flight launch vehicle monitoring and assist Indian Human Spaceflight Programme.

A Data Relay Satellite System (DRSS) facilitates continuous real-time communication between Low Earth orbit bound spacecraft to the ground station as well as inter-satellite communication. Such a satellite in geostationary orbit can track a low altitude spacecraft up to almost half of its orbit.

India operates one of world's largest remote sensing satellites systems. Visibility of these satellites is not more than 10-15 minutes in a day and sometimes even lower. The IDRSS satellites, one opposite to each half of earth in GEO, can see about 80 per cent of the area where Indian remote sensing satellites are orbiting, hence enhancing visibility range and data

transfer rates of satellites. IDRSS can also monitor a launch vehicle from the time it lifts off from the launch pad. Satellites will hereby also reduce dependency on ground stations. Implementation of the system will be essential for tracking Gaganyaan, India's future crewed spacecraft.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Correct**
IRDSS will be placed in Geostationary orbit from where it can see about 80 per cent of the area where Indian remote sensing satellites are orbiting, hence enhancing visibility range and data transfer rates of satellites.	It with better visibility range, with enhance communication of ground station and orbiting satellites. It will also assist Gaganyaan.

Q.19) Consider the following statement about NASA-ISRO Synthetic Aperture Radar (NISAR)

1. Both NASA and ISRO will share cost equally.
2. It will be placed in Geostationary Orbit for larger coverage of earth.

Choose correct statement from the below given options:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 not 2

Q.19) Solution (d)

Basic Information:

NISAR (NASA-ISRO Synthetic Aperture Radar)

- The NASA-ISRO Synthetic Aperture Radar (NISAR) mission is a joint project between NASA and ISRO to co-develop and launch **dual-frequency synthetic aperture radar** on an Earth observation satellite.
- The satellite will be the **first radar imaging satellite to use dual frequencies**.

- It will be used **for remote sensing**, to observe and understand natural processes on Earth. For example, its left-facing instruments will study the Antarctic cryosphere.
- With a total cost estimated at **US$1.5 billion**, NISAR is likely to be the **world's most expensive Earth-imaging satellite**.
- The satellite will be launched from India aboard a **Geosynchronous Satellite Launch Vehicle.**
- The orbit will be a **Sun-synchronous**, dawn-to-dusk type.
- The planned mission life is **three years**.
- Data collected from NISAR will reveal information about the evolution and state of Earth's crust, help scientists better understand our planet's natural processes and changing climate, and aid future resource and hazard management.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Incorrect**
ISRO's share of the project cost is about ₹788 crore (US$110 million), and NASA's share is about US$808 million.	The orbit will be a Sun-synchronous, dawn-to-dusk type. (It is an Earth-imaging satellite, which are usually placed in Low Earth orbit for better visibility, and usually follow sun-synchronous orbit to access sunlight all the time)

Q.20) Consider the following statements about Space debris:

1. Currently, there is no binding international legal rule which prohibits the creation of space debris.
2. Outer Space Treaty bars states party to the treaty from placing weapons of mass destruction in Earth orbit.
3. RemoveDEBRIS Mission is mission to remove debris from space, led by NASA.

Choose the correct option from the options given below:

a) 1 and 2 only
b) 2 and 3 only
c) 2 only
d) All of the above

Q.20) Solution (a)

Basic Information:

Space debris

- Space debris, also called space junk, artificial material that is orbiting Earth but is no longer functional.
- This material can be as large as a discarded rocket stage or as small as a microscopic chip of paint.
- Kessler syndrome postulates that crashes would first be seen between fragments and larger objects like satellites and would eventually be between two fragments. Crashes will continue till the debris becomes very small.

International laws

- There is no binding international legal rule (yet) which prohibits the wanton creation of space debris.
- 1967 Outer Space Treaty bars states party to the treaty from placing weapons of mass destruction in Earth orbit.

Removal of debris

RemoveDEBRIS Mission

- The RemoveDEBRIS mission is led by the Surrey Space Centre (SSC) at the University of Surrey, UK, and is co-funded by the European Commission and other partners, including prominent European space companies and institutions.

Statement Analysis

Statement 1	Statement 2	Statement 3
Correct	Correct	Incorrect
Till now, there is no binding agreement which prohibit creation of space debris.	Outer space treaty, 1967 prohibit state party to treaty from placing weapons of mass destruction, but it does not bar states from placing missiles or other weapon which does not come under category of mass destruction.	The RemoveDEBRIS mission is led by the Surrey Space Centre (SSC) at the University Of Surrey, UK, and is co-funded by the European Commission and other partners, including prominent European space companies and institutions.

Q.21) Recently, the maiden test of the Medium Range Surface to Air Missile (MRSAM) for the Indian Army was conducted. Consider the following statements with regard to it:

1. It is developed jointly by DRDO and Russia.
2. It is a high response, quick reaction, vertically launched supersonic missile with maximum speed of 5 mach.

Which of the above statements is/are correct?

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

Q.21) Solution (d)

Statement analysis

Statement 1	Statement 2
Incorrect	**Incorrect**
MRSAM is being developed by the DRDO (Defence Research and Development Organisation) in collaboration with Israel Aerospace Industries (IAI) for Army. **(Hence, Statement 1 is incorrect)**	MRSAM is a high response, quick reaction, vertically launched supersonic missile, designed to neutralize enemy aerial threats – missiles, aircraft, guided bombs, helicopters. The propulsion system assisted with Thrust vector control system result into maximum speed upto 2 mach**. (Hence, Statement 2 is incorrect)** **Note:** Supersonic missiles exceed the speed of sound (Mach 1) but they are not faster than Mach-3.

Basics about MRSAM Missile:

Barak 8, also known as MR-SAM is an Indo-Israeli surface-to-air missile (SAM), designed to defend against any type of airborne threat including aircraft, helicopters, anti-ship missiles, and UAVs as well as ballistic missiles, cruise missiles and combat jets. Both maritime and land-based variants of the system exist.

Barak 8 was jointly developed by Israel Aerospace Industries (IAI) and India's Defence Research & Development Organisation (DRDO)

MRSAM is the land based configuration of the missile. It consists of a command and control system, tracking radar, missile and mobile launcher systems. Each launcher will have eight such missiles in two stacks and are launched in a canister configuration. The system is also fitted with an advanced radio frequency (RF) seeker.

Q.22) Consider the following statements regarding recent systems developed by DRDO:

1. Varunastra is land-based heavy weight air to surface missile.
2. Rustom-1 is the first Indian Remotely Piloted Aircraft System to have conventional take-off and landing capability.

Which of the above statements is/are correct?

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

Q.22) Solution (b)

Explanation:

Varunastra is **ship launched**, heavy weight, electrically-propelled anti-submarine torpedo capable of targeting quiet submarines, both in deep and shallow waters in an intense countermeasures environment. Varunastra can be fired from all ASW ships capable of firing heavy weight torpedoes. VARUNASTRA has been inducted by Indian Navy in 2016. (So, statement 1 is incorrect)

RUSTOM-1 is an all composite, 800 kg class Short Range Remotely Piloted Aircraft System (SR-RPAS) having capabilities of Intelligence, Surveillance, Reconnaissance, Target Acquisition/ Tracking and Image Exploitation. **Rustom-1 is the first Indian RPAS to have conventional take-off and landing capability.** It has autonomous flight mode and Get-To-Home features. (So, statement 2 is incorrect)

Q.23) Consider the following statements about artillery weapons of India:

1. Sharang Artillery gun with range of 36 km has been upgraded by DRDO.
2. K9 Vajra is the self-propelled artillery gun, indigenously produced in India.

Which of the following option is/are correct as per given statement?

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

Q.23) Solution (d)

Statement analysis

Statement 1	Statement 2
Incorrect	**Incorrect**
Sharang Artillery gun with range of 36 km has been upgraded by the **Ordnance Factory Board (OFB)**. The gun's range has now gone from 27km to over 36km with the upgrade.	K9 Vajra-T Gun is an artillery gun **produced by South Korea**. It will be the first induction of heavy artillery since the Swedish Bofors guns imported in the 1980s. It is a 155-mm, 52-calibre self-propelled artillery gun with a maximum range of 40 km, customized from the original K9 Thunder gun. Recently, government inaugurated India's first private sector small arms manufacturing plant - Armoured Systems Complex (ASC), developed by Larsen & Toubro (L&T) at Hazira (Gujrat). This ASC will manufacture K9 Vajra self-propelled Howitzer guns under Make in India initiatives. This is the India's first private facility where the K9 Vajra self-propelled Howitzer guns will be manufactured.

Additional information:

Sharang Artillery Gun

- Sharang is the 130mm artillery gun 'up-gunned' to 155mm, 45 calibre up-gunning based on the Army's tender.
- The gun is upgraded by **The Ordnance Factory Board (OFB).**
- The gun's range has now gone from 27km to over 36km with the upgrade.
- It also has the more explosive capability and hence and more damage potential.
- This step will reduce the logistic trail of the Army as it does away with the need to carry 130mm shells and support equipment as the mainstay of the Army's long-range artillery is 155mm guns.

K9 Vajra

- The K9 VAJRA-T is a tracked self-propelled howitzer, which has its roots in the K9 Thunder, the mainstay of the South Korean Army.
- The Vajra offers a high rate of fire at a long-range and is compatible with Indian and standard NATO ammunition.
- The K9 Thunder platform is made of all-welded steel armour protection material.
- The K9 gun has been developed under the `Buy Global' programme of the Defence Procurement Procedure (DPP) where foreign companies are **allowed to participate —in this case Hanwha Techwin of South Korea is the technology partner of L&T.**
- The first 10 K9 Vajra guns have been imported from South Korea and have been assembled by L&T in India. The balance 90 guns will be largely manufactured in the country.

Q.24) Which of the following statements with reference to Aircraft Carrier of Indian Navy is/are correct?

1. INS Vikrant is first aircraft carrier to be built in India.
2. INS Vikramaditya is only active aircraft carrier of India.

Select the correct code

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

Q.24) Solution (c)

INS Vikrant

- India's Cochin Shipyard Limited (CSL) has completed the basin trials of Indigenous Aircraft Carrier (IAC), INS Vikrant.
- **It is India's first domestically built aircraft carrier.** (So, Statement 1 is correct)
- It leads ship of the Indian Navy's Vikrant-class, to be designed and built in India under Indigenous Aircraft Carrier (IAC) program.
- The 40,000 Tons aircraft carrier is designated as IAC-1, operates a ski-jump assisted Short Take-Off But Arrested Recovery (STOBAR) launch systems for launching aircraft
- With speed of 52 kmph, it is capable of accommodating MiG 29K fighter jets, HAL Dhruv and helicopters.

INS Vikramaditya

- The operational INS Vikramaditya, former Kiev-class warship Admiral Gorshkov, was inducted into service in 2014.
- The 45,000-ton INS Vikramaditya could operate around twenty MiG-29K fighters, along with utility helicopters.
- It is only active operation aircraft carrier in India.
- It is equipped with Barak1 and Barak 8(LRSAM) missiles.

Q.25) Consider the following statements regarding INS Arihant:

1. It is nuclear powered submarine built under the Advanced Technology Vessel (ATV) project.
2. This submarine completes India's nuclear triad.
3. Challenge with INS Arihant is that it has to come on surface for regular supply of fuel.

Which of the statements given above is/are correct?

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

Q.25) Solution (a)

Explanation:

INS Arihant

- INS Arihant (designated S2 Strategic Strike Nuclear Submarine) is the lead ship of India's Arihant class of **nuclear-powered ballistic missile submarines.**
- The 6,000 tonne vessel was built under the Advanced Technology Vessel (ATV) project at the Ship Building Centre in the port city of Visakhapatnam.
- With Arihant, India has now entered into a club of nations that have the technological capability to design, build and operate nuclear-powered ballistic missile submarines **or ship submersible ballistic nuclear (SSBNs).**
- India's 'triad' is a mix of missiles fired from land — the Agni 2, the Agni 4 and the Agni 5. From the air, Sukhoi Su-30MKIs, Mirage 2000s and Jaguars are capable of launching nuclear missiles. The 6,000-tonne INS Arihant now adds a maritime strike capability.
- The SSBN is the most dependable platform for a second-strike. Because they are powered by nuclear reactors, these submarines can stay underwater indefinitely without the enemy detecting it.(So, statement 3 is incorrect)
- The submarines will be armed with up to 12 Sagarika (K-15) missiles armed with nuclear warheads. Sagarika is a submarine-launched ballistic missile with a range of 700 km.

Q.26) Consider the following Aircrafts of Indian Air force

1. Globemaster C17
2. Mirage -2000
3. MIG 29
4. SEPECAT Jaguars
5. Dassault Rafael

Which of the above aircraft are capable of nuclear payload launch?

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

Q.26) Solution (d)

Explanation:

Globemaster C17 - A high-wing, 4-engine, T-tailed military-transport aircraft, the multi-service C-17 can carry large equipment, supplies and troops directly to small airfields in harsh terrain anywhere in the world day or night. The massive, sturdy, long-haul aircraft tackles distance, destination and heavy, oversized payloads in unpredictable conditions. It has delivered cargo in every worldwide operation since the 1990s.

Other four i.e. Mirage-2000, Mig-29, SPECECAT Jaguars and Dassault Rafael were originally designed to perform air-to-air combat missions, though they could potentially be modified to deliver air-dropped nuclear weapons.

Q.27) Which of the following helicopters used by Indian Armed forces as attack helicopters?

1. CH-47 Chinook
2. AH-64 Apache
3. HAL Dhruv
4. Mi-26
5. Mi-24

Which of the above aircraft are capable of nuclear payload launch?

a) 1, 3 and 5 only
b) 1, 2 and 5 only
c) 2 and 5 only
d) 2, 3 and 5 only

Q.27) Solution (c)

Explanation:

Helicopter's name	Country of Origin	Type
HAL Light Combat Helicopter	India	Attack
Boeing AH-64 Apache	United States	Attack
Mil Mi-24	Russia	Attack

HAL Rudra	India	Armed
CH-47 Chinook	United States	Heavy transport
Mil Mi-26	Russia	Heavy transport
Mil Mi-17	Russia	Utility transport
HAL Dhruv	India	Utility
HAL Chetak	France / India	Light utility
HAL Cheetah	France / India	Light utility

Q.28) Mission Shakti is related to:

a) Empowering rural women by nurturing for Entrepreneurship
b) Transparent Allocation of Coal Blocks
c) Development of Nuclear powered submarine
d) Testing anti-satellite weapon

Q.28) Solution (d)

Statement analysis:

Statement (a): **Project Shakti** enables rural women in villages across India to nurture an entrepreneurial mind-set and become financially independent. In an attempt to provide regular income, these women entrepreneurs (called Shakti Ammas) are trained on basic principles of distribution management and familiarisation with the company's products. This is the project of Hindustan Uniliver Limited

Statement (b): **Scheme for Harnessing and Allocating Koyala Transparently in India or SHAKTI** is for power units with power purchase agreements (PPAs) but no long-term coal supply. Under the scheme, Coal India offers assured coal supply to units through bidding.

Statement (c):INS Arihant was developed under **Advanced Technology Vessel (ATV) project to**

design and build nuclear-powered submarines.

Statement (d): On 27 March 2019, **India tested an anti-satellite weapon during an operation code named Mission Shakti**. The target of the test was a satellite present in a low Earth orbit, which was hit with a kinetic kill vehicle.

The ASAT test utilized a modified anti-ballistic missile interceptor code-named Prithvi Defence Vehicle Mark-II which was developed under Project XSV-1. The test made India the fourth country after the United States, Russia and China to have tested an ASAT weapon.

Q.29) Consider the following missiles:

1. Akash
2. Trishul
3. Brahmos
4. Nag
5. Prithvi

Which of the above mentioned missiles were developed under the 'Integrated Guided Missile Development Programme' (IGMDP)?

a) 1, 2, 4 and 5 only
b) 2, 3 and 5 only
c) 1, 3, 4 and 5 only
d) All of the above

Q.29) Solution (a)

The Integrated Guided Missile Development Programme (IGMDP) was an Indian Ministry of Defence programme for the research and development of the comprehensive range of missiles.

The programme was managed by the Defence Research and Development Organisation (DRDO) and Ordnance Factories Board in partnership with other Indian government political organisations.

The project started in 1982–83 under the leadership of Dr. Abdul Kalam who oversaw its ending in 2008 after these strategic missiles were successfully developed.

The 5 missiles (P-A-T-N-A) developed under this program are:

1. Short range surface-to-surface missile (code-named **Prithvi**)↑↑
2. Short range low-level surface-to-air missile (code-named **Trishul**)

3. Medium range surface-to-air missile (code-named **Akash**)
4. Third-generation anti-tank missile (code-named **Nag**)
5. The **Agni missile** was initially conceived in the IGMDP as a technology demonstrator project in the form of a re-entry vehicle, and was later upgraded to a ballistic missile with different ranges.

Brahmos is not a part of IGMDP, but it has been developed as part of joint venture between India and Russia.

Q.30) Who among the following personalities, is generally referred to as the 'Missile woman of India'?

a) Ritu Karidhal
b) Tessy Thomas
c) Minal Rohit
d) Nandini Harinath

Q.30) Solution (b)

Tessy Thomas is an Indian scientist and Director General of Aeronautical Systems and the former Project Director for Agni-IV missile in Defence Research and Development Organisation. She is the first woman scientist to head a missile project in India and commonly referred to as the 'Missile woman of India'.

Q.31) Which of the following statements are not correct with reference to Chief of Defence Staff?

1. India was the only large democracy which did not have a single point military advisor.
2. Chief of Defence Staff is chief military advisor to government of India.
3. Chief of Defence Staff will head Defence Acquisition Council.

Select the correct option as per given statement:

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

Q.31) Solution (a)

Statement Analysis:

Statement 1: The Defence Secretary, a civil servant, remains as the main defence adviser, whilst the CDS has been sanctioned the role of being the main military adviser, acting as the single-point military adviser to the government and Defence Minister. **India was the only large democracy which did not have a single point military advisor**; with all P5 countries having one.

Statement 2: As the highest ranking officer of the armed forces, the CDS is the commanding officer and chairperson of the Joint Commanders and Staff Committee and here the CDS has an operational role where he is **responsible as the chief military adviser to the government of India** and the Ministry of Defence.

Statement 3: As the Permanent Chairman of Chiefs of Staff Committee, CDS will perform the following functions:

- Implementing weapons procurement procedures.
- Integrating operations of the Army, Air Force and Navy.
- Bring about jointness and ensure optimal utilisation of infrastructure in the three Services.
- Apart from being the military advisor for the government, the CDS also heads the Department of Military Affairs.
- Authority to create theatre commands as and when needed.
- Command tri-service agencies, organisations, and commands including those related to cyber and space.
- **CDS will be member of Defence Acquisition Council and Defence Planning Committee**
- Function as the Military Advisor to the Nuclear Command Authority.
- Bring about reforms in the functioning of three services aimed at augmenting combat capabilities of the Armed Forces by reducing wasteful expenditure.
- Assign inter-services prioritisation to capital acquisition proposals.

So, statement 3 is incorrect, as Defence Acquisition Council is headed by Minister of Defence.

Basics of Chief of Defence Staff

The CDS is a four-star officer selected from among the serving officers of the Indian Armed Forces. While being "first among equals" among the service chiefs, the CDS is a single-point military advisor to the defence minister. The holder of the post is also the head of all tri-service command structures to replace the post of Chief of Integrated Defence Staff. The CDS is assisted by a deputy, the Vice Chief of the Defence Staff. The CDS heads the Department of Military Affairs under the Ministry of Defence, as its secretary. Apart from heading the DMA, the CDS is the Permanent Chairperson of the Chiefs of Staff Committee (PC-CoSC).

Q.32) Which state/Union Territory hosts the famous 'Dr. Abdul Kalam Island', which is very widely seen in the news?

a) Andhra Pradesh
b) Tamil Nadu
c) Andaman and Nicobar
d) Odisha

Q.32) Solution (d)

Dr. Abdul Kalam Island, formerly known as Wheeler Island, is an island off the coast of Odisha, India, approximately 150 kilometres east of the state capital Bhubaneswar. The Integrated Test Range missile testing facility is located on the island.

Location of Abdul Kalam Island in Odisha, India

Q.33) consider the following statements:

1. "Secure Application for Internet" is a cyber-security framework for Ministry of Home Affairs.
2. Information Fusion Centre- Indian Ocean Region is jointly administered by Indian Navy and Indian Coast Guard.

Select the correct answer using the code given below

a) 1 only
b) 2 only

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

Q.33) Solution (b)

Explanation:

Statement 1: "Secure Application for Internet (SAI)"

- In the quest for 'Atmanirbhar Bharat', Indian Army has developed a simple and secure messaging application named the "Secure Application for Internet (SAI)".
- The application supports end to end secure voice, text and video calling services for Android platform over internet. **(Hence, Statement 1 is incorrect)**
- The model is similar to commercially available messaging applications like Whatsapp, Telegram, SAMVAD and GIMS and utilises end to end encryption messaging protocol.
- SAI scores over on security features with local in-house servers and coding which can be tweaked as per requirements.
- The application has been vetted by CERT-in empaneled auditor and Army Cyber Group.

Statement 2: Information Fusion Centre –Indian Ocean Region

- The IFC-IOR stems from the importance of the Indian Ocean to world trade and security, and the need for the various maritime nations and organisations to collaborate towards enhancing maritime safety and security on the seas of this region.
- In addition to utilising the collective wisdom and resources towards addressing myriad challenges in the region, IFC-IOR will help interface and integrate, wherein, all partners and stakeholders would benefit from each other's best practices and expertise.
- **The IFC has been established at Gurugram, India and is collocated with Information Management and Analysis Centre which is jointly administered by the Indian Navy and Indian Coast Guard. (Hence, Statement 2 is correct)**
- The setting up of IFC-IOR underscores the governmental approach and effort in line with the vision of our Indian government towards **Security and Growth of All in the Region (SAGAR)**.

Q.34) Consider the following statements about "National Critical Information Infrastructure Protection Centre":

1. It is a statutory body made for protection of Critical Information Infrastructure.
2. It was created under section 70 of Information Technology Act, 2000.
3. It is under administrative control of National Technical Research Organisation.

Which of the statements given above is/are correct?

e) 1 and 2 only
f) 1 and 3 only
g) 2 and 3 only
h) 1, 2 and 3

Q.34) Solution (c)

Explanation:

National Critical Information Infrastructure Protection Centre (NCIIPC) is an organisation of the Government of India created under Sec 70A of the Information Technology Act, 2000 (amended 2008), through a gazette notification on 16th Jan 2014 based in New Delhi, India. It is designated as the National Nodal Agency in respect of Critical Information Infrastructure Protection. **(So, Statement 1 is incorrect, while statement 2 is correct)**

Basics about NCIIPC

- **Aims to protect 12 such critical infrastructures** like **nuclear, aviation, defense, energy** etc.
- Under **NTRO** (National Technical Research organization) **(So, Statement 3 is correct)**
- **Nodal agency for cybersecurity**
- Main role as **advisor** of security issues & as a **feeder of intelligence to other agencies**
- Under **National Security Advisor, Prime Minister Office**
- To roll out counter-measures to protect the **Critical Information Infrastructure Protection**

Q.35) Consider the following pairs of Military exercise of Indian armed forces:

	Military Exercise	**:**	**Country**
1.	Desert Knight 21	:	United Arab Emirates
2.	SIMBEX - 20	:	Singapore
3.	SLINEX - 20	:	Sri Lanka

Which of the pairs given above is/are correctly matched?

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

Q.35) Solution (c)

Explanation:

Name of Exercise	Type of exercise	Country involved
Desert Knight 21	Air warfare Exercise	France
SIMBEX – 20	Maritime Exercise	Singapore
SLINEX – 20	Maritime Exercise	Sri Lanka

Q.36) Consider the following pairs of Military exercise of Indian armed forces:

	Military Exercise	**:**	**Armed Forces Involved**
1.	Exercise Kavach	:	Indian Navy and US Navy
2.	Passage Exercise	:	Australian Navy and Indian Navy
3.	Indra Navy	:	Indian Navy and Russian Navy

Which of the pairs given above is/are correctly matched?

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

Q.36) Solution (c)

Explanation:

Name of Exercise	Type of exercise	Country involved

Exercise Kavach	Joint Military Exercise	Indian Navy, Indian Army , Indian Air Force and Indian Coast Guard
Passage Exercise	Maritime Exercise	Indian Navy and Australian Navy
Indra Navy	Maritime Exercise	Indian Navy and Russian Navy

Q.37) Consider the following statements about Air Breathing Engines:

1. Scramjet Engines designed by ISRO uses liquid fluorine as fuel.
2. Ramjet engine does not work efficiently when vehicle reaches hypersonic speeds.
3. With Scramjet technology, nearly 70% propellant will be reduced and hence will reduce the overall fuel need.

Select the correct answer using the code given below:

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

Q.37) Solution (c)

Statement 1: The Scramjet engine designed by ISRO uses Hydrogen as fuel and the Oxygen from the atmospheric air as the oxidiser.

Statement 2: Ramjets work most efficiently at supersonic speeds around Mach 3. However, the ramjet efficiency starts to drop when the vehicle reaches hypersonic speeds.

Statement 3: Nearly 70% of the propellant (fuel-oxidiser combination) carried by today's launch vehicles consists of oxidiser. Therefore, using atmospheric oxygen would considerably reduce the overall propellant required to place the satellite in the orbit.

Basics about Air Breathing engines

- The basic difference between air-breathing systems and others is the material that plays the role of oxidiser.
- Generally, launch vehicles use combustion of propellants consisting of oxidiser and fuel for deriving the energy. Air breathing propulsion systems use atmospheric oxygen, which is available up to about 50 km of earth's surface to burn the fuel stored on-board thereby making the system much lighter, more efficient and cost effective.

Types of air-breathing systems:

- **Ramjet Engine**: A ramjet is a form of air-breathing jet engine that uses the vehicle's forward motion to compress incoming air for combustion without a rotating compressor. Fuel is injected in the combustion chamber where it mixes with the hot compressed air and ignites. It works most efficiently at supersonic speeds around mach 3.
- **Scramjet Engine**: A scramjet engine is an improvement over the ramjet engine as it efficiently operates at hypersonic speeds and allows supersonic combustion. Thus it is known as Supersonic Combustion Ramjet, or Scramjet.
- **Dual mode ramjet (DMRJ)**: It is a type of jet engine where a ramjet transforms into scramjet over Mach 4-8 range, which means it can efficiently operate both in subsonic and supersonic combustor modes.

Q.38) Consider the following statements

1. India has signed Nuclear Non-Proliferation Treaty, but hasn't ratified it.
2. India has signed and ratified Comprehensive Test Ban Treaty (CTBT).
3. India, China and Pakistan, all three follow policy of no–first –use of nuclear weapon.

Which of the above statements are *incorrect*?

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

Q.38) Solution (d)

Statement Analysis

Statement 1 & 2: India is not a member of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) or the Comprehensive Nuclear Test Ban Treaty (CTBT), but is a state party to

the Partial Test Ban Treaty (PTBT). The dominant Indian narrative has been to project the 'discriminatory' nature of the Non-Proliferation Treaty (NPT) as the reason for India's perennial opposition and that the treaty, as drafted by the then superpowers, cannot facilitate disarmament and, instead, could only sustain a world of nuclear 'haves' and 'have-nots'. **(So, both statement 1 and 2 are incorrect)**

Statement 3: While both India and China follow No-First use policy, Pakistan do not follow such policy. **(So, Statement 3 is incorrect)**

Since the adoption of nuclear doctrine, India has said consistently that its nuclear weapons were based on staggering and punitive retaliation, in case the deterrence has failed.

Pakistan, by contrast, has openly threatened India with the use of nuclear weapons on multiple occasions beginning from the time the two nations were not even acknowledged nuclear powers

Basics – India's Nuclear Profile

India is not a member of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) or the Comprehensive Nuclear Test Ban Treaty (CTBT), but is a state party to the Partial Test Ban Treaty (PTBT). India embarked on a nuclear energy program in 1948 and a nuclear explosives program in 1964. The latter culminated in India's May 1974 test of a "peaceful nuclear explosion," which provoked global condemnation and proliferation concerns. Following five nuclear weapons tests in May 1998, India formally declared itself a nuclear weapons state.

According to 2020 estimates, the Indian arsenal comprises approximately 150 nuclear warheads. India has one operational Arihant-class nuclear-powered ballistic missile submarine (SSBN), which completed its first deterrence patrol in November 2018, and has one more submarine currently undergoing sea trials. Although India is increasingly concentrating on developing missiles for nuclear delivery roles, aircraft such as the Mirage 2000 and the Jaguar remain integral parts of its nuclear delivery force. In addition to the Mirage 2000 and the Jaguar, addition of 36 nuclear-capable Rafale fighter jets to India's delivery arsenal will increase its nuclear deterrence.

India and the United States announced a nuclear cooperation initiative in July 2005 that would permit India to participate in international nuclear trade, under certain conditions. In 2008, India negotiated a limited safeguards agreement with the International Atomic Energy Agency (IAEA). Subsequently, in October 2008, India and the United States signed a bilateral 123 nuclear cooperation agreement. In June of 2014, India ratified a version of the IAEA Additional Protocol after a 5-year delay. India also seeks to join the NSG, but China has continually blocked India's membership bid.

Q.39) Consider the following statements about Biological Weapon Convention (BWC):

1. BWC was the first multilateral disarmament treaty to ban the production of an entire category of weapons of mass destruction.
2. Treaty allows the stockpiling of biological agents and toxins for "prophylactic, protective or other peaceful purposes.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both
d) None of these

Q.39) Solution (c)

Explanation:

Statement 1: Having entered into force on 26 March 1975, the BWC was the first multilateral disarmament treaty to ban the production of an entire category of weapons of mass destruction. The Convention is of unlimited duration. As of February 2021, 183 states have become party to the treaty. Four additional states have signed but not ratified the treaty, and another ten states have neither signed nor acceded to the treaty. The Biological Weapons Convention (BWC) is a disarmament treaty that effectively bans biological and toxin weapons by prohibiting their development, production, acquisition, transfer, stockpiling and use.

Statement 2: However, Treaty allows the stockpiling of biological agents and toxins for "prophylactic, protective or other peaceful purposes.

Q.40) Consider the following pairs:

1. The Wassenaar Arrangement (WA) : : control of chemical and biological
2. The Nuclear Suppliers Group (NSG) : : nuclear and nuclear-related technology
3. The Australia Group (AG) : : Conventional Arms and Dual-Use Goods and Technologies
4. The Missile Technology Control Regime (MTCR) : : weapons of mass destruction

Which of the above pairs are correctly matched?

a) 2 and 3 only
b) 2 and 4 only

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

Q.40) Solution (b)

Statement analysis:

A multilateral export control regime is an informal group of like-minded supplier countries that seek to contribute to the non-proliferation of weapons of mass destruction, delivery systems, and advanced conventional weapons through national implementation of guidelines and control lists for exports.

There are currently four such regimes:

1. The **Wassenaar Arrangement (WA)** on Export Controls for Conventional Arms and Dual-Use Goods and Technologies.
2. The **Nuclear Suppliers Group (NSG),** for the control of nuclear and nuclear-related technology.
3. The **Australia Group (AG)** for the control of chemical and biological technology that could be weapon zed.
4. The **Missile Technology Control Regime (MTCR)** for the control of rockets and other aerial vehicles capable of delivering weapons of mass destruction.

India is member of all three multilateral export control regime except NSG, where its inclusion has been protested by China.

While not formally an export control regime, the Zangger Committee has developed guidance on nuclear export restrictions required by the Non-Proliferation Treaty (NPT).

Q.41) Consider the following statements about mitochondrial DNA and Nuclear DNA?

1. Both Nuclear DNA and mitochondrial DNA are circular in shape.
2. MtDNA contains two copies per somatic cell, whereas Nuclear DNA usually has only 100-1,000 copies per somatic cell.

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

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

Q.41) Solution (c)

Explanation:

Deoxyribonucleic acid (DNA) carries genetic information that is used as a set of instructions for growth and development, as well as the ultimate functioning and reproduction of living organisms. It is a nucleic acid and is one of the four major types of macromolecules that are known to be essential for all forms of life.

Within eukaryotic cells, DNA is organised into structures called chromosomes, chromosomes are duplicated through the process of **DNA Replication**, as long as each cells has its own complete set of chromosomes.

Eukaryotic organisms such as animals, plants and fungi, store the majority of their DNA inside the cell nucleus and some of their DNA in organelles such as mitochondria.

Being located in different regions of the eukaryotic cell, **there are a number of fundamental differences between mitochondrial DNA (mtDNA) and nuclear DNA (nDNA).**

	Mitochondrial DNA	**Nuclear DNA**
Location	Mitochondria	Cell Nucleus
Copies per somatic cell	100-1,000	2
Structure	Circular and closed	Linear and open ended
Membrane enclosure	Not enveloped by a membrane	Enclosed by a nuclear membrane
Genome size	1 chromosome with 16,569 base pairs	46 chromosomes with 3.3 billion base pairs
Number of genes	37 genes	20,000-25,000 genes
Method of inheritance	Maternal	Maternal and Paternal

Method of translation	Some codons do not follow universal codon pattern	Follows universal codon pattern
Method of transcription	Polycistronic	Monocistronic

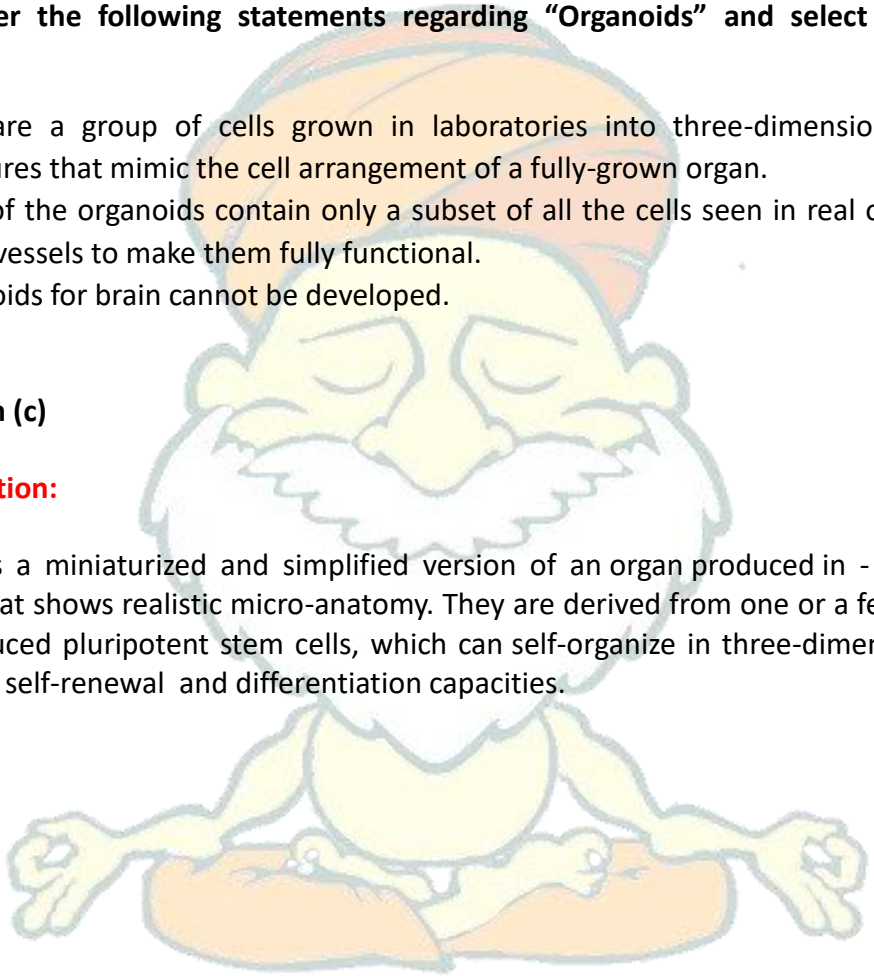
Q.42) Consider the following statements regarding "Organoids" and select the incorrect statement:

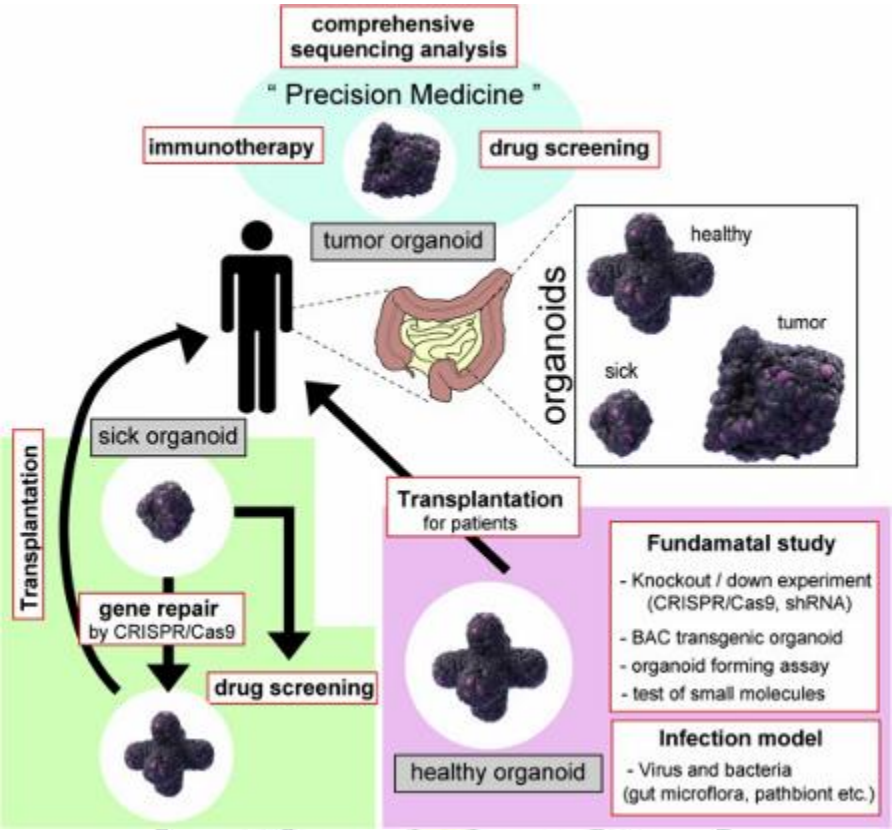
a) They are a group of cells grown in laboratories into three-dimensional, miniature structures that mimic the cell arrangement of a fully-grown organ.
b) Most of the organoids contain only a subset of all the cells seen in real organ, but lack blood vessels to make them fully functional.
c) Organoids for brain cannot be developed.
d) None.

Q.42) Solution (c)

Basic Information:

An **organoid** is a miniaturized and simplified version of an organ produced in - vitro in three dimensions that shows realistic micro-anatomy. They are derived from one or a few cells from a tissue or induced pluripotent stem cells, which can self-organize in three-dimensional culture owing to their self-renewal and differentiation capacities.





Statement Analysis:

Statement (a)	Statement (b)	Statement (c)
Correct	**Correct**	**Incorrect**
They are tiny (typically the size of a pea) organ-like structures that do not achieve all the functional maturity of human organs but often resemble the early stages of a developing tissue. They are **a group of cells grown in laboratories into three-dimensional, miniature structures that mimic the cell arrangement**	Most organoids contain **only a subset of all the cells seen in a real organ, but lack blood vessels to make them fully functional.**	Brain organoids have already been developed. The largest brain organoids developed is of 4mm.

of a fully-grown organ.		

Q.43) Consider the following statements about 'Genome India Project':

1. The project aims to carryout whole genome sequencing of 10,000 Indians in the first phase.
2. The project will be completed in 3 years and anyone looking for free mapping of their entire genome can sign up for it.

Which of the statements given above is/are NOT correct?

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

Q.43) Solution (d)

Note: Incorrect statements are asked in the question.

Basic Information:

The Rs 238-crore Genome India project will involve 20 leading institutions including the Indian Institute of Science (IISc) in Bengaluru and few IITs.

The human genome is made of 3.2 billion DNA base pairs and between any two humans, the amount of genetic variation is about 0.1 percent. Therefore, one base pair out of every 1000 will differ between any two individuals. These genetic variations differentiate one individual from the other and play an important role in inherited traits, susceptibility to diseases, and response to drugs and help track migration and evolution patterns.

Statement Analysis:

Statement 1	**Statement 2**
Correct	**Correct**
The first stage of the project will look at samples of "10,000 persons from all over the	Genome India project has **been sanctioned by Department of Biotechnology (DBT) on**

country" to form a "grid" that will enable the development of a "reference genome".	**January 16, 2020 for a period of 3 years.** **Anyone looking for free mapping of their entire genome can sign up for this project.** Those who get their genes mapped will get a card and access to an app.

Q.44) Consider the following statements:

1. The concept of Germline gene therapy is to introduce gene modified cells into the germline that can be transmitted horizontally across generations.
2. The somatic cell gene therapy affects the targeted cells/tissue/organs in the patient, and is not passed on to subsequent generations.

Which of the above statements is/are correct?

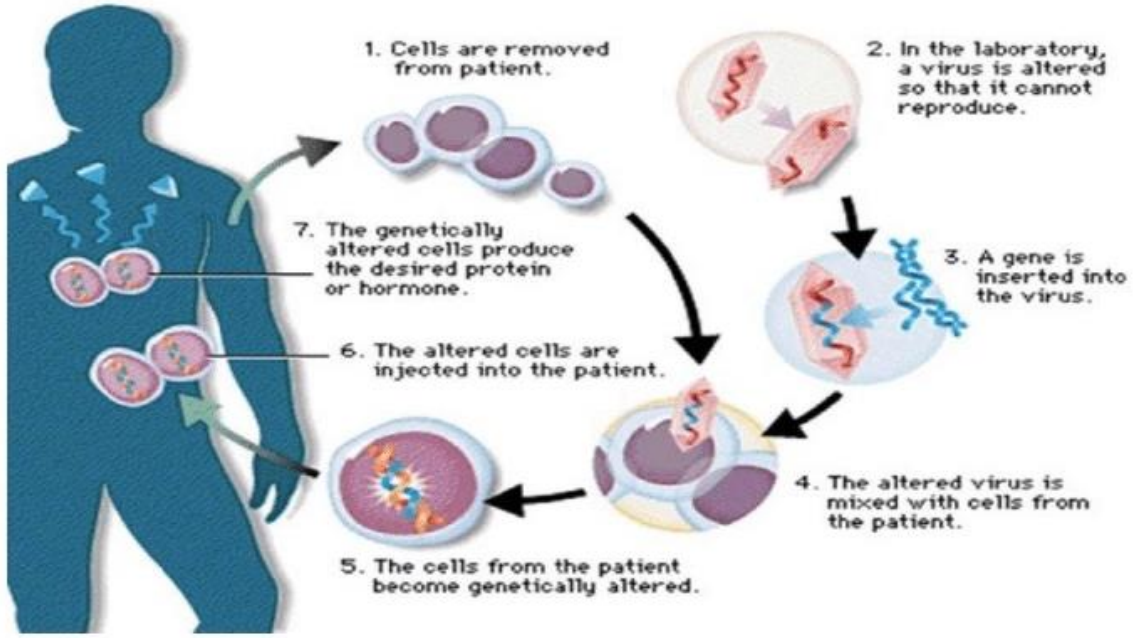
a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 and 2

Q.44) Solution (b)

Basic Information:

Gene therapy is a technique which involves the replacement of defective genes with healthy ones in order to treat genetic disorders. It is an artificial method that introduces DNA into the cells of the human body. The first gene therapy was successfully accomplished in the year 1989.

The simple process of gene therapy in shown in the picture.



Steps involved in gene therapy.

Basically there are two types of gene therapy;-

1. **Somatic gene therapy; -** this usually occurs in somatic cell of human body. It involves the placement of a human gene into a living person's somatic cells—cells that do not produce the eggs and sperm that in turn produce the next generation. Somatic cell gene therapy would aim to cure a disease only in the patient, not in the patient's descendants.
2. **Germline gene therapy; -** is when DNA is transferred into the cells that produce reproductive cells, eggs or sperm, in the body. This type of **therapy** allows for the correction of disease-causing **gene** variants that are certain to be passed down from generation to generation. Experimenting with this type of **therapy**, scientists injected fragments of DNA into fertilized mouse eggs. The mice grew into adults and their offspring had the new **gene**.

Statement Analysis:

Statement 1	Statement 2
Incorrect	Correct

The concept of germ-line gene therapy is to introduce gene modified cells into the Germline that can be transmitted **vertically across generations.** It is not yet legal in India.	The somatic cell gene Therapy affects the targeted cells/tissue/organs in the patient, and is not passed on to subsequent generations. This is legal in India.

Q.45) Consider the following statements about International campaign to abolish Nuclear weapons:

1. Nobel peace prize was given to it in 2015.
2. Its main objective is to achieve full implementation of the treaty on the prohibition of nuclear weapons.
3. It was launched in 1998 and has it's headquarter in Melbourne.

Which of the above statements is/are correct?

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

Q.45) Solution (b)

Basic Information:

The International Campaign to Abolish Nuclear Weapons (ICAN) is a coalition of non-governmental organisations in one hundred countries promoting adherence to and implementation of the United Nations Treaty on the Prohibition of Nuclear Weapons.

Statement Analysis:

Statement 1	Statement 2	Statement 3
Incorrect	**Correct**	**Incorrect**
The campaign received the 2017 Nobel Peace Prize for its work to draw attention to the catastrophic humanitarian	Its main objective **is to promote adherence to and full implementation of the Treaty on the Prohibition of Nuclear**	It was **launched in 2007 and its head quarter is in Geneva** though it was founded at Melbourne.

consequences of any use of nuclear weapons	**Weapons.**	

Q.46) Recently, among scientific community this living creature has attracted a lot of attention due to its potential use in regenerative biology of the heart. Identify the species –

a) Dragon flies
b) Tardigrade
c) Zebrafish
d) Platypus

Q.46) Solution (c)

Explanation:

Indian researchers have identified the genes in zebrafish that can promote heart regeneration. Zebrafish is a small freshwater fish found in the tropical and subtropical regions. The fish is native to South Asia's Indo-Gangetic plains.

This fish's unique characteristics lie in its transparency during its embryonic stages, allowing observing all organs, including beating heart and blood circulation.

The zebrafish is probably one of the most important models for developmental and regenerative biology of the heart. In the last decades, the zebrafish has become increasingly important for scientific research due to its adequate regeneration capacity of almost all its organs, including the brain, heart, eye, spinal cord.

The researchers have identified cellular communication network factor 2a (ccn2a), a gene that can promote heart regeneration by enhancing cardiomyocyte proliferation in zebrafishes. Ccn2a promotes the innate regenerative response of the adult zebrafish heart and maybe a promising therapeutic target for humans.

Q.47) Consider the following statements regarding India's three stage Nuclear power Programme

1. It was designed by Vikram Sarabhai.
2. In the first stage, fast breeder reactor (FBR) was to be used followed by pressurized heavy water reactor (PHWR).

3. The ultimate focus of the programme was enabling thorium reserves of India to be utilized for energy needs.

Which of the above statements is/are correct?

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

Q.47) Solution (c)

Basic Information:

India envisages A Three Stage Programme based on the optimum utilisation of the indigenous limited uranium and abundant thorium resources. Although we have around 25% of the world's thorium reserves, it itself is not a fissile material. It needs to undergo transmutation to U-233 in a reactor fuelled by other fissile material.

The sequential 3-stage programme is based on a closed fuel cycle, where the spent fuel of one stage is reprocessed to produce fuel for the next stage.

Statement Analysis:

Statement 1	Statement 2	Statement 3
Incorrect	**Incorrect**	**Correct**
Homi J Bhabha, the father of India's Nuclear program, devised India's Three Stage Nuclear Power Program.	In the first stage PRESSURIZED HEAVY WATER REACTORS (PHWR) was to be used in which Natural Uranium is used as a fuel and heavy water as a coolant and moderator. In **the second stage fast breeder reactor** is fuelled by a mixed oxide of U-238 and	**The ultimate focus of the programme was enabling thorium reserves of India to be utilized for energy needs**, Since India has good amount of thorium resources compared to uranium.

	Pu-239 which have been recovered by reprocessing the spent fuel in the first stage. The **Stage III reactor is based on utilizing Thorium** which involves a self-sustaining series of thorium-232-uranium-233 fuelled reactors	

Q.48) Consider the following statements:

1. Mitochondrial diseases are incurable.
2. CRISPR-Cas9, the gene editing technology has been harnessed from bacteria.

Which of the above statements is/are correct?

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

Q.48) Solution (c)

Basic Information:

Mitochondrial disease is a group of disorders caused by mitochondrial dysfunction. **Mitochondrial diseases are currently incurable**, although a new IVF technique of mitochondrial transfer gives families affected by mitochondrial disease the chance of having healthy children – removing affected mitochondria from an egg or embryo and replacing them with healthy ones from a donor

Gene drives dramatically increase the likelihood that a particular suite of genes will be passed onto the next generation, allowing the genes to rapidly spread through a population and override natural selection. **Since the CRISPR/Cas9 system is derived from bacteria**, it is possible

to induce an immune response upon its entrance to the target cell, thus, the nanoparticles should be designed so as to eliminate or minimize immune response.

Recently, the **Nobel Prize in Chemistry for 2020** was given to two women scientists namely Emmanuelle Charpentier (France) & Jennifer A. Doudna (Germany). The Nobel Prize was given to them for the development of a method for genome editing.

Q.49) Consider the following statements:

1. Cold fusion describes a form of energy generated when hydrogen interacts with various metals like nickel and palladium.
2. Cold fusion seeks to produce nuclear energy without harmful radiation.

Which of the above statements is/are correct?

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

Q.49) Solution (c)

Basic Information:

Here, both statements are correct

Cold fusion offers a new energy economy based on green power from energy-dense LENR. Cold fusion means it is economically-viable to recycle all waste, restore wilderness and waterways to pristine conditions, and keep a planetary biosphere from extinction. Hydrogen isotopes Protium, Deuterium, and Tritium.

Cold fusion is also referred to as the Anomalous Heat Effect AHE, reflecting the fact that there is no definitive theory of the elusive reaction.

Statement Analysis:

Statement 1	Statement 2

Correct	Correct
Cold fusion describes a **form of energy generated when hydrogen interacts with various metals like nickel and palladium**.	**Cold fusion seeks to produce nuclear energy without harmful radiation**, complex equipment and the application of very high temperatures and pressures. But it has no conclusive theory explaining it and flies in the face of a well-established physics law that goes against easy fusion of nuclei.

Q.50) TALEN and Zinc Finger nucleases are heard in the context of

a) Nuclear technology
b) Gene editing
c) Nanotechnology
d) Defence industry

Q.50) Solution (b)

Explanation:

They are genome editing tool just like CRISPR Cas9 (which is not first gene editing tool).

TALEN (transcription activator-like effectors nuclease) which was developed in 2009 .TALENs are produced by a common type of plant bacteria. Like ZFNs, TALENs bind to and cut targeted DNA sequences. A key advantage the TALEN gene-editing method holds over ZFN is that engineering TALENs is simpler than using ZFNs.

Zinc finger nuclease technology: Has been used longer than any other gene-editing method. First developed in the 1990s, this approach involves the binding of a pair of ZFNs to a DNA target

Q.51) The term "Spindle Nuclear transfer" is associated with which of the following?

a) Nuclear technology
b) Cloning
c) Nano technology
d) Three parent baby

Q.51) Solution (d)

Explanation:

In 2016, the birth of world's 1st three parent baby child was announced here, human offspring produced is from the genetic material of one man and two women through the use of assisted reproductive technologies, specifically mitochondrial manipulation (or replacement) technologies and three-person in vitro fertilization (IVF). **This specialized IVF procedure is called "Spindle Nuclear Transfer".**

Mitochondria which provide energy to our cells are critically important for proper functioning of the body, when they fail to do so cells starves for energy which proves devastating.

Mitochondria are inherited from our mothers, so women with with so-called "defective" mitochondrial genes pass that faulty mtDNA on to their biological children. Those with no or mild symptoms—who might not even know they carry unhealthy mitochondria—can unexpectedly have a child with a more severe mitochondrial disease, or be unable to carry a baby to term at all. Even if a pregnancy is successful, the child may suffer from one or many forms of mitochondrial disease, which can lead to serious disability; early deaths are not uncommon in these children. To solve this problem this three parent IVF procedure is done in **which the mother, the father and a woman who donates eggs are involved.**

In 2015, the United Kingdom became the first country to expressly legalize mitochondrial donation—but only for preventing heritable diseases.

Q.52) Which of the following diseases are genetic diseases?

1. Sickle cell anaemia
2. Down syndrome
3. Huntington diseases
4. Breast cancer

Select the correct answer using the code given below:

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

Q.52) Solution (d)

Basic Information:

A genetic disease is any disease caused by an abnormality in the genetic makeup of an individual. The genetic abnormality can range from minuscule to major -- from a discrete mutation in a single base in the DNA of a single gene to a gross chromosomal abnormality involving the addition or subtraction of an entire chromosome or set of chromosomes.

Some people inherit genetic disorders from the parents, while acquired changes or mutations in a pre-existing gene or group of genes cause other genetic diseases. Genetic mutations can occur either randomly or due to some environmental exposure.

Statement Analysis:

Statement 1	Statement 2	Statement 3	Statement 4
Correct	**Correct**	**Correct**	**Correct**
Sickle cell anaemia is a genetic disease of the red blood cells (RBCs). Normally, RBCs are shaped like discs, which gives them the flexibility to travel through even the smallest blood vessels. However, with this disease, the RBCs have an abnormal crescent shape resembling a sickle. This makes them sticky and rigid and prone to getting trapped in small	Down syndrome is a condition in which a child **is born with an extra copy of their 21st chromosome — hence its other name, trisomy 21.** It causes a distinct facial appearance, intellectual disability and developmental delays. It may be associated with thyroid or heart disease.	Huntington diseases is an **inherited condition in which nerve cells in the brain break down over time.** It causes uncontrolled movements, emotional problems, and loss of thinking ability (cognition). Adult-onset Huntington disease, the most common form of this disorder, usually appears in a person's thirties or forties	In breast cancer, the cancer forms in the cells of breasts. It commonly occurs in women but can also occur in men. The **most common cause of hereditary breast cancer is an inherited mutation in the BRCA1 or BRCA2 gene.**

vessels, which blocks blood from reaching different parts of the body. This can cause pain and tissue damage.			

Q.53) With reference to International Atomic energy Agency (IAEA), consider the following statements?

1. Its headquarter is in Rome
2. Its objective is to promote the peaceful use of nuclear energy, and to inhibit its use for any military purpose, including nuclear weapons
3. It reports both to United Nation General Assembly and UN Security council

Select the correct answer using the code below:

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

Q.53) Solution (b)

Basic Information:

The IAEA is the international centre for cooperation in the nuclear/atomic field. It is a UN agency. It works with its member countries and many partners to promote peaceful uses of nuclear technologies.

Statement Analysis:

Statement 1	Statement 2	Statement 3
Incorrect	**Correct**	**Correct**
Set up as the world's "Atoms for Peace" organization in 1957 within	Its objective is **to promote the peaceful use of nuclear energy, and to inhibit its use for any**	Though established independently of the United Nations through its own international treaty, the IAEA

the United Nations family. Its headquarter is in Vienna, not Rome.	**military purpose, including nuclear weapons**	Statute, the **IAEA reports to both the United Nations General Assembly and Security Council.**

Q.54) The Department of Atomic energy functions under:

a) Prime Minister of India
b) Ministry of earth sciences
c) Ministry of Power
d) Principal scientific adviser to PM

Q.54) Solution (a)

Explanation:

The Department of Atomic Energy (DAE) came into being on August 3, 1954 **under the direct charge of the Prime Minister** through a Presidential Order. According to the Resolution constituting the AEC, the Secretary to the Government of India in the Department of Atomic Energy is ex-officio Chairman of the Atomic Energy Commission.

Its headquarter is in Mumbai.

DAE has been engaged in the development of nuclear power technology, applications of radiation technologies in the fields of agriculture, medicine, industry and basic research.

Q.55) Consider the following statements:

1. Ht-Bt cotton can tolerate Glyphosate, a herbicide variety, whose action kill only the weeds (Pink Bollworm), not the crop.
2. Bt brinjal sowing is not allowed commercially by GEAC
3. Genetic Engineering Appraisal Committee (GEAC) functions under Ministry of Agriculture and Fisheries.

Select the correct answer using the code below:

a) 1, 2 and 3
b) 2 and 3 only

c) 1 and 2 only
d) 1 and 3 only

Q.55) Solution (c)

Basic Information:

GM is a technology that involves inserting DNA into the genome of an organism.

To produce a GM plant, new DNA is transferred into plant cells. Usually, the cells are then grown in tissue culture where they develop into plants. The seeds produced by these plants will inherit the new DNA.

Statement Analysis:

Statement 1	Statement 2	Statement 3
Correct	**Correct**	**Incorrect**
Ht-Bt cotton can tolerate Glyphosate, a herbicide variety, whose action kill only the weeds (Pink Bollworm), not the crop. It is an unauthorised GM crop.	Bt brinjal sowing is not allowed commercially by GEAC.	Genetic Engineering Appraisal Committee (GEAC) established under Environment Protection Act 1986. GEAC is the apex body which allows for commercial release of any GM crop in India. **GEAC functions under Ministry of Environment, Forest and Climate Change (MoEFCC).**

Q.56) Consider the following statements:

1. Fission is the process by which the sun and other stars generate light and heat.
2. Fusion is the splitting of a heavy, unstable nucleus into two lighter nuclei.

Which of the above statements is/are correct?

a) Statement 1 is correct only
b) Statement 2 is correct only
c) Both the statements are correct

d) Both the statements are incorrect

Q.56) Solution (d)

Basic Information:

Both the statements are incorrect

The word fusion means "a merging of separate elements into a unified whole". Nuclear fusion refers to the "union of atomic nuclei to form heavier nuclei resulting in the release of enormous amounts of energy." Fusion takes place when two low-mass isotopes, typically isotopes of hydrogen, unite under conditions of extreme pressure and temperature.

Nuclear fission takes place when a large, somewhat unstable isotope (atoms with the same number of protons but different number of neutrons) is bombarded by high-speed particles, usually neutrons. These neutrons are accelerated and then slammed into the unstable isotope, causing it to fission, or break into smaller particles.

Statement Analysis:

Statement 1	Statement 2
Incorrect	**Incorrect**
Fusion is the process by which the sun and other stars generate light and heat. It is a nuclear process, where energy is produced by smashing together light atoms..	Fission is the splitting of a heavy, unstable nucleus into two lighter nuclei.

Q.57) Consider the following statements:

1. Kaiga Atomic Power Station is located in Tamil Nadu.
2. Nuclear power is the fifth-largest source of electricity in India after coal, gas, hydroelectricity and wind power.
3. India has uranium supply agreement with Mongolia.

Which of the above statements is/are correct?

a) 1 and 2 only
b) 2 only

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

Q.57) Solution (c)

Basic Information:

Nuclear power plants are a type of power plant that use the process of nuclear fission in order to generate electricity. They do this by using nuclear reactors in combination with the Rankine cycle, where the heat generated by the reactor converts water into steam, which spins a turbine and a generator.

Statement Analysis:.

Statement 1	Statement 2	Statement 3
Incorrect	**Correct**	**Correct**
Kaiga Nuclear power plant is a nuclear power generating station situated at Kaiga, near the river Kali, in Uttar Kannada district of Karnataka, India. The plant has been in operation since March 2000 and is operated by the Nuclear Power Corporation of India.	Nuclear power **is the fifth-largest source of electricity in India after coal, gas, hydroelectricity and wind power.** As of November 2020, India has 22 nuclear reactors in operation in 7 nuclear power plants, with a total installed capacity of 6,780 MW.	**India has uranium supply agreements with Russia, Mongolia, Kazakhstan, Argentina and Namibia.**

Q.58) Which of the following countries have signed civil nuclear cooperation agreement with India?

1. USA
2. Russia
3. Japan
4. Czech Republic

Select the correct code:

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

Q.58) Solution (d)

Basic Information:

Nuclear cooperation has brought a new dimension to India's diplomacy in the 21st century. India's status as a responsible nuclear power is predicated upon the civil relationships in the nuclear domain that it has established with major powers. This, despite not being a signatory to the Non-Proliferation Treaty and operating outside the ambit of the Nuclear Suppliers Group.

India is the only country with known nuclear weapons which is not a party to the Non-Proliferation Treaty (NPT) but is still allowed to carry out nuclear commerce with the rest of the world

Statement Analysis:

Statement 1	**Statement 2**	**Statement 3**	**Statement 4**
Correct	**Correct**	**Correct**	**Correct**
123 agreement' (also known **as US-India Civil Nuclear Agreement) was signed in 2008.**	India has also uranium supply agreements with **Russia along with Civil nuclear cooperation agreements.**	There was no civil nuclear cooperation agreement with Japan, **and after six years of negotiations a full nuclear cooperation agreement was signed in November 2016.**	India has civil nuclear cooperation agreement with Czech republic, Namibia along with 12 other nations

Q.59) Select the correct statements from the following:

1. World Association of Nuclear Operators (WANO) is a not for profit, international organisation with a mission to maximise the safety and reliability of the world's commercial nuclear power plants.
2. China and USA have ratified Comprehensive Nuclear Test Ban Treaty (CTBT)

Choose from the below given options:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 not 2

Q.59) Solution (a)

Basic Information:

- World Association of Nuclear Operators was established on 15 May 1989 following the nuclear accident at Chernobyl (Ukraine). After the accident, nuclear operators worldwide began to work together through WANO to improve safety, reliability and prevent recurrences.
- Comprehensive Nuclear Test Ban Treaty is multilateral treaty banning all nuclear explosions for both military and civilian purposes. It was negotiated at the Conference on Disarmament in Geneva and was opened for signature in 1996.

Statement Analysis:

Statement 1	Statement 2
Correct	**Incorrect**
World Association of Nuclear Operators **(WANO) is a not for profit, international organisation with a mission to maximise the safety and reliability of the world's commercial nuclear power plants.**	Comprehensive Nuclear Test Ban Treaty can only come enter into force **after it is ratified by eight countries with nuclear technology capacity, namely China, Egypt, India, Iran, Israel, North Korea, Pakistan and the United States.**

Q.60) Consider the following statements about International Thermonuclear Experimental Reactor (ITER):

1. It is a collaboration of 133 nations launched in 1985
2. it is located in France

3. Its goal is to demonstrate the scientific and technological feasibility of fusion energy for peaceful use.
4. India is not a member of it.

Select the Incorrect code:

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

Q.60) Solution (a)

Basic Information:

ITER is international nuclear fusion research and engineering megaproject, which will be the world's largest magnetic confinement plasma physics experiment. It aims to build the world's largest tokamak to prove the feasibility of fusion as a large-scale and carbon-free source of energy.

The 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.

Statement Analysis:

Statement 1	Statement 2	Statement 3	Statement 4
Incorrect	**Correct**	**Correct**	**Incorrect**
It is a collaboration of **35 nations launched in 1985, not 133.**	It is **located in France.**	Its goal is to demonstrate the scientific and technological feasibility of fusion energy for peaceful use.	The ITER members include China, the European Union, I**ndia**, Japan, South Korea, Russia and the United States

Q.61) It is a method of inquiry in artificial intelligence for determining whether a computer is capable of thinking like a human being or not. Which method is being referred here?

a) Ebert Test
b) ELIZA
c) Feigenbaum test
d) Turing Test

Q.61) Solution (d)

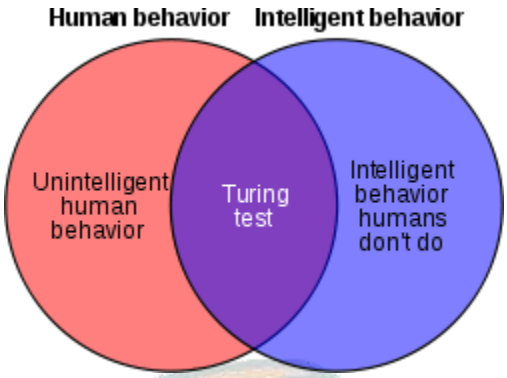
Basic Information:

Statement 1: The Ebert test gauges whether a computer-based synthesized voice can tell a joke with sufficient skill to cause people to laugh. It was proposed by film critic Roger Ebert at the 2011 TED conference as a challenge to software developers to have a computerized voice master the inflections, delivery, timing, and intonations of a speaking human.

Statement 2: ELIZA is an early natural language processing computer program created from 1964 to 1966 at the MIT Artificial Intelligence Laboratory by Joseph Weizenbaum. Created to demonstrate the superficiality of communication between humans and machines, Eliza simulated conversation by using a "pattern matching" and substitution methodology that gave users an illusion of understanding on the part of the program, but had no built in framework for contextualizing events.

Statement 3: Feigenbaum test is also known as subject matter expert Turing test, here an computer system attempts to replicate an expert in a given field such as chemistry or marketing. It was proposed by Edward Feigenbaum in 2003.

Statement 4: there are probabilities that very soon one might fail to distinguish between a robot and a human being. The form of robot that has reached this level can be tested through a method called '**Turing Test'**. A Turing test is a method of inquiry in artificial intelligence for determining whether a computer is capable of thinking like a human being or not. This test is named after Alan Turing (1912-1954), an English computer scientist, cryptanalyst, mathematician and theoretical biologist. This test was was introduced by Turing in his research paper, 'Computing Machinery and intelligence' (1950), He described it calling the 'imitation game'. If an wvaluator is unable to distinguish between machine and human behaviour then it is believed that the machine (AI) has passed the Turing Test.



Q.62) With reference to Nanomicelles, consider the following statements:

1. It can be used for cancer treatments.
2. They are not stable at room temperature, so scientists keep them in specially designed tubes.
3. Nanomicelles are less than 100 nm in size.

Which of the above statements are correct?

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

Q.62) Solution (c)

Basic Information:

With the advance in nanotechnology, researchers across the globe have been exploring how to use nanoparticles for efficient drug delivery.

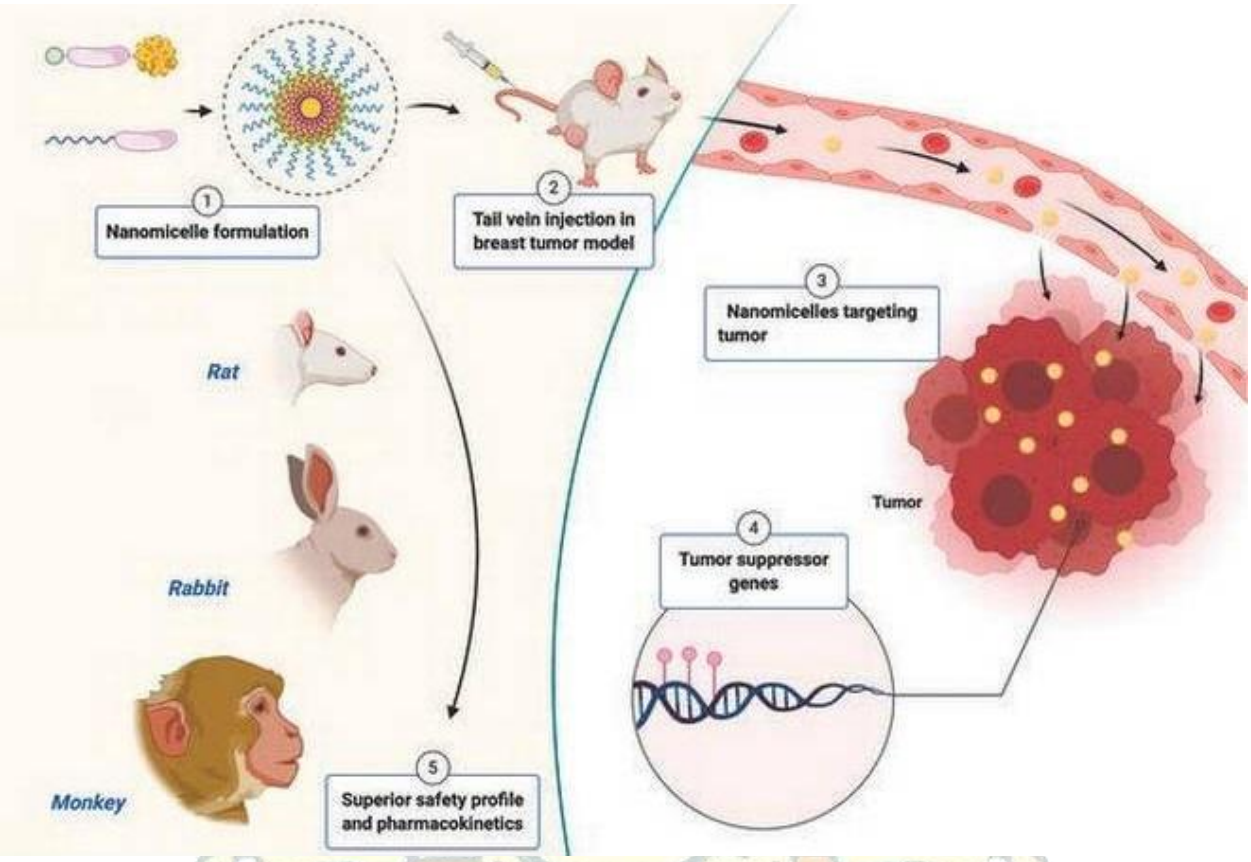
Similar to nanoshells and nanovesicles, nanomicelles are extremely small structures and have been noted as an emerging platform in targeted therapy. Nanomicelles are globe-like structures with a hydrophilic outer shell and a hydrophobic interior. This dual property makes them a perfect carrier for delivering drug molecules.

Statement analysis

Statement 1: The ideal goal for cancer therapy is destroying the cancer cells without harming healthy cells of the body, and chemotherapeutics approved for treatment of cancer are highly toxic. The currently used docetaxel is a highly hydrophobic drug, and is dissolved in a chemical

mixture (polysorbate-80 and alcohol). This aggravates its toxic effects on liver, blood cells, and lungs. Recently a team of scientists has created a **nanomicelle that can be used to deliver a drug named docetaxel, which is commonly used to treat various cancers including breast, colon and lung cancer.**

Statement 2 and 3: The nanomicelles **are less than 100nm in size and are stable at room temperature**. Once injected intravenously these nanomicelles can easily escape the circulation and enter the solid tumours where the blood vessels are found to be leaky.



Picture showing working of nanomicelles.

Q.63) Which of the following statement defines Grey goo?

a) Toxic by-product resulting from the synthesis of graphene.
b) A hypothetical substance composed of out-of-control self-replicating nanobots that consumes all living matter on Earth.
c) A Hypothetical structure that encloses a large urban area under a single roof.

d) A one atom thick sheet of carbon.

Q.63) Solution (b)

Explanation:

One of the more interesting concerns of nanotechnology is 'grey goo.' Grey goo, a nightmarish scenario of nanotechnology in which out-of-control self-replicating nanobots destroy the biosphere by endlessly producing replicas of themselves and feeding on materials necessary for life. The term was coined by American engineer Eric Drexler in his book Engines of CrGrey goo.

Optimists have hailed the positive possibilities of such self-replicating machines. Molecular-level "assemblers" could solve the world's energy crisis through low-cost solar power, cure terrible diseases like cancer by boosting the human immune system, completely clean up the environment, and even enable the restoration of extinct species. The cheapness and abundance of materials, since the basic building blocks of the technology are at the molecular level, would make it easy and cheap to create any product, including incredibly inexpensive pocket supercomputers.

However, pessimists have warned against the possibility of such molecular-level assemblers wreaking havoc because they could spin out of control, could be deliberately diverted to destructive applications, or become so incredibly efficient and intelligent that human oversight or control would become superfluous. Central to this argument is that nanotechnology crucially gives Nano assemblers the ability to reproduce, meaning that it would be a small step from an intelligent robot to a robot species. **Moreover, historical examples of unforeseen consequences of technological innovation, such as the emergence of antibiotic-resistant bacteria or DDT-resistant malarial mosquitoes, have been used to underline the dangers of creating robots, engineered organisms, and nanobots that self-replicate, manifestly multiplying their capacity for destruction of the physical world.**

Q.64) Which of the following country had granted citizenship to a Robot for the first time in world?

a) Japan
b) USA
c) UAE
d) Saudi Arabia

Q.64) Solution (d)

Explanation:

In 2017, there took place an astounding incident in the world of robots **when a gynoid (female android) named Sophia built by Hong Kong based company Hanson Robotics, was granted citizenship by Saudi Arabia.**

Sophia made her first public appearance in March, 2016 in Austin, Texas, USA she had a conversation with the audiences and media personnel and even answered their queries at public shows in overcrowded auditoriums. In October 2017, Sophia was granted citizenship by Saudi Arabia. In November 2017, Sophia was named the United Nations Development Programme's first ever Innovation Champion, and is the first non-human to be given any United Nation title.

Sophia is capable of mimicking body language and facial expression of human beings. She can talk easily on topics like weather. Sophia's innovator and creator David Hanson states that this robot with Artificial intelligence would utilize her citizenship to protect women's Fundamental rights.

Q.65) Consider the following statements with reference to Nano materials:

1. Nanomaterial are materials of which a single unit small sized (in at least one dimension) between 1 and 100 mm.
2. Nanomaterial do not occur naturally, they are artificially made.

Which of the above given statements is/are correctly matched?

a) 1 only
b) 2 only
c) Both 1 and 2

d) Neither 1 nor 2

Q.65) Solution (d)

Basic Information:

Nanotechnologies make use of very small objects or artefacts. Nanomaterials are an increasingly important product of nanotechnologies. Nanomaterials are coming into use in healthcare, electronics, cosmetics and other areas. The number of products produced by nanotechnology or containing nanomaterials entering the market is increasing. Current applications include healthcare (in targeted drug delivery, regenerative medicine, and diagnostics), electronics, cosmetics, textiles, information technology and environmental protection.

Explanation:

Nanomaterials can be defined as materials possessing, at minimum, one external dimension measuring 1-100nm. (Not mm), they may be in the form of particles, tubes, rods or fibres. The definition given by the European Commission states that the particle size of at least half of the particles in the number size distribution must measure 100nm or below.

Nanomaterials can occur naturally, be created as the by-products of combustion reactions, or be produced purposefully through engineering to perform a specialised function. These materials can have different physical and chemical properties to their bulk-form counterparts.

So, both statements are correct here.

Q.66) Consider the following statements about Xenobots?

1. They are living Robots developed by stem cells of Frog.
2. Xenobots can move toward a target and can heal themselves after being cut

Which of the statements given above is/are correct?

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

Q.66) Solution (c)

Explanation:

Scientists in the United States have created the world's first "living machines" — tiny robots built from the cells of the African clawed frog that can move around on their own. They are named after the species of aquatic frog found across sub-Saharan Africa from Nigeria and Sudan to South Africa, Xenopus laevis.

Statement 1: Xenobots are less than a 1 millimeter (0.039 inches) wide and composed of just two things: skin cells and heart muscle cells, **both of which are derived from stem cells harvested from early (blastula stage) frog embryos.**

Statement 2: The xenobots "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.**

Q.67) Consider the following statements with reference to All India Council for Robotics and Automation:

1. It is autonomous body under Ministry of Science and Technology.
2. It sets up standards in Robotics and Automation and education industry in India.

Which of the statements given above is/are correct?

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

Q.67) Solution (b)

Explanation:

AICRA a not-for-profit organization is the apex body, setting up standards in Robotics & Automation and education industry as well as helping over 35,00+ members organizations and professionals to solve difficult technical problems, while enhancing their leadership and personal career capabilities.

Established in 2014 and ever since, AICRA's relentless pursuit has been to constantly support the Robotics & Automation industry, providing support systems to institutions such as quality assurance, information systems and train-the-trainer (TTT) academies either directly or through partnerships. To strengthen supplementary skill development, **AICRA focuses on fostering**

private sector led efforts that include both non-profit and for-profit initiatives with the goal of building models that are scalable.

AICRA is focused on building the architecture integral to the development of the automation sector through policy advocacy, and help in setting up the strategic direction for the sector to unleash its potential and dominate newer frontiers.

The executive board of AICRA is the senior governing body that's composed of the President, President - elect Secretary, Vice President, Treasurer, 8 members with geographic, technical, and operational experience, the Parliamentarian (non-voting), and up to 5 at-large, competency-based members. The Executive Board works closely with the AICRA staff, made up of dozens of seasoned experts in areas like non-profit management, finance, event planning, marketing, training, publishing and more.

So, Statement (1) is incorrect here.

Q.68) Consider the following pairs:

Robot	**:**	***Country***
1. FEDOR	:	France
2. KIROBO	:	Japan
3. ROBONAUT 2	:	USA

Which of the above given pairs is/are correctly matched?

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

Q.68) Solution (c)

Explanation:

Statement 1: **FEDOR is humanoid robot, the first from Russia**, Originally intended for rescue operations, it was sent on an experimental mission to the International Space Station in 2019. Short for Final Experimental Demonstration Object Research, Fedor can be operated manually by ISS astronauts wearing robotic exoskeleton suits. The robot mirrors their movements.

Fedor stands 180 cm tall and weighs 160 kg. It copies human movements, which will enable it to

perform tasks that are risky for astronauts strapped onto an exoskeleton.

Statement 2: While Fedor is Russia's first robot in space, other countries have previously sent theirs**. In 2011, NASA sent up Robonaut 2, a humanoid developed with General Motors that had a similar aim of working in high-risk environments,** AFP reported. Robonaut 2 was flown back to Earth in 2018 after experiencing technical problems.

Statement 3: **In 2013, Japan sent up a small robot called Kirobo**, developed with Toyota. It was able to hold conversations in Japanese. Kirobo set two Guinness World Records after it returned to Japan, following an 18-month stay on board the International Space Station.

- First companion robot in space
- Highest altitude for a robot to have a conversation

Q.69) Consider the following statements with reference to NASA's Magnetospheric Multiscale Mission:

1. It was launched in December 2020.
2. It recently made the first high resolution measurement of an interplanetary shock.
3. It has set Guinness record for highest altitude fix of a GPS signal.

Which of the statements given above is/are correct?

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

Q.69) Solution (b)

Basic information:

Magnetospheric Multiscale Mission.

It is NASA robotic space mission to study the Earth's magnetosphere, using four identical spacecraft flying in a tetrahedral formation. **It was launched in 2015**. **It investigates how the Sun's and Earth's magnetic fields connect and disconnect, explosively transferring energy from one to the other.** This process occurs throughout the universe and is known as magnetic reconnection. **So, statement 1 is incorrect here.**

It consists of four spacecrafts that orbit Earth to study a lesser known phenomenon called

magnetic reconnection – when magnetic field lines of Earth cross the Sun's magnetic fields and release a burst of energy, reconnection process taps this field energy stored and coverts it into heat and energy in the form of charged particle acceleration and large-scale flows of matter.

The 4 spacecrafts are arranged in a tetrahedral or a pyramid pattern.

Magnetic reconnection is a phenomenon unique to plasma, that is, the mix of positively and negatively charged particles that make up the stars and fill up the space.

Statement Analysis:

Statement 2: **Recently it made the first high resolution measurement of an interplanetary shock.** Interplanetary shocks are a type of collision less shock — ones where particles transfer energy through electromagnetic fields instead of directly bouncing into one another. These collision less shocks are a phenomenon found throughout the universe, including in supernovae, black holes and distant stars.

Statement 3: NASA's Magnetospheric Multiscale mission (MMS) **has set the Guinness World Record for highest altitude fix of a GPS signal— at 70,000km above the surface of the Earth.**

Q.70) Consider the following statements about Global partnership on Artificial intelligence (GAPI)

1. It was founded under the auspices of UN and aims to promote responsible and human centric development of AI.
2. India is among its founding member.

Which of the above given statements is/are correct?

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

Q.70) Solution (b)

Explanation:

GPAI is an international and multi-stakeholder initiative to guide the responsible development and use of AI, grounded in human rights, inclusion, diversity, innovation, and economic growth. This is also a first initiative of its type for evolving better understanding of the challenges and

opportunities around AI using the experience and diversity of participating countries. In order to achieve this goal, the initiative will look to bridge the gap between theory and practice on AI by supporting cutting-edge research and applied activities on AI-related priorities**. Launched in June 2020, GPAI is the fruition of an idea developed within the G7, under the Canadian and French presidencies.**

GPAI's 15 founding members are Australia, Canada, France, Germany**, India,** Italy, Japan, Mexico, New Zealand, the Republic of Korea, Singapore, Slovenia, the United Kingdom, the United States and the European Union. They were joined by Brazil, the Netherlands, Poland and Spain in December 2020.

GPAI will be supported by a Secretariat, to be hosted by Organization for Economic Cooperation and Development (OECD) in Paris, as well as by two Centers of Expertise- one each in Montreal and Paris. **So, only statement (b) is correct here.**

Q.71) What are the potential health effects of nanomaterials?

1. They can lead to genetic damage.
2. They may lead to lung inflammation.
3. They cannot cause brain disease.

Select the correct code

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

Q.71) Solution (a)

Basic Information:

There is experimental evidence of a range of possible interactions with biological systems and health effects of manufactured nanoparticles. In experimental systems in the laboratory they can affect the formation of the fibrous protein tangles which **are similar to those seen in some diseases, including brain diseases. Airborne particles might cause effects in the lungs but also on the heart and blood circulation similar to those already known for particulate air pollution. There is some evidence that nanoparticles might lead to genetic damage, either directly or by causing inflammation.**

All these effects would depend on nanoparticles' fate in the body. Only a minimal amount of

nanoparticle doses escape the lungs or intestine, but long-term exposure could still mean a large number are distributed round the body. Most are held in the liver or the spleen, but some appear to reach all tissues and organs. There may also be entry into the brain via the membranes inside the nose.

Nanotubes or rods with similar characteristics to asbestos fibres pose a risk of the mesothelioma (a form of cancer of the pleura).

Q.72) Which of the following statements about graphene is/are correct?

1. Graphene is the name for a honeycomb sheet of carbon atoms.
2. Graphene consists entirely of carbon atoms.
3. It is harder than diamond yet more elastic than rubber.

Select the correct answer using the code below:

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

Q.72) Solution (d)

Basic information:

Graphene is the name for an atom-thick honeycomb sheet of carbon atoms. It is the building block for other graphitic materials (since a typical carbon atom has a diameter of about 0.33 nanometers, there are about 3 million layers of graphene in 1 mm of graphite).

Units of graphene are known as nanographene; these are tailored to specific functions and as such their fabrication process is more complicated than that of generic graphene.
Nanographene is made by selectively removing hydrogen atoms from organic molecules of carbon and hydrogen, a process called dehydrogenation.

Statement analysis:

Statement 1**: Graphene is the name for a honeycomb sheet of carbon atoms**. Its striking physical, electronic, and chemical properties originate from the two-dimensional (2D) electron confinement within a one-atom-thick layer.

Statement 2**: Graphene consists entirely of carbon atoms** and graphene sheets are building

blocks for other graphitic materials such as graphite, carbon nanotubes and fullerenes. The Nobel Prize in Physics 2010 was awarded jointly to Andre Geim and Konstantin Novoselov "for ground-breaking experiments regarding the two-dimensional material graphene".

Statement 3: **It is harder than diamond yet more elastic than rubber;** tougher than steel yet lighter than aluminium. Graphene is the strongest known material. Graphene possesses other amazing characteristics: Its high electron mobility is 100x faster than silicon; it conducts heat 2x better than diamond; its electrical conductivity is 13x better than copper; it absorbs only 2.3% of reflecting light; it is impervious so that even the smallest atom (helium) can't pass through a defect-free monolayer graphene sheet.

Q.73) Which of the following are features of Indian humanoid robot, Vyommitra?

1. It is half humanoid robot which will be sent into space as part of the Gaganyaan programme.
2. It has been developed by DRDO.
3. It is programmed to speak Hindi and English and perform multiple tasks.

Select the correct code:

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

Q.73) Solution (c)

Basic information:

Before India's first human spaceflight, a half-humanoid will travel solo to help determine if the trip is safe enough. Like any robot, a humanoid's functions are determined by the computer systems to which it is connected. With the growth of artificial intelligence and robotics, humanoids are being increasingly used for repetitive jobs, such as that of a waiter at a restaurant

Explanation:

Statement 1: She is a half-humanoid, her body stops at the torso and has no legs. **She will be sent to space as a part of Gaganyaan Mission which aims to send three Indians in Space by 2022.**

Statement 2: It has been developed by the ISRO Inertial Systems Unit, Thiruvananthapuram, **so statement 2 is incorrect.**

Statement 3: **it is programmed to speak Hindi and English and perform multiple tasks** which includes switching panel operations, ECLSS [environment control and life support systems] functions, be a companion, converse with the astronauts, recognise them and also respond to their queries. She can also detect and give out warnings if environmental changes within the cabin get uncomfortable to astronauts and change the air condition.

Q.74) Which of the following disadvantages are associated with reference to use of nanomaterials?

1. There are still knowledge gaps regarding nanomaterials.
2. They can pollute water bodies.
3. Possible health risks are ingestion exposure and dust explosion hazards.

Select the correct code

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

Q.74) Solution (d)

Basic information

The use of nanomaterials is prevalent in a wide range of industries and consumer products.

In the cosmetics industry, mineral nanoparticles –such as titanium oxide –are used in sunscreen, due to the poor stability that conventional chemical UV protection offers in the long-term. Just as the bulk material would, titanium oxide nanoparticles are able to provide improved UV protection while also having the added advantage of removing the cosmetically unappealing whitening associated with sunscreen in their nano-form.

The sports industry has been producing baseball bats that have been made with carbon nanotubes, making the bats lighter therefore improving their performance. Further use of nanomaterials in this industry can be identified in the use of antimicrobial nanotechnology in items such as the towels and mats used by sportspeople, in order to prevent illnesses caused by bacteria.

Statement analysis:

Statement 1: **there are still knowledge gaps regarding nanomaterials**, meaning the manufacturing process can often be complex and difficult. The overall process is also expensive, requiring optimum results - especially regarding their use in consumer goods - in order to avoid financial losses.

Statement 2: Additionally, Risk-assessments concerning any potential **environmental effects indicate that nanomaterials used in cosmetic items such as sunscreen, which are applied to the skin, run the risk of ending up in aquatic ecosystems after they are washed off**. Nanomaterials that have been engineered may also end up in water bodies such as lakes and rivers, before accumulating to create particles of a larger size. This may put freshwater species - such as snails- at risk by possibly inducing a decline in life processes such as growth and reproduction.

Statement 3: there are number of disadvantages associated with nanomaterial use. Due to the relative novelty of the widespread use of nanomaterials, there is not a large amount of information on the health and safety aspects of exposure to the materials.

Currently, one of the main disadvantages associated with nanomaterials is considered to be inhalation exposure. This concern arises from animal studies, the results of which suggested that nanomaterials such as carbon nanotubes and nanofibers may cause detrimental pulmonary effects, such as pulmonary fibrosis**. Further possible health risks are ingestion exposure and dust explosion hazards.**

Q.75) Consider the following statements with reference to National Artificial Intelligence Portal

1. It has been jointly developed by Ministry of Science and Technology in collaboration with NASSCOM.
2. The portal shall work as a one stop digital platform for AI related developments in India

Select the *incorrect* statements:

a) 1 only
b) 2 only
c) Both
d) None

Q.75) Solution (a)

Explanation:

Incorrect statement is being asked here.

National Artificial intelligence Portal has been jointly developed by the Ministry of Electronics and IT and IT Industry. National e-Governance Division of Ministry of Electronics and IT and NASSCOM from the IT industry will jointly run this portal. **This portal shall work as a one stop digital platform for AI related developments in India,** sharing of resources such as articles, startups, investment funds in AI, resources, companies and educational institutions related to AI in India. The portal will also share documents, case studies, research reports etc. It has section about learning and new job roles related to AI. **So, statement (a) is incorrect here.**

Q.76) Consider the following statements with reference to application of Nanotechnology

1. The Nano CO2 Harvester can capture more CO2 than usual and is more efficient fuel converter.
2. Nanoparticle of silver embedded into fibres have antimicrobial action.
3. Nanoenhanced paints can increase emission of nitrogen oxides, hydrocarbons and carbon monoxide in atmosphere.

Which of the above statements is/are correct?

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

Q.76) Solution (a)

Basic informstion:

Nanotechnology is science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometers. The physical, chemical and biological properties exhibited by a material changes at this size level is unique and peculiar way, i.e. it follows the laws of quantum physics which is very different from the laws of Newtonian physics we see and feel. As nanotechnology allows manipulation of properties at a very small scale, it can have many applications such as:

Explanation:

Application based on nanotechnology:

- Graphene is used in transparent electrodes for solar cell, LCD, robust non-volatile atomic switches, chemical and biological sensors and in spintronic devices.
- Nanowhishkers on clothes create a cushion of air around the fabric so that liquids cannot stain them.
- **Nanoparticles of silver embedded into fibres have anti-microbial action.**
- Silver nanoparticles are incorporated in apparel, footwear, paints, wound dressings, appliances, cosmetics and plastics for their antibacterial properties.
- New and cheap solar cells use nanoparticles of titanium oxide coated with dye molecules to capture the energy of visible light and convert it into electricity.
- **Nanoenhanced paints can reduce emission of nitrogen oxides, hydrocarbons and carbon monoxide in the atmosphere;** addition of nanoparticles make paint scratchproof, easy cleaning, air purifying, UV resistant, water repellent, flame resistant and antibacterial.
- **The Nano CO2 Harvester can capture more CO2 than usual and is more efficient fuel converter.**
- The magnetically charged nanoparticles have been proved potent in researches to have effectively carried on adsorption process to remove heavy & toxic metals, dyes from and oil spills from water bodies.
- They accelerate the conversion of organic waste into organic manures or biogas and fertilizers can also be quickened through use of Nanoparticles (such as Iron oxide particles).

Q.77) National strategy for Artificial Intelligence has been released by

a) Niti Aayog

b) Department of Science and Technology
c) FICCI
d) NASSCOM

Q.77) Solution (a)

Basic Information:

Artificial intelligence is the use of computers to simulate human intelligence. It enables computer system to carry out task on their own that otherwise requires human intelligence. AI amplifies our cognitive abilities — letting us solve problems where the complexity is too great, the information is incomplete, or the details are too subtle and require expert training.

Explanation:

Union Budget-2018 mandated NITI Aayog to come up with a national programme on employing Artificial Intelligence towards national development. **NITI has, since, published a National Strategy for Artificial Intelligence.**

National Strategy lays down the vision of India for evolving a robust ecosystem for AI research and adoption. The Strategy is termed #AIForAll as it is focused on leveraging AI for inclusive growth in line with the Government policy of Sabka Saath, Sabka Vikas.

Aiming to put AI to use for all and across sectors, NITI has identified barriers that needs to be addressed to achieve success in the use of AI. These include lack of expertise, absence of enabling data ecosystem, high resource cost and low awareness, privacy and security issues and absence of collaborative approach to adoption and application of AI.

Q.78) The World's first artificial Human NEON has been created by

a) Google
b) Hanson Robotics
c) Samsung
d) Honda

Q.78) Solution (c)

Explanation:

Neon isn't a robot or a voice assistant like Siri or Alexa. Instead, it's a simulated human assistant that appears on a screen and learns about people to help it give seemingly intelligent and life-

like responses -- think of it like an animated chatbot. Samsung claims the Neons will be able to provide a response to questions in milliseconds.

Neon isn't a voice assistant or a robot, but rather a video chatbot that can learn people's preferences and respond to their queries in an unusually lifelike way, the company claims.

Q.79) Feynman's prophecy is associated with which of the followings

a) Robotics
b) Programmable matter
c) Artificial intelligence
d) Nanotechnology

Q.79) Solution (d)

Explanation:

Scientists are able to see beyond times due to their great powers of imagination. Richard Feynman was one such scientist **who delivered a prophetic talk describing a new field of nanotechnology on 29th December 1959.** The completion of 60 years of this event provides as an occasion to pay tribute to the imagination of one of the greatest minds that led to emergence of one of the most advanced field of science and technology.

Feynman delivered the talk at the annual meeting of the American physical society at the California institute of technology and the title of the talk was **"There is Plenty of Room at the Bottom- An invitation to enter a New Field of Physics."**

The new field of nanotechnology presaged by Feynman in this lecture grew very rapidly in the following decades not only translating Feynman's predictions into reality but also providing several new breakthroughs in this field.

Feynman describe a new bottle is field in his talk - one of manipulating and controlling things on the scale of a nanometre(nm), which is a brilliant part of a metre just for a quantitative feel, ten hydrogen atoms in a line make up 1 nm, a DNA double helix is about 2 nm across, the smallest cellular life forms are around 200 nm in length, the smallest thing that can be seen with unaided human eye is about 10,000 nm across and a human hair is about 50,000 nm thick.

Q.80) With reference to Carbon Nanotubes, consider the following statements?

1. Carbon nanotubes (CNTs) are cylindrical molecules that consist of rolled-up sheets of single-layer carbon atoms (graphene).
2. They have very high current densities with no heat loss
3. They have wide application ranging from paints and textiles to medical diagnostic tools.

Select the incorrect code:

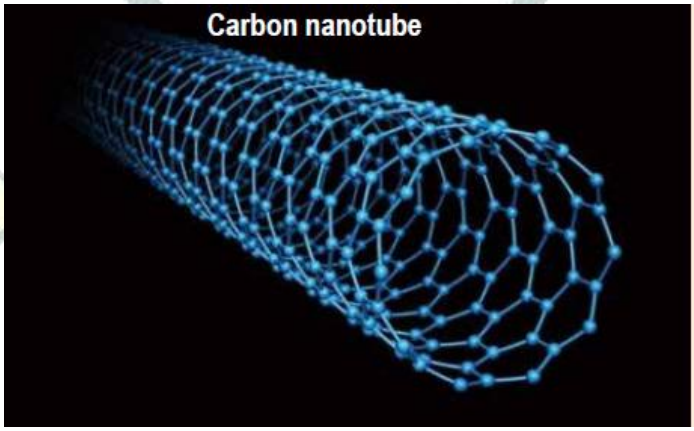
a) 1 and 2 only
b) 2 and 3 only
c) 3 only
d) None

Q.80) Solution (d)

Explanation:

Carbon nanotubes (CNTs) are cylindrical molecules that consist of rolled-up sheets of single-layer carbon atoms (graphene). They can be single-walled (SWCNT) with a diameter of less than 1 nanometre (nm) or multi-walled (MWCNT), consisting of several concentrically interlinked nanotubes, with diameters reaching more than 100 nm. Their length can reach several micrometres or even millimetres**. Carbon nanotubes are used in products ranging from paints and textiles to medical diagnostic tools.**

There are numerous carbon nanotubes properties and applications which take full advantage of CNTs unique properties of aspect ratio, mechanical strength, electrical and thermal conductivity.



Carbon Nanotubes Properties

- their mechanical tensile strength can be 400 times that of steel

- **They have very elastic strength alongside low mass densities or very high current densities with no heat loss.**
- they are very light-weight – their density is one sixth of that of steel;
- their thermal conductivity is better than that of diamond;
- they have a very high aspect ratio greater than 1000, i.e. in relation to their length they are extremely thin;
- a tip-surface area near the theoretical limit (the smaller the tip-surface area, the more concentrated the electric field, and the greater the field enhancement factor);
- just like graphite, they are highly chemically stable and resist virtually any chemical impact unless they are simultaneously exposed to high temperatures and oxygen - a property that makes them extremely resistant to corrosion;
- Their hollow interior can be filled with various nanomaterials, separating and shielding them from the surrounding environment - a property that is extremely useful for nanomedicine applications like drug delivery.

All these properties make carbon nanotubes ideal candidates for electronic devices, chemical/electrochemical and biosensors, transistors, electron field emitters, lithium-ion batteries, white light sources, hydrogen storage cells, cathode ray tubes (CRTs), electrostatic discharge (ESD) and electrical-shielding applications.

Q.81) With reference to India Innovation Index, consider the following statements?

1. It is released by Ministry of Science and Technology.
2. It measures index based on innovation inputs and innovation outputs.

Which of the above statements is/are correct?

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

Q.81) Solution (b)

Statement analysis

Statement 1: NITI Aayog releases the India Innovation Index.

Statement 2: Index measures innovation inputs through 'Enablers' and innovation output as

'Performance'.

- **Enabler parameters** (factors that reinforce innovative capacities): Human Capital, Investment, Knowledge Workers, Business Environment, Safety and Legal Environment.
- **Performance parameters**: Knowledge Output, Knowledge Diffusion.

Basics about India Innovation Index:

The index has been developed on the lines of the Global Innovation Index (GII), to ameliorate the innovation ecosystem of Indian states and Union Territories (UTs) and to design policies to drive innovation across regions.

The states have been bifurcated into three categories:

- Major states: Top performers are Karnataka, Maharashtra, Tamil Nadu, Telangana.
- North-east and hill states: Top performers are Himachal Pradesh, Uttarakhand Manipur.
- UTs and City States: Top performers are Delhi, Chandigarh, Daman and Diu

The indicators that the survey uses include the level and quality of education and parameters such as:

- Number of PhD students and knowledge-intensive employment.
- Enrolment in engineering and technology and number of highly skilled professionals.
- Investment in R&D and number of patents and trademark applications filed.
- Internet subscribers.
- FDI inflows, business environment and safety and legal environment.

Q.82) Consider the following statements regarding Traditional Knowledge Digital Library:

1. It is a collaborative initiative of CSIR, Ministry of Science and Technology and Ministry of Health.
2. Data of traditional knowledge stored at TKDL is available to general public to make most benefit of centuries old practices.

Which of the above statements is/are correct?

a) 1 only
b) 2 only

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

Q.82) Solution (a)

Explanation:

Statement 1: TKDL was initiated in 2001, as collaboration between the Council of Scientific and Industrial Research (CSIR), Ministry of S&T, and Department AYUSH, Ministry of Health.

Statement 2: The database is **available to only patent examiners through TKDL Access** (Non-disclosure) Agreement.

About Traditional Knowledge Digital Library

- Traditional Knowledge Digital Library (TKDL) is an Indian digital knowledge repository of traditional knowledge (TK), especially about medicinal plants and formulations used in Indian systems of medicine.
    - TK is knowledge, know-how, skills and practices that are developed, sustained and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity.
- TKDL database contains more than 3.9 lakh formulations/ practices from the Indian systems of medicine (Ayurveda, Yoga, Siddha, Unani and Sowa Rigpa) in digitized format
- All data are in five languages: English, German, French, Japanese and Spanish.
- It seeks to prevent misappropriation of the country's traditional medicinal knowledge at International Patent Offices by preventing the granting of patents for products developed utilizing Indian TK.
- Also, non-patent database serves to foster modern research based on traditional knowledge, by simplifying access to vast knowledge of practices.

Q.83) Consider the following statements about PM Wi-Fi Access Network Interface (PM-WANI):

1. It is similar to the concept of Public Call Office (PCO), where even a shopkeeper can provide Wi-Fi.
2. A customer can access the network of Wi-Fi only after eKYC authentication.

Which of the statements given above is/are correct?

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

Q.83) Solution (c)

Explanation:

About PM Wi-Fi Access Network Interface

- The initiative aims to elevate wireless internet connectivity in the country.
- This initiative will be operated by different stakeholders – Public Data Office, Public Data Office Aggregator, App Provider, and Central Registry.
- A PDOA will buy bulk bandwidth from licenced telecoms/ISPs, and re-sells it to multiple PDOs.
- This nationwide network of public Wi-Fi hotspots, termed PDOs after the public call office (PCO) concept rolled out by the Indian government to set up a nationwide network of landline public payphones.
- There will be no licence fee for providing broadband Internet through these public Wi-Fi networks, and any small shopkeeper can become Public Data office, on the similar line of PCO.**(So, Statement 1 is correct)**
- All data related to complete use data and usage log will be stored in India.
- A customer wanting to access the network from a PDO's premise can do so only after an eKYC authentication. **(So, Statement 2 is correct)**

Q.84) Which of the following statements with reference to Narrow Band Internet of Things (NB-IoT) is/are correct?

1. NB-IoT can only operate on 4G mobile networks.
2. Its application will lead to extended long range coverage and deep penetration indoors and underground.

Select the correct code

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

Q.84) Solution (b)

Explanation

- Narrowband IoT (NB-IoT) is a wireless communication standard for the Internet of Things (IoT) belonging to the category of low-power wide-area networks (LPWAN).
- It enables to connect devices that need small amounts of data, low bandwidth, and long battery life.
- NB-IoT can co-exist with 2G, 3G, and 4G mobile networks. **(Hence, Statement 1 is incorrect)**
- As, ability to co-exist on 2G, 3G and 4G network, its application will lead to extended long coverage and deep penetration indoors and underground**. (So, Statement 2 is correct)**

NB-IoT has various applications like

- smart city infrastructures such as connecting street lamps or dustbins,
- smart metering (electricity, gas, and water),
- intruder and fire alarms,
- measuring health parameters,
- tracking of persons, animals or objects

Q.85) It is the practice of sending fraudulent communications that appear to come from a reputable source, usually through email. What it is?

a) Men-in-the Middle Attack
b) Denial of Service Attack
c) SQL injection
d) Phishing

Q.85) Solution (d)

Explanation:

- **Phishing is the practice of sending fraudulent communications that appear to come from a reputable source, usually through email.** The goal is to steal sensitive data like credit card and login information or to install malware on the victim's machine. Phishing is an increasingly common cyber threat.

- Man-in-the-middle (MitM) attacks, also known as eavesdropping attacks, occur when attackers insert themselves into a two-party transaction. Once the attackers interrupt the traffic, they can filter and steal data.
    - Two common points of entry for MitM attacks:
    - On unsecure public Wi-Fi, attackers can insert themselves between a visitor's device and the network. Without knowing, the visitor passes all information through the attacker.
    - Once malware has breached a device, an attacker can install software to process all of the victim's information.
- A denial-of-service attack floods systems, servers, or networks with traffic to exhaust resources and bandwidth. As a result, the system is unable to fulfill legitimate requests. Attackers can also use multiple compromised devices to launch this attack. This is known as a distributed-denial-of-service (DDoS) attack.
- A Structured Query Language (SQL) injection occurs when an attacker inserts malicious code into a server that uses SQL and forces the server to reveal information it normally would not. An attacker could carry out a SQL injection simply by submitting malicious code into a vulnerable website search box.

Q.86) Consider the following measures taken to secure Cyber Security measures taken in India:

1. Cyber Swachhta Kendra is an initiative of Ministry of Electronics and Information Technology.
2. National Cyber Coordination Centre is established under Ministry of Defence.
3. CERT-In conducts regular training programmes for network / system administrators.

Which of the given statements are correct?

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

Q.86) Solution (b)

Explanation:

1) **Cyber Swachhta Kendra –**It has been set up for analysing BOTs/malware characteristics and providing information and enabling citizens for removal of BOTs/malware. In addition, "Cyber Swachhta Kendra" will strive to create awareness among citizens to secure their data, computers, mobile phones and devices such as home routers. It is a part of the Indian Computer Emergency Response Team (CERT-In), which is established under administrative control of Ministry of Electronics and Information Technology. (So, Statement 1 is correct)
2) **National Cyber Coordination Centre** – established under National Security Council Secretariat (NSCS) coordinates with different agencies at the national level for cyber security matters. NSCS is body under Prime Minister Office. (So, Statement 2 is incorrect)
3) **CERT –In -** CERT-In conducts regular training programmes for network / system administrators and Chief Information Security Officers (CISOs) of Government and critical sector organisations regarding securing the IT infrastructure and mitigating cyber-attacks. (So, Statement 3 is correct)

CERT-In is operational since January 2004. The constituency of CERT-In is the Indian Cyber Community. CERT-In is the national nodal agency for responding to computer security incidents as and when they occur.

In the recent Information Technology Amendment Act 2008,CERT-In has been designated to serve as the national agency to perform the following functions in the area of cyber security:

- Collection, analysis and dissemination of information on cyber incidents.
- Forecast and alerts of cyber security incidents
- Emergency measures for handling cyber security incidents
- Coordination of cyber incident response activities.
- Issue guidelines, advisories, vulnerability notes and whitepapers relating to information security practices, procedures, prevention, response and reporting of cyber incidents.
- Such other functions relating to cyber security as may be prescribed

Q.87) Consider the following statements regarding Mobile networks:

1. 5G uses Radio Frequency waves to increase network speed.
2. 5G deployment is based on Optical Fibre infrastructure, while 4G deployment was based on microwave based cell-sites.
3. Latency in 5G will increase in comparison with 4G.

Which of the above statements are *incorrect*?

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

Q.87) Solution (c)

Explanation:

Statement 1: The increased speed is achieved partly by using higher-frequency radio waves than previous cellular networks. However, higher-frequency radio waves have a shorter useful physical range, requiring smaller geographic cells. For wide service, 5G networks operate on up to three frequency bands – low, medium, and high. A 5G network will be composed of networks of up to three different types of cells, each requiring specific antenna designs, each providing a different trade off of download speed vs. distance and service area. 5G cell phones and wireless devices connect to the network through the highest speed antenna within range at their location.

Statement 2: 5G deployment is based on optical fibre infrastructure. 4G LTE introduced IP-based connectivity, replacing copper- or microwave-based cell sites with optical fibre.

Statement 3: Latency in 5G is 10 times less than 4G network. (In a network, latency measures the time it takes for some data to get to its destination across the network. It is usually measured as a round trip delay - the time taken for information to get to its destination and back again.)

Q.88) Consider the following statements regarding Artificial Intelligence:

1. As per National Strategy for Artificial Intelligence, National Information Centre has identified 5 key area m where AI can be used.
2. Responsible AI for Social Empowerment (RAISE-2020) has been organised by Ministry of Electronics and Information Technology and NITI Aayog.
3. High-frequency trading is form of stock trading which uses Artificial Intelligence.

Which of the given statements are correct?

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

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

Q.88) Solution (c)

Statement analysis:

Statement 1: **National Strategy for Artificial Intelligence- NITI Aayog** has identified five areas where AI can be useful. It has noted the lack of regulation around AI as a major weakness for India. (So, statement 1 is not correct.)

Statement 2: **RAISE 2020 (Responsible AI for Social Empowerment):** A global meeting of minds to exchange ideas and chart a course for using AI for social transformation, inclusion and empowerment in areas like Healthcare, Agriculture, Education and Smart Mobility, among other sectors. It has been organised jointly by NITI Aayog and Ministry of Electronics and Information Technology.

Statement 3: **High-frequency trading** (**HFT**) is a type of algorithmic financial trading characterized by high speeds, high turnover rates, and high order-to-trade ratios that leverages high-frequency financial data and electronic trading tools. It uses AI systems to make trading decisions at speeds several orders of magnitudes greater than any human is capable of, often making millions of trades in a day without any human intervention.

Q.89) Consider the following statements with reference to Voice over WLAN (Vo-WLAN):

1. Network provider usually charges extra payment to access Vo-WLAN.
2. It led to clarity in voice call than usually placed on general mobile network.
3. It can be accessed on only that device which has early access to HD calls.

Which of the statements given above is/are correct?

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

Q.89) Solution (b)

Statement Analysis:

Statement 1: Wi-Fi calling is included at no additional charge on compatible devices. Generally

Wi-Fi calls to Indian numbers are free, even while traveling internationally. Wi-Fi calls to a country other than the India are charged international long distance rates regardless of whether or not you have Travel Pass or an international travel plan. **(So, Statement 1 is incorrect)**

Statement 2: **Key benefit of Wi-Fi calling**

- **Improves voice quality in areas where network coverage is weak**
- Incurs no additional charges – WiFi calls inside the India and to the India are typically included in your monthly voice plan
- Requires no add-on services and special plans – calls may count toward your minutes unless your plan is unlimited
- Needs no separate applications – the feature is built into most devices
- Uses your existing phone number – no additional logins are necessary

Statement 3: **one's device must be HD Voice capable to use Wi-Fi Calling**. For that phone usually are asked to have 4G enabled SIM. And only compatible device for Wi-Fi calling can use this feature. It's not available on all mobile phones.

Q.90) Consider the following statements regarding Quantum Computing:

1. Quantum enabled Science and Technology (QuST) has been initiated by Ministry of Electronics and Information Technology.
2. Apex committee headed by Prime minister takes all decision regarding National Mission on Quantum Technologies & Applications (NMQTA).

Which of the statements given above is/are correct?

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

Q.90) Solution (d)

Explanation:

Statement 1: In 2018, the Department of Science & Technology unveiled a programme called Quantum-Enabled Science & Technology (QuST) to accelerate research on Quantum computing. (So, Statement 1 is incorrect)

Statement 2: NMQTA has an apex committee taking all its decisions. It includes one chairman, one member secretary and 6 members. Currently, VK Saraswat is the chairman. (So, Statement 2 is incorrect)

About NMQTA

- Quantum Technologies & Applications is one of the 9 missions of national importance, under Prime Minister's Science and Technology Innovation Advisory Council (PM-STIAC).
- It runs through the Principal Scientific Advisor's office to contribute to scientific research for India's sustainable development.
- The mission will be functioning under the Science and Technology department, DST
- The areas of focus would both be in fundamental science and towards developing technology platforms in the following:
    1) Quantum Computing & Simulations
    2) Quantum Materials & Devices
    3) Quantum Communications
    4) Quantum Sensor & Metrology

Q.91) Which of the following statements are correct with reference to 'Edge Computing'?

1. In this computing data is analysed locally, which is opposite to conventional approach.
2. This is more expansive route to scalability than cloud computing.
3. It offers better security as processing, storage and application is distributing over large range.

Select the appropriate option:

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

Q.91) Solution (b)

Statement Analysis:

Statement 1: Edge computing enables data to be analysed, processed, and transferred at the edge of a network. Meaning, the data is analysed locally, closer to where it is stored, in real-

time without latency. Current conventional Cloud computing systems perform all of their computations in the cloud using data centres.

Statement 2: Edge Computing offers a far less expensive route to scalability and versatility, allowing companies to expand their computing capacity through a combination of IoT devices and edge data centres. Establishment of separate data centres makes cloud computing more costly.

Statement 3: Edge computing offers better security by distributing processing, storage, and applications across a wide range of devices and data centres, which makes it less vulnerable to any single disruption to take down the network.

Q.92) Consider the following statements with reference to 'Dark Net':

1. Dark net are part of internet generally inaccessible to Internet Service Provider.
2. TOR browser creates several layers of IP to reach destination, which is generally deliberately hidden.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) None of the above

Q.92) Solution (c)

Explanation:

- Dark Net is that part of the Internet which cannot be accessed through traditional search engines like Google nor is it accessible by normal browsers like Chrome or Safari.
- It generally uses non-standard communication protocols which make it inaccessible to internet service providers (ISPs) or government authorities.
- TOR browser was developed in the mid-1990s by the United States Naval Research laboratory employees to protect US intelligence communications online. Traffic from the browser creates several layers of IP (Internet Protocols) before reaching the destination site.

- Dark net is part of Deep Web which includes sites that are protected by passwords. For e.g. – One's Personal information on any website, which is encrypted. That information will be available to all through general Google search.

Q.93) With reference to "Storage of Payment System Data", consider the following statements:

1. RBI clarified that the entire payment data shall be stored in systems located only in India.
2. There is bar on the processing of payment transactions outside India.
3. The data should be deleted from the systems abroad and brought back to India not later than one business day or 24 hours from the payment processing, whichever is earlier

Which of the statements given above are correct?

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

Q.93) Solution (c)

Explanation:

1. The Reserve Bank of India (RBI) has clarified that payment system providers need to store entire payments data in a system only in India.

2. The data should include end-to-end transaction details and information pertaining to payment or settlement transaction that is gathered, transmitted as part of a payment message or instruction.

3. The data could be pertaining to customer data like name, mobile number, and Aadhar number, payment-sensitive data like customer and beneficiary account details and transaction data among others.

4. Further, the RBI clarified that in case the processing is done abroad, the data should be deleted from the systems abroad and brought back to India within one business day or 24 hours from the payment processing whichever is earlier.

5. In April 2018, Reserve Bank of India (RBI) had asked payment firms to ensure their data are stored exclusively on local servers. RBI had also set a deadline of six months for compliance

which some foreign firms such as MasterCard and Visa had missed.

6. The main intent behind data localisation is to protect the personal and financial information of the country's citizens and residents from foreign surveillance and give local governments and regulators the jurisdiction to call for the data when required.

7. There is no bar on processing of payment transactions outside India if so desired by the PSOs. However, the data shall be stored only in India after the processing. The complete end-to-end transaction details should be part of the data.

8. In case the processing is done abroad, the data should be deleted from the systems abroad and brought back to India not later than the one business day or 24 hours from payment processing, whichever is earlier. The same should be stored only in India.

Q.94) Dark Fibre is related to:

a) Darkest colour fibre used in Optical Fibre net
b) Fibre used to provide network access to Dark net
c) Extra optical fibre laid by companies to avoid competition
d) None of the above

Q.94) Solution (c)

Explanation:

About Dark Fibre

- A dark fibre or unlit fibre is an unused optical fibre, available for use in fibre-optic communication.
- Dark fibre originally referred to the potential network capacity of telecommunication infrastructure. Dark fibre may be leased from a network service provider.
- Dark fibre can be used to create a privately operated optical fibre network that is run directly by its operator over dark fibre leased or purchased from another supplier.
- This is opposed to purchasing bandwidth or leased line capacity on an existing network. Dark fibre networks may be used for private networking, or as Internet access or Internet infrastructure networking.
- In a bid to cut down on capital expenditure, telecom service providers —Reliance Jio Infocomm, Bharti Airtel and Vodafone Idea — have reached out to Bharat Broadband

Network Limited to use dark fibre laid by latter. That will enhance rural presence of these telecom companies.

Q.95) Consider the following statements regarding Prominent models of Internet governance:

1. Multi-stakeholder Model is supported by Western countries.
2. Multi-Lateral Model is supported by Russia and China.
3. Multi-lateral model give recognition to technical expertise of corporates.

Which of the statements given above is/are correct?

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

Q.95) Solution (a)

Explanation:

Multi-stakeholder Model

- It is supported by western nations like US.
- This governance model is based on decentralized governance institutions where non-state actors like corporates, NGOs & civil society have a say in making globally acceptable norms regulating cyberspace.
- It gives recognition to technical expertise of corporates.

Multilateral Model

- It is supported by Russia and China
- This model emphasis on the agreements between multiple governments with limited involvement of non-state actors.
- This model holds sovereignty of nation state in managing cyberspace and provides the scope for the exercise of inherent right of self-defence and the law of state responsibility, including countermeasures in the cyberspace.

Q.96) Global Cyber-Security Index is released by:

a) World Economic Forum
b) Global Alliance for ICT and Development
c) International Telecommunication Union
d) Computer Aid International

Q.96) Solution (c)

Explanation:

The Global Cybersecurity Index (GCI)

- It is released by International Telecommunication Union.
- It is a multi-stakeholder initiative to raise cybersecurity awareness and to measure the commitment of countries to cybersecurity and its wide field of application cutting across industries and sectors.
- Each country's level of development is analyzed within five categories:
    - Legal Measures,
    - Technical Measures,
    - Organizational Measures,
    - Capacity Building and
    - Cooperation.

Q.97) Consider the following statements about Government Instant Messaging System (GIMS):

1. It is developed by National Informatics Centre (NIC).
2. Servers are hosted in India only; however data processing may take place outside India also.
3. Only government employee can join this platform for messaging service.

Which of the statements given above are *incorrect*?

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

Q.97) Solution (c)

Explanation: Government Instant Messaging System (GIMS) is a prototype of an Indian equivalent of popular messaging platforms, such as Whatsapp and Telegram for secure internal use.

Statement 1: GIMS is designed and developed by the Kerala unit of National Informatics Centre (NIC).

Statement 2: The server hosting GIMS is installed within the country and the information stored would be in the government-based cloud — NIC-operated data centres that are only meant for use by the government and its departments. So processing of data will take place in India only. (Hence, Statement 2 is incorrect)

Statement 3: The GIMS (Sandes app) can be used by both government officials and individual users. It requires a mobile number or government email ID for sign up. Once signed up, users can send and receive messages as well as new create groups or send multimedia content such as images and videos. (Hence, statement 3 is incorrect)

Q.98) Which of the following is NOT one of the nine pillars of Digital India?

a) e-Kranti - Electronic Delivery of Services.
b) Electronics Manufacturing
c) Affordable Internet availability
d) Universal access to mobile connectivity.

Q.98) Solution (c)

Explanation:

Nine pillars of Digital India

1) Broadband Highways
2) Universal Access to Mobile Connectivity
3) Public Internet Access Programme
4) e-Governance: Reforming Government through Technology
5) e-Kranti - Electronic Delivery of Services
6) Information for All
7) Electronics Manufacturing
8) IT for Jobs
9) Early Harvest Programmes

Q.99) In the context of optical fibres, consider the following statements:

1. A transparent cladding material, which has a refractive index more than that of the core, surrounds the core of the optical fibre.
2. Light is propagated in an optical fibre by total internal reflection.

Which of the statements given above is/are correct?

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

Q.99) Solution (b)

Explanation:

Statement 1: The core of the optical fibre is surrounded by a layer called the 'cladding', which has a refractive index less than that of the core is one of the conditions for total internal reflection of light. (So, Statement 1 is incorrect)

Statement 2: Optical fibres use total internal reflection to transmit light. It has a solid core of dense glass surrounded by a less dense cladding. The light ray passing through the inner core is reflected back instead of being refracted to the rarer cladding. (Hence, Statement 2 is correct)

About Optical Fibres

- An optical fiber is a flexible, transparent fiber made by drawing glass (silica) or plastic to a diameter slightly thicker than that of a human hair.
- Optical fibers are used most often as a means to transmit light between the two ends of the fiber and find wide usage in fiber-optic communications, where they permit transmission over longer distances and at higher bandwidths (data transfer rates) than electrical cables.
- Fibers are used instead of metal wires because signals travel along them with less loss; in addition, fibers are immune to electromagnetic interference, a problem from which metal wires suffer.
- Fibers are also used for illumination and imaging, and are often wrapped in bundles so they may be used to carry light into, or images out of confined spaces, as in the case of a fiberscope.

- Specially designed fibers are also used for a variety of other applications, some of them being fiber optic sensors and fiber lasers.
- Optical fibers typically include a core surrounded by a transparent cladding material with a lower index of refraction.
- Light is kept in the core by the phenomenon of total internal reflection which causes the fiber to act as a waveguide.
- Fibers that support many propagation paths or transverse modes are called multi-mode fibers, while those that support a single mode are called single-mode fibers (SMF)

Q.100) Consider the following statements with reference to Telecom Regulatory Authority of India

1. TRAI is an executive body established by Cabinet resolution.
2. Telecommunications Dispute Settlement and Appellate Tribunal adjudicate dispute between licensor and licensee.
3. TRAI also fix minimum tariff that should be charged by telecom providers to prevent monopoly.

Which of the above statements are *incorrect*?

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

Q.100) Solution (b)

Statement analysis:

Statement 1: It was established by an Act of Parliament (Telecom Regulatory Authority of India Act, 1997) to regulate telecom services, including fixation/revision of tariffs for telecom services. So it is a statutory body. (Hence, Statement 1 is incorrect)

Statement 2: The TRAI Act was amended to establish a Telecommunications Dispute Settlement and Appellate Tribunal (TDSAT) to take over the adjudicatory and disputes functions from TRAI.

TDSAT was set up to adjudicate any dispute between a licensor and a licensee, between two or more service providers, between a service provider and a group of consumers, and to hear and dispose of appeals against any direction, decision or order of TRAI. (So, Statement 2 is correct)

Statement 3: There has been demand in market over fixing minimum price of tariff, so that any telecom firm will not do Predatory pricing. But currently, there is no such provision of Minimum tariff in mobile telecom services.

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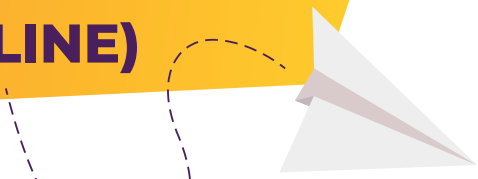

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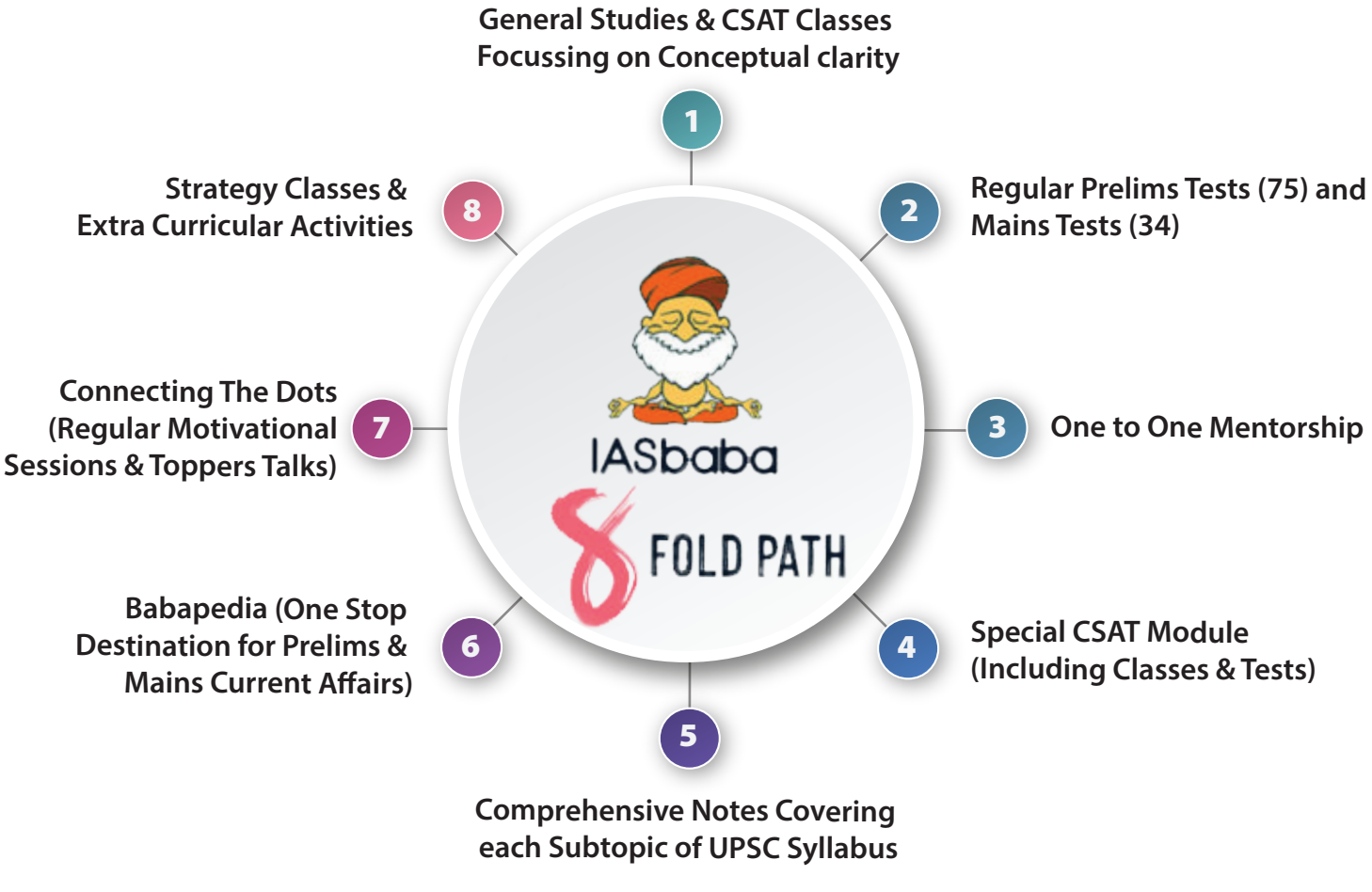

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