



PRELIMS MISSION TEST-07 (17-02-2024)

EXPLANATION

1. Consider the following statements about Gaganyaan mission

1. The Vyomanauts of Gaganyaan program will be launched by GSLV-MK III
2. It is place the Indian astronauts at 400 km altitude for up to 7 days
3. Rakesh Sharma was the first and only Indian to travel to space
4. GSLV-MKIII has the capability to launch 25 tons to Low Earth Orbit

How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 is correct: The ISROs program Gaganyaans Objective is to demonstrate the indigenous capability to undertake a human space flight mission to Lower Earth Orbit (LEO) with a crew of three astronauts to 400 km Low Earth Orbit. This mission will provide a sustained Indian human space exploration program in the long run. As part of this program, two uncrewed and one human-crewed mission are approved by the Government of India (GoI). The Astronauts will be addressed as "Vyomnauts" in the Gaganyaan Manned Mission 2022. Humanrated GSLV MkIII is identified as the launch vehicle for the Gaganyaan mission. The Gaganyaan program aims to carry three Crew to Low Earth Orbit (LEO) and bring them back safely to a predetermined location on Earth.

Statement 2 is correct: In its maiden crewed mission, the Indian Space Research Organisation (ISRO)'s largely autonomous 5.3-metric ton capsule will orbit the Earth at 400 km altitude for up to seven days with a two- or three-person crew on board.

Statement 3 is correct: Rakesh Sharma an Indian citizen was the first astronaut to go into space. Other Indians who travelled to space includes Kalpana Chawla and Sunitha Williams. Thus, Rakesh Sharma was the first and only Indian to travel to space in a Soviet rocket in April 1984.

Statement 4 is incorrect: GSLV MkIII is configured as a three-stage vehicle with two solid strap-on motors (S200), one liquid core stage (L110) and a

high-thrust cryogenic upper stage (C25). Payload capability to support 10-ton to Low Earth Orbit (LEO) missions.

2. Consider the following statements about Human Papillomavirus (HPV)

1. It is a single-stranded Ribonucleic acid that affects human beings.
2. HPV 16 and 18 genotypes causes most of the cancers
3. Cervical cancer is primarily caused due to HPV
4. Gardasil is an indigenously developed HPV vaccine in India

How many statements given above are correct?

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

Ans: b (Only two)

Statement 1 is incorrect: Human Papillomavirus is Double stranded deoxyribonucleic acid Virus that affects human beings. HPV is a group of more than 200 related viruses which can be transmitted through sexual and Nonsexual modes. Non-sexual transmission includes direct skin-to-skin contact. Sexually transmitted HPV types are classified into Low risk and High Risk.

Statement 2 & 3 are correct: Cervical cancer, mainly caused by Human Papillomavirus infection, is the leading cancer in Indian women and the second most common cancer in women worldwide. Most human papillomavirus infection is harmless but persistent infection with high-risk human papillomavirus (especially type 16 HPV) can cause cancer of the cervix, vulva, vagina, anus, penis, and oropharynx. The two most common "high-risk" genotypes (HPV 16 and 18) cause approximately 70% of all cervical cancers.

Statement 4 is incorrect: Gardasil 9 is an India's first gender-neutral HPV Vaccine which is a manufactured by Merck & Co whereas Cervavac is the India's first indigenously developed quadrivalent human papillomavirus vaccine for prevention of cervical cancer developed by the Pune-based Serum Institute of India in coordination with the



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Government of India's Department of Biotechnology (DBT).

3. Consider the following submarines, which are part of 'Project 75'?

1. INS Kalvari
2. INS Arihant
3. INS Karanj
4. INS Sindhukirti
5. INS Vagsheer

How many of the statements given above are correct?

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

Ans: c (Only three)

Explanation: The Kalvari-class submarines, formally classified as the Project-75 submarines (P-75), is a class of diesel-electric attack submarines operated by the Indian Navy (IN). Currently being constructed by a syndicate of French and Indian shipyards, namely, Naval Group and Mazagon Dock Limited (MDL) respectively, the class is an export derivative of the French-origin Scorpène-class submarine, originally designed by Naval Group.

This project was originally planned in the late-1990s as an initial phase of a 30-year long naval rearmament roadmap to replace the IN's conventional submarine fleet, namely the Sindhughosh-class and Shishumar-class submarines.

Ships of the class [\[edit \]](#)

Name	Pennant	Yard	Builder	Launched	Commissioned	Homeport	Status
Fleet I							
Kalvari	S21	11875	Mazagon Dock Limited	27 October 2015 ^[41]	14 December 2017 ^[42]		
Khander ^[43]	S22 ^[44]	11876		12 January 2017 ^[45]	28 September 2019 ^[46]		
Karanj	S23	11877 ^[47]		31 January 2018 ^[48]	10 March 2021 ^{[49][50][51]}		Active
Vela ^[52]	S24	11878 ^[53]		6 May 2019 ^[54]	25 November 2021 ^[55]		
Vagri ^[56]	S25	11879 ^[57]		12 November 2020 ^[58]	23 January 2023 ^{[58][59][60]}		
Vagsheer	S26	11880		20 April 2022 ^[61]	March 2024 (expected) ^[62]		Sea trials ^[32]

4. Consider the following statements about Plant and Animal Cells

1. Centriole is present in the animal cell but generally absent in plant cell.
2. Carbohydrates are stored in the animal in form of starch and plants in the form of glycogen.

Which of the statements given above are correct?

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

Ans: a (Only 1)

Statement 1 is correct: Centrioles are paired barrel-shaped organelles located near the nuclear envelope in the cytoplasm of animal cells. They play a role in organizing microtubules that serve as the cell's skeletal system. They help determine the locations of the nucleus and other organelles within the cell and help in Cell Division and Locomotion. Plant and animal cells are different as the former possess cell walls, plastids, and a large central vacuole which are absent in animal cells. On the other hand, animal cells have centrioles which are absent in almost all plant cells.

Statement 2 is incorrect: Carbohydrates are one of the major forms of energy for animals and plants. During the process of Photosynthesis, plants build carbohydrates using light energy from the Sun. whereas animals eat plants or other animals to obtain carbohydrates. Plants store carbohydrates in long polysaccharide chains called Starch, while animals store carbohydrates as the molecule glycogen. These large polysaccharides contain many chemical bonds and therefore store much chemical energy. When these molecules are broken down during metabolism, the energy in the chemical bonds is released and can be harnessed for cellular processes. Thus, plants store carbohydrates in the form of Starch and animals in the form of Glycogen, and not vice versa.

5. Consider the following statements about Small Satellite Launch Vehicles (SSLV)

1. SSLV was designed to launch a payload of 300 kg into Sun-synchronous orbit
2. It can support multiple orbital drop-offs
3. It uses both solid and liquid propellants
4. Vikram-S is ISRO's first Small Satellite Launch Vehicle

How many statements given above are correct?

- (a) Only one
- (b) Only two
- (c) Only three



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(d) All four

Ans: b (Only two)

Statements 1 & 2 are correct: The Small Satellite Launch Vehicle (SSLV) is a small-lift launch vehicle developed by ISRO with payload capacity to deliver 500 kg to low Earth orbit or 300 kg to Sun-synchronous orbit for launching small satellites, with the capability to support multiple orbital drop-offs. SSLV is made keeping low cost, low turnaround time in mind with launch-on-demand flexibility under minimal infrastructure requirements.

Statement 3 is incorrect: Small Satellite Launch Vehicle (SSLV) is a 3 stage Launch Vehicle configured with three Solid fuel based stages and a liquid fuel-based velocity trimming module (VTM) which is used to place satellites in the orbit. The SSLV is specifically designed to launch Satellites to serve the emerging global market for launching small satellite.

Statement 4 is incorrect: Vikram-S is India's first privately built rocket. Its maiden flight lifted on 18 November 2022 at 11 A.M. from Sounding Rocket Complex, Sriharikota. The rocket was designed and developed by Skyroot Aerospace.

6. Consider the following statements about Satellite Based Internet System

1. Satellite internet constellations like starlink provide lesser latency than fiber optic internet.
2. Internet services provided by satellite constellations could be affected by moisture and precipitation.
3. 'Responsible Space' is an initiative by Starlink to outline the approaches to promote sustainability and safe operation of satellite systems in space.
4. As per new Telecommunication Bill: 2023, Spectrum for space based tele-communications will be allocated by auction

How many statements given above are correct?

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

Ans: a (Only one)

Statement 1 is incorrect: Latency is an expression of how long a data packet travels from one designated point to another. Starlink is a satellite internet constellation operated by SpaceX, providing satellite Internet access coverage to nearly 40 countries. Satellite internet provides higher latency compared to cable and fibre internet. Cable and fibre internet offers latency in the range of 20 to 50 milliseconds (ms), whereas satellite internet ranges can be as high as 600 ms because Satellite internet data travels a long way as satellites are positioned 22,000 miles above the earth. So it offers high latency.

Statement 2 is correct: Internet Service Provided by Satelite Constellations is affected by storms and Precipitation. In heavy snowfall, communications can be restored by removing snow accumulations around the satellite dish.

Statement 3 is incorrect: Responsible space (RS) is an initiative by OneWeb which used to describe practices that drive sustainability within the space industry, avoiding harming our lower Earth orbit (LEO) environment while developing this new frontier in mobility, communications and connectivity so that it works for, and benefits, generations to come. Thus it is not an initiative by Starlink.

Statement 4 is incorrect: As per the new Telecommunications bill:2023, Spectrum for space based communications will be allocated by central government as an administrative decision.

7. Consider the following statements about Nuclear Technology

1. Graphite is used as a coolant and moderator in the Pressurise heavy water reactor
2. Fast breeder Reactors can operate without moderators.
3. Light water reactor uses normal water as a moderator
4. CANDU type of nuclear reactors uses natural Uranium as fuel

How many statements given above are correct?

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



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Ans: c (Only three)

Statement 1 is incorrect: A pressurized heavy water reactor is a type of nuclear reactor that makes use of heavy water as its coolant and moderator. Heavy water contains an isotope of hydrogen called deuterium and Graphite is also used as a moderator because they reflect fast-moving neutrons, but it is not used as a coolant in the Pressurized Heavy water reactor because at 3600 degrees, Graphite tends to release CO₂.

Statement 2 is correct: Moderators are used to slow down the neutrons in the Nuclear reactor. Neutrons produced by fission have high energies and move rapidly. These so-called fast neutrons do not cause fission as efficiently as slower-moving ones. so they are slowed down in most reactors by the moderator. A liquid or gas moderator, commonly water or helium, cools the neutrons to optimum energies for causing fission. These slower neutrons are also called thermal neutrons because they are brought to the same temperature as the surrounding coolant. In contrast to most normal nuclear reactors, however, a fast reactor uses a coolant that is not an efficient moderator, such as liquid sodium, so its neutrons remain high-energy. Although these fast neutrons are not as good at causing fission, they are readily captured by an isotope of uranium (U238), which then becomes plutonium (Pu239). This plutonium isotope can be reprocessed and used as more reactor fuel or in producing nuclear weapons.

Statement 3 is correct: Light water is simply ordinary or normal water that does not contain large amounts of deuterium, making it distinct from heavy water. Although this water does contain small numbers of heavy water molecules, it isn't enough to make any significant changes in its properties. Light water plays an important role in the generation of electricity from nuclear energy in Light water reactors, as it can serve both as a moderator and a coolant to carry away the energy generated by nuclear fission.

Statement 4 is correct: Heavy water isn't 'preferred' it is a requirement is certain designs of nuclear reactors like the CANDU type. The advantage is that reactors of this type can use natural Uranium, that is

un-enriched uranium, as fuel. In essence the moderator is enriched, rather than the fuel.

8. Consider the following statements about Ribose Nucleic Acid (RNA)

1. In the cell of a human being, RNA is present in mitochondria and the nucleus of the cell.
2. t-RNA carries information in the form of codes from DNA towards Ribosome for protein synthesis.
3. Ribosome is known as powerhouse of a cell

How many statements given above are correct?

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

Ans: d (None)

Statement 1 is incorrect: DNA, or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms. Nearly every cell in a person's body has the same DNA. Most DNA is located in the cell nucleus (where it is called nuclear DNA), but a small amount of DNA can also be found in the mitochondria (where it is called Mitochondrial DNA or mtDNA). Mitochondria are structures within cells that convert the energy from food into a form that cells can use. Thus, in the cell of a human being DNA is present in the mitochondria and the nucleus of the cell. Whereas Ribonucleic acid (RNA) is a molecule that is present in the majority of living organisms and viruses. It is made up of nucleotides, which are ribose sugars attached to nitrogenous bases and phosphate groups. The nitrogenous bases include adenine, guanine, uracil, and cytosine.

Statement 2 is incorrect: Three main types of RNA are involved in protein synthesis. They are messenger RNA (mRNA), transfer RNA (tRNA), and ribosomal RNA (rRNA). In that, mRNA (messenger RNA) will transcribe information from DNA and it contains the genetic blueprint to make proteins and carry that to the site of protein synthesis in the cytoplasm. Whereas the tRNA carries amino acids to the ribosome during protein synthesis.

Statement 3 is incorrect: Mitochondria is known as powerhouse of a cell because Energy required by a cell for all chemical actions are released by



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Mitochondria in the form of Adenosine Triphosphate (ATP).

9. Consider the following statements about cancer treatment in India

1. Cancer is a genetic disease
2. Proton therapy uses x-rays to treat cancer.
3. Cyclotron is used for generating high-power energy radiation in proton therapy.
4. Proton therapy has less chance of damaging other healthy tissue surrounding malignant tumours

How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 is correct: Genetic changes that cause cancer can be inherited or arise from certain environmental exposures. Genetic changes can also happen because of errors that occur as cells divide. Yes, cancer is a genetic disease. It is caused by changes in genes that control the way cells grow and multiply.

Statement 2 is incorrect: Proton therapy is a type of radiation therapy called Proton beam radiation therapy (PBRT). A proton is a positively charged particle. At high energy, protons can destroy cancer cells. Doctors may use proton therapy alone. They may also combine it with x-ray radiation therapy, surgery, chemotherapy, and/or immunotherapy. It uses protons rather than x-rays which is used, in regular radiation therapy. X-rays continue to give radiation doses as they leave the person's body. This means that radiation damages nearby healthy tissues, possibly causing side effects. In the case of proton therapy, there is less radiation dose outside of the tumor. It precisely delivers a beam of protons to disrupt and destroy tumor cells.

Statement 3 is correct: A machine called a synchrotron or cyclotron speeds up protons. The high speed of the protons creates high energy. This energy makes the protons travel to the desired depth in the body. The protons then give the targeted radiation dose to the tumor.

Statement 4 is correct: Proton therapy is given with painless radiation through the skin from a machine outside the body. It may allow for a higher radiation dose to the tumor. This increases the chances that all the tumor cells targeted by the proton therapy will be destroyed. Around 60% less radiation can be delivered to the healthy tissues surrounding the malignant tumor, lowering the risk of radiation damage to these tissues. It is also used for treating children because it reduces the chance of harming healthy, growing tissue

10. If earth swaps its position with Mars, then what will be the possible consequences?

1. May lead to extinction of living creatures
2. Decrease the length of the day on the Earth
3. Orbital period of the planet around the sun increases

How many statements given above are correct?

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

Ans: b (Only two)

Statement 1 is correct: Mars would be benefitted, as a fairly modest increase in Mars's temperature would melt the polar caps and liberate gases from the soil, flipping the Martian climate into a new, cozier state nearly as warm as Earth. But Earth would get the short end of the deal as now, the Sunlight would be half as intense and the planet would freeze over. Because of this arrangement some living creatures on Earth, which need plenty of sunlight to survive, may fail to withstand such freezing temperatures.

Statement 2 is incorrect: Assuming that when Earth occupies the Martian position its rotation time will be equal to that of Martian rotation time (24 hrs- now), this makes the length of the day to be lengthier (increases and not decreases) than that before, in the Earth.

Statement 3 is correct: The orbital period (time taken to complete one revolution around the Sun) of the martian position is around 687 days and hence the orbital period increases, when Earth goes to the Martian position



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11. Consider the following statements about water
1. Pure water is a good conductor of electricity
 2. Water is amphoteric in nature
 3. Water density decreases on heating between 0°C to 4°C
 4. Water can exist in 3 phases (states) at the same time

How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 is incorrect: Distilled Water is Pure Water; distilled Water is free of salts and a poor conductor of electricity. When salt such as common table salt (sodium chloride (NaCl)) is dissolved in distilled Water, a salt solution is obtained, which is the conductor of electricity. Pure Water is an excellent insulator and does not conduct electricity. Water in nature is most nearly pure in its vapour state, and Water is an excellent solvent and stops being an excellent insulator once it starts dissolving substances around it. Even a small number of ions in a water solution enables it to conduct electricity. When water contains these ions, it will conduct electricity.

Statement 2 is correct: A substance or compound with both acid and a base is known as amphoteric. According to the Bronsted-Lowry theory of acids and bases, acids are proton donors, and bases are proton acceptors. Water has two molecules that make a molecular autoionization (Self-ionization) reaction, in which one water molecule acts as an acid and another as a base. Water is thus the most common example, which behaves as an acid and a base and therefore is amphoteric in nature.

Statement 3 is correct: The volume of a given amount of Water decreases as it is cooled from room temperature until its temperature reaches 4°C . Below 4°C , the volume increases, and therefore the density decreases, which means that Water has a maximum density at 4°C and hence the water contracts. The density of Water reaches a maximum value of 1 g mL^{-1} or 1000 kg m^{-3} at 4°C , and its volume increases when the density decreases. This phenomenon is the anomalous behaviour of Water.

Statement 4 is correct: The triple point of a substance is the temperature and pressure at which the three phases (gas, liquid, and solid) of that substance coexist in thermodynamic equilibrium. The triple point of water is used to define the Kelvin(K), the base unit of thermodynamic temperature in the International System of Units (SI). The triple point of water is 273.16 K , 0.01°C , or 32.018°F .

12. Which of the following rays are used in computed tomography?

- (a) X-rays
- (b) Gamma rays
- (c) Beta rays
- (d) Magnetic resonance

Ans: a (X-rays)

Explanation: Computed tomography (C.T.) imaging, also known as "CAT scanning" (Computerized Axial Tomography), provides a different form of imaging known as cross-sectional imaging or "slices" of anatomy, like the slices in a loaf of bread. Computed tomography, or C.T., scans are medical imaging tests that use ionizing radiation to create cross-sectional (slices) pictures inside selected areas of the body from different angles. And it combines a series of x-ray (radiography) images into a three-dimensional picture.

13. Consider the following statements

1. Liquid petroleum gas is odourless and colourless, consisting of Propane and butane.
2. Liquid petroleum gas is lighter than compressed natural gas.
3. CNG is heavier than air

How many statements given above are correct?

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

Ans: a (Only one)

Statement 1 is correct: LPG fuel, or liquefied petroleum gas, is a liquefied gas and is a by product derived while extracting crude petroleum. LPG weighs twice as much as air and is colorless, odourless (While odorant is added to it only to ensure safety) and is a highly flammable explosive gas. It is



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comprised of propane mixed with butane, traces of propylene and butylenes.

Statement 2 is incorrect: CNG is Compressed Natural Gas, which is mainly methane compressed at a pressure of 200 to 248 bars. Compressed natural gas (CNG) is produced by compressing natural gas under high pressure, and it is a cleaner fuel in transport vehicles (buses, trucks and cars) and contains Methane. CNG is a good alternative to petrol and diesel because it causes less pollution. In the order of density, LPG > Air > CNG. Therefore, Liquid petroleum gas is heavier than compressed natural gas.

Statement 3 is incorrect: Compressed Natural gas is lighter than Air because natural gas density is lower than Air's density and rapidly dissipates into the Air when released.

14. Consider the following statements about Fortification of Food

1. Fortification guidelines are given by the Food Safety and Standard Authority of India.
2. According to the rules given by FSSAI, milk packed in the pouch should be mandatorily fortified with Vitamin A and D.
3. Golden Rice produced through genetic fortification requires greater changes in management practices during cultivation
4. As per FASSI guidelines '+F' symbol on all fortified foods is mandatory

How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 is correct: Fortification means deliberately increasing the content of essential micronutrients in food to improve the nutritional quality of food and provide health benefits with minimal risk to the public's health. The Food Safety and Standards Authority of India (FSSAI) statutory body under the Food Safety and Standards Act, 2006, frames regulations, lays orders and guidelines under Food Safety and Standards (Food Products Standards and Food Additives) Regulations 2011 for Packaging and Labelling of Food Businesses.

Statement 2 is correct: Food Safety and Standard Authority of India in December 2020, issued a draft notification, for mandatory fortification of packaged toned, double toned, skimmed milk or standardised milk with Vitamin A and Vitamin D. This will ensure nationwide availability of fortified milk and a positive impact in mitigating micronutrient malnutrition among population which is crucial to make concerted efforts for scaling up and sustaining efforts towards quality fortification while making fortification mandatory in the country. As per the FSSAI standards, the milk needs to be fortified with Vitamin A and D at a level of 270 µg RE - 450 µg RE per litre and 5 µg - 7.5 µg per litre respectively. Fortifying milk with micronutrients is a good strategy for addressing micronutrient malnutrition, since it is consumed by all groups of people.

Statement 3 is not correct: Biofortification or biological fortification refers to nutritionally enhanced food crops that are developed and grown using modern biotechnology techniques, conventional plant breeding, and agronomic practices. Golden Rice is biofortified with provitamin A, and rice is the staple crop and can effectively control vitamin A deficiency (VAD). Golden Rice is rice genetically engineered to produce and accumulate β-carotene (beta carotene provitamin A, a plant pigment that the body converts into vitamin A as needed) in the endosperm (the edible part of the grain) and hence this compound gives yellow-orange or golden colour. Like ordinary rice, Golden Rice does not require any special cultivation practices, and generally has the same yield and agronomic performance.

Statement 4 is correct: Use of a fortification logo on labels is now a mandatory requirement on all fortified foods in India. On August 22, India FSSAI announced that the fortification logo (+F logo) is now a mandatory labelling requirement on all fortified food labels.

15. Consider the following statements about Lithium

1. Lithium is the lightest metal on earth
2. Excess intake of lithium can cause black foot disease

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3. Region of the lithium triangle consists of Chile, Argentina, and Bolivia.
4. China is the largest producer of Lithium in the world

How many statements given above are correct?

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

Ans: b (Only two)

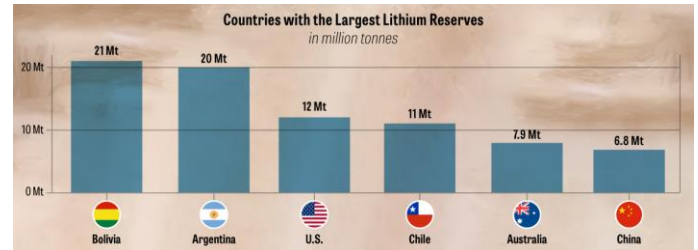
Statement 1 is correct: Density is the amount of matter per unit of volume. The less matter there is in a space, the lighter the substance is. So, the lightest metallic element is the one with the lowest density. The lightest or least dense element that is a metal is lithium (also known as white gold). Lithium has atomic number 3 on the periodic table, with a density of 0.534 g/cm³. The density of water is about 1 g/cm³, so lithium floats on water.

Statement 2 is incorrect: Lithium toxicity, also called lithium overdose, can lead to coma, brain damage, or even death. Moreover, Lithium can induce serotonin syndrome, a potentially fatal and life-threatening condition. Whereas Blackfoot disease is a vascular disease associated with long-term exposure to Arsenic(inorganic).

Serotonin syndrome: Serotonin is a chemical that the body produces naturally. It's needed for the nerve cells and brain to function. But too much serotonin causes signs and symptoms that can range from mild (shivering and diarrhea) to severe (muscle rigidity, fever and seizures). Severe serotonin syndrome can cause death if not treated. Serotonin is produced by Pineal gland located on the back of your brain.

Statement 3 is correct: The remote regions of the three countries that make up the Lithium Triangle are Argentina, Bolivia and Chile, which account for more than 63 percent of the world's lithium reserves. Salar de Uyuni in Bolivia, has the richest lithium deposits in the world.

Statement 4 is incorrect: Australia is the largest producer of Lithium in the world followed by Chile, China.



16. Consider the following statements about Sun Spots

1. Increase in the number of Sunspot cause an increase in the area geo-tail than the normal sunspot activity.
2. If the number of Sunspots increases on the sun, then decrease in the temperature of the corona of the sun.
3. Sunspots are the regions with higher magnetic pressure.

How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 is correct: Geo tails are formed due to the interactions between the Sun's magnetic fields and Earth's magnetic fields. Sunspots are areas where the magnetic field is about 2,500 times stronger than Earth's, much higher than anywhere else on the Sun, increase in presence of which will lead to more compression of the earth side facing envelop (refer diagram), and the area of the geo tail will thus be increased than during the normal sunspot activity.

Statements 2 & 3 are correct: Sunspots are areas of a high magnetic field. Because of the strong magnetic field, the magnetic pressure increases while the surrounding atmospheric pressure decreases. This lowers the temperature relative to its surroundings because the concentrated magnetic field prevents the flow of hot, new gas from the Sun's interior to the surface. Thus the temperature of the corona of the Sun will be decreased.

17. Which of the following are radioactive elements?

1. Hassium
2. Promethium



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3. Technetium
4. Zirconium
5. Nobelium

How many statements given above are correct?

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

Ans: c (Only four)

Explanation:

Hassium is a highly radioactive metal belonging to the transuranium group with atomic number 108. The German physicist's Peter Armbruster and Gottfried Munzenberg discovered this element in the German state called Hesse. So, It got the name Hassium. At present, it is only used for research purposes

Promethium is a radioactive material with atomic number 61 named after the Greek Prometheus and was discovered by Jacob. A. Marinsky, Lawrence E. Glendenin, and Charles D. Coryell. It is mostly used for research purposes, and further, it is used in specialized atomic batteries. These are roughly the size of a drawing pin and are used for pacemakers, guided missiles, and radios. It can also be used as a source of x-rays and radioactivity in measuring instruments.

Technetium was the silver-grey radioactive element with atomic number 43 and the first artificially produced element. It was discovered by Carlo Perrier and Emilio Segre in 1937. It was created by bombarding molybdenum atoms with deuterons and is used for medical diagnostic studies and as a corrosion inhibitor for steel.

Zirconium is a hard, silvery metal that is very resistant to corrosion. It got its name from the Arabic word, 'zargun,' meaning gold. Martin Heinrich Klaproth discovers it in 1789. **But it is not a radioactive element**, but it is used as a semi-precious gemstone and in making ceramics

Nobelium is a radioactive metal with a half-life of only 58 minutes, named after Alfred Nobel, the founder of the Nobel prize. Still, it is not used in any outside research or biological activities.

18. Consider the following statements

1. Silicon and Germanium are commonly used in microprocessor manufacturing.
2. Due to the absence of free electrons, zero resistivity can be achieved in superconductors.
3. Superconductivity can be achieved at room temperature.
4. Superconductors can transmit electricity to long distance with limited loss during transmission.

How many statements given above are correct?

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

Ans: d (All four)

Statement 1 is correct: A semiconductor is the foundation of modern electronics driving the next phase of digital transformation under Industry 4.0. These are materials that have conductivity between conductors and non conductors or insulators. It can be pure elements, such as silicon or germanium, gallium arsenide, or cadmium selenide compounds. Semiconductors such as silicon, Cadmium, and Germanium are used for manufacturing microprocessors used in Cell phones, Computers, household appliances, Automobiles, etc.

Statement 2 is correct: A superconductor is a material that achieves superconductivity, a state of matter with no electrical resistance, and does not allow magnetic fields to penetrate. Electricity is the movement of free electrons in a conducting material like copper. While In conductors, the free electrons move randomly and frequently collide with one another and other particles in the material, thus offering resistance to the current flow. Here, a lot of energy is lost in the form of heat Energy. In a superconducting state, all the electrons align themselves in a particular direction and move without obstruction in a "coherent" manner. Because of zero resistance, superconducting materials can save huge amounts of energy and be used to make highly efficient electrical appliances. Thus, unlike Conductors, free electrons are absent in Superconductors and hence it has zero resistivity.



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Statement 3 is correct: Critical Temperature is a temperature at which the material becomes superconductive, where the material shows Zero resistance. Scientists have been able to make materials superconduct only at temperatures much below zero degrees C, which makes it practically very difficult. But recently, a team led by a Professor from the Indian Institute of Science (IISc), Bengaluru, confirmed that the material in the form of nanosized films and pellets made of silver nanoparticles embedded in a gold matrix exhibited superconductivity at room temperature and Pressure. But, silver and gold independently do not exhibit superconductivity.

Statement 4 is correct: Superconductors are used in particle accelerators, generators, transportation, computing, electric motors, medical, power transmission, etc. Superconductors are primarily employed for creating powerful electromagnets in MRI scanners. These conductors are used to transmit power for long distances without any loss of electricity during transmission.

19. Consider the following statement related to Light Interferometer Gravitational Observatory (LIGO)

1. LIGO help to prove the general theory of relativity with help of laser
2. Like Large Hadron collider (LHC), LIGO operates in vacuum chambers.
3. Collision of two black holes can produce gravitational waves
4. A Single object cannot produce Gravitational waves

How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 is correct: The general theory of relativity is defined as when massive accelerating objects such as neutron stars or black holes orbit each other. They would disrupt space-time so that 'waves' of distorted space would radiate from the source. These ripples travel at the speed of light through the universe, carrying information about their origins and

invaluable clues to the nature of gravity itself. Thus, the LIGO detector, which uses Laser to detect Gravitational waves, supported the general theory of relativity.

Statement 2 is correct: The Large Hadron Collider (LHC) is the world's largest and most powerful particle accelerator. It consists of a 27-kilometre ring of superconducting magnets with a number of accelerating structures to boost the energy of the particles along the way. LIGO's vacuum volume is the third largest in the world, where after the Large Hadron Collider (LHC) in Switzerland, and NASA's "Space Simulation Vacuum Chamber".

Statement 3 is correct: When two black holes collide, they will merge to become one bigger black hole, which is very violent, and these mergers would produce tremendous energy and send massive ripples through the Space-time fabric of the Universe. These ripples are called as Gravitational waves and they travel at the speed of light (186000 miles per second).

Statement 4 is incorrect: Every object with mass that accelerates produce Gravitational waves. These can be Human, Cars, airplane etc. Thus, Single object can also produce gravitational waves.

20. Consider the following statements about Producer gas

1. Producer gas is a colorless gas that mainly consists of Methane and hydrogen.
2. Producer gas is generated by burning coal or coke without the presence of oxygen.
3. Mostly used as fuel in the iron and steel manufacturing industries.
4. Water gas is used to synthesizing methanol and several hydrocarbons

How many statements given above are correct?

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

Ans: b (Only two)

Statement 1 is incorrect: Producer gas is a fuel gas obtained when coal or coke is burnt with air deficiency and a controlled amount of moisture. It is a mixture of flammable gases like Carbon monoxide and hydrogen and nonflammable gases like nitrogen



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and carbon dioxide. Its average composition includes, $\frac{3}{4}$ Carbon Monoxide = 22.3% $\frac{3}{4}$ Hydrogen = 8.12% $\frac{3}{4}$ Nitrogen = 52.55% $\frac{3}{4}$ Carbon dioxide = 3% Thus, it has only the above-mentioned compounds and doesn't contain Methane.

Statement 2 is incorrect: It is produced when coke or other carbonaceous material such as anthracite is burnt with controlled moisture and oxygen supply, but not without a complete absence of oxygen. A higher calorific value could be obtained by using oxygen-enriched air with steam.

Statement 3 is correct: Producer gas was used primarily as industrial fuel for iron and steel manufacturing, such as firing coke ovens and blast furnaces, cement, and ceramic kilns, or mechanical power through gas Engines. It is used as a reducing agent in metallurgical operations and also used to power gas turbines, Spark ignited engines, or Diesel internal combustion engines.

Statement 4 is correct: The mixture of CO and H₂ is called water gas. This mixture of CO and H₂ is used for synthesizing methanol and several hydrocarbons; it is also called synthesis gas or 'syngas.' Nowadays, 'syngas' is produced from sewage, sawdust, scrap wood, newspapers, etc. The process of producing 'syngas' from coal is called coal gasification.

21. Consider the following statements about Polymerase Chain Reaction (PCR) technique

1. PCR helps in making many copies of a small amount of DNA.
2. DNA molecule is first cooled to break it up into two strands followed by heating with primers so that they bind to the DNA.
3. RT-PCR diagnosis used for COVID-19 employs (NAAT) method
4. CRISPR-Cas9 is used to generate multiple copies of DNA sample

How many statements given above are correct?

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

Ans: b (Only two)

Statement 1 is correct: Polymerase chain reaction (PCR), is also known as "molecular photocopying,"

is a fast and inexpensive technique used to "amplify" - copy - small segments of DNA. Because significant amounts of a sample of DNA are necessary for molecular and genetic analyses, studies of isolated pieces of DNA are nearly impossible without PCR amplification. Once amplified, the DNA produced by PCR can be used in many different laboratory procedures. PCR is also valuable in a number of laboratory and clinical techniques, including DNA fingerprinting, detection of bacteria or viruses (particularly AIDS), and diagnosis of genetic disorders.

Statement 2 is incorrect: The steps in PCR are: 1. To amplify a segment of DNA using PCR, the sample is first heated so the DNA denatures, or separates into two pieces of single-stranded DNA. 2. Primers are added and the DNA is cooled so that they bind to the DNA. 3. Next, an enzyme called "Taq polymerase" synthesizes - builds - two new strands of DNA, using the original strands as templates. This process results in the duplication of the original DNA, with each of the new molecules containing one old and one new strand of DNA. Then each of these strands can be used to create two new copies, and so on, and so on. The cycle of denaturing and synthesizing new DNA is repeated as many as 30 or 40 times, leading to more than one billion exact copies of the original DNA segment.

Statement 3 is correct: A Nucleic Acid Amplification Test, or NAAT, is a type of viral diagnostic test for SARS-CoV-2, which causes COVID-19. NAATs for SARS-CoV-2 specifically identify the RNA (ribonucleic acid) sequences that comprise the virus's genetic material. The NAAT procedure works by first amplifying or making many copies of the virus's genetic material, if any is present in a person's specimen. Amplifying those nucleic acids enables NAATs to detect very small amounts of SARS-CoV-2 RNA in a specimen, making these tests highly sensitive for diagnosing COVID-19.

Statement 4 is incorrect: CRISPR-Cas9 is a unique technology that enables geneticists and medical researchers to edit parts of the genome by removing, adding or altering sections of the DNA sequence.

22. Catalytic converter is used to



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- (a) Conversion of Biomass into Ethanol
- (b) Conversion of sewage sludge into biogas
- (c) Conversion of methane hydrates into natural gas
- (d) Conversion of toxic gases emitted from engines into stream

Ans: d (Conversion of toxic gases emitted from engines into stream)

Explanation: A catalytic converter is a device fixed in the exhaust system of a vehicle (front part) which is close to the engine and it to reduce the emission of gaseous pollutants, such as carbon monoxide (CO), nitrogen oxides (NOx) and hydrocarbons (HCs). It uses a chamber called a catalyst to convert the harmful compounds (toxic gases) from an engine's emissions into safe gases, like steam.

23. Consider the following statements about Indian Navigation System

- 1. IRNSS is a global navigation system developed indigenously in India.
- 2. GAGAN is a Satellite Based Augmentaion System (SBAS) launched by India to ensure safety of civilian aviation by augmenting the IRNSS Signal quality.
- 3. Ionosphere layer of atmosphere can interfere with radio communication.
- 4. Ionosphere grows and shrinks based on energy it absorbs from the sun

How many statements given above are correct?

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

Ans: b (Only two)

Statement 1 is incorrect: IRNSS (Indian Regional Navigational Satellite System), popularly known as Navigation with Indian Constellation (NavIC) is an autonomous regional satellite navigation system developed by Indian Space Research Organization (ISRO) to implement an independent and indigenous regional spaceborne navigation system for national applications. The other Global systems are GPS (US), GLONASS (Russia), BeiDou (China), and Galileo (European Union). Thus, IRNSS is a regional

Navigational System, not a Global Navigation system.

Statement 2 is incorrect: GAGAN (GPS Aided GEO Augmented Navigation) is a Satellite Based Augmentation System (SBAS) launched by ISRO and the Airport Authority of India (AAI) to ensure civilian aviation safety by augmenting the Global Positioning System. India has become the first Asian-Pacific country to develop such a system for aviation use successfully. It uses a constellation of satellites and a network of ground stations to provide necessary augmentations to the GPS standard positioning service (SPS) navigation signal for air traffic management. Thus, GAGAN uses GPS, not IRNSS.

Statement 3 & 4 are correct: The ionosphere is a very active part of the atmosphere, and it grows and shrinks depending on the energy it absorbs from the Sun. The name ionosphere comes from the fact that gases in these layers are excited by solar radiation to form ions with an electrical charge. The ionosphere also plays a role in our everyday communications and navigation systems. Radio and GPS signals travel through this layer of the atmosphere; the ionosphere is where Earth's atmosphere meets space.

24. Consider the following statements about Bacteriophage

- 1. It is a bacteria that can integrate its own DNA into DNA of another bacteria.
- 2. It hijacks the host bacterium's cellular machinery to produce the bacteriophage's own proteins.
- 3. Bacteriophages cannot infect and replicate in human cells.
- 4. They can be used as biocontrol agents

How many statements given above are incorrect?

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

Ans: a (Only one)

Statement 1 is incorrect: A bacteriophage is a type of virus that infects bacteria. The word "bacteriophage" means "bacteria eater," which are so small they do not even have a single cell but are



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instead just a piece of DNA surrounded by a protein coat. Thus, they are viruses, not Bacteria.

Statement 2 is correct: After affecting the Bacteria, the bacteriophage hijacks the bacterium's cellular machinery to prevent it from producing bacterial components and instead forces the cell to produce viral components.

Statement 3 is correct: Bacteriophages can infect and replicate only in bacterial cells. It cannot infect and replicate in human cells, but Bacteriophages are an important part of the human Microbiome. The reason for the replication in human cells is yet to be found, and research is going on.

Statement 4 is correct: Recent studies have indicated that bacteriophages can be used indirectly to detect pathogenic bacteria or directly as biocontrol agents. Moreover, they can be used to develop new molecules for clinical applications, vaccine production, drug design, and in the nanomedicine field via phage display.

25. Consider the following statements about Quarks

1. Quarks are elementary particles which come up in six flavours such as up, down, charm, strange, top and bottom.
2. The Large Hadron Collider beauty (LHCb) experiment investigates the slight difference between the matter and antimatter by studying the "Strange quark" particle.
3. Protons and electrons are elementary particles made up of three different quarks

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

Ans: c (2 and 3 only)

Statement 1 is correct: Quarks are the elementary particles that are the smallest known building blocks of the Universe. The present standard model has six "flavors" of quarks. They are up, down, charm, strange, top and bottom.

Statement 2 is incorrect: The Large Hadron Collider beauty (LHCb) experiment specializes in investigating the slight differences between matter and antimatter by studying a type of particle called

the "beauty quark" or "b quark." It is not by studying the strange quark particle.

Statement 3 is incorrect:

Leptons are elementary particles which carry one unit of electric charge or neutral. Therefore, the charged leptons are the electrons, muons and taus. Each of these types has a negative charge and a distinct mass. Electrons, the lightest leptons, have a mass of only 1/1,840 that of a proton. The neutral Leptons are called Neutrino, which has no electric charge and no significant mass.

On Contrast, Protons and Neutrons are made up of two kinds of quarks, up and down quarks. A quark is an elementary particle and a fundamental constituent of matter. Protons are composed of two up quarks and a down quark, while neutrons are composed of two downs and an up. The up-and-down quarks are the lightest varieties. Because more-massive particles tend to decay into less massive ones, the up-and-down quarks are also the most common in the Universe; therefore, protons and neutrons make up most of the matter in the Universe.

Thus, Protons are made up of two different Quarks and electrons are not made up of Quarks.

26. Consider the following statements

1. If a star in a distant galaxy rotates in a direction away from the earth, the red shift occurs when electromagnetic radiation is emitted by the stars.
2. Doppler effect is used by traffic police to check the over-speeding of vehicles.
3. Human ear hears only the sounds between the frequencies of 20 Hz to 10000Hz
4. Volcanoes, Earthquakes and Ocean waves produces infrasonic sound.

How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 is correct: Redshift and blueshift are used by astronomers to work out how far an object is from Earth. As an object moves away from us (Earth), the sound or light waves emitted by the object are



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stretched out, which makes them have a lower pitch and move them toward the red end of the electromagnetic spectrum, where light has a longer wavelength. In the case of light waves, this is called redshift. As an object moves towards us (Earth), sound and light waves are bunched up, so the pitch of the sound is higher, and light waves are moved towards the blue end of the electromagnetic spectrum, where light has a shorter wavelength. In the case of light waves, this is called blueshift. Thus if a star rotates in a direction away from the earth, the light from the object (electromagnetic radiation) occurs in the form of a redshift.

Statement 2 is correct: A sound wave or electromagnetic wave of known frequency is sent toward a moving object. Some part of the wave is reflected from the object and its frequency is detected by the monitoring station. This change in frequency is called the Doppler shift. Radar detectors are electronic devices that help detect radio waves or radio signals. These are forms of electromagnetic energy that are emitted from radars, such as those used by police to locate cars driving over the speed limit. For example, if the car moves toward the radar device, the return signal wave frequency increases. Then, this radar gun can use this change in frequency to determine the speed at which the car is moving due to the Doppler effect which helps the police to check the speed.

Statement 3 is incorrect: Normal human ears hear only the frequencies of 20Hz to 20000 Hz. Sounds of less than 20 Hz are infrasonic waves and sounds of more than 20,000 Hz are called ultrasonic waves.

Statement 4 is correct: The term "infrasonic" applied to sound refers to sound waves below the frequencies of audible sound, and nominally includes anything under 20 Hz. Sources of infrasound in nature include volcanoes, avalanches, earthquakes, and meteorites. Even ocean storms and waves generate a lot of infrasound

27. Consider the following pairs about different white blood cells and their functions

White Blood Cell	Function
Eosinophils	Associated with Allergic reaction

Basophils	Involved in inflammatory reaction
Lymphocytes	Immune response
Monocytes	Fights off bacteria, virus and fungi

How many pairs given above are correct?

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

Ans: d (All four)

Pair 1 is correctly matched: Eosinophils (2-3 per cent of total white blood cells) resist infections and are also associated with allergic reactions.

Pair 2 is correctly matched: Basophils are constitutes 0.5-1% of total white blood cells. They secrete histamine, serotonin, heparin, etc., and are involved in inflammatory reactions.

Pair 3 is correctly matched: Lymphocytes (20-25 per cent) are of two major types – ‘B’ and ‘T’ forms. Both B and T lymphocytes are responsible for immune responses of the body.

Pair 4 is correctly matched: Monocytes are a type of white blood cell that fights off bacteria, viruses and fungi.

28. Consider the following statements about Stem Cells

1. Stem cells are special cells that can make copies of themselves and change into many different kinds of cells.
2. Stem cells in umbilical cord blood transplants can completely cure HIV patients.

Which of the statements given above are correct?

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

Ans: c (Both 1 and 2)

Statement 1 is correct: Stem cells are undifferentiated (unspecialized) cells in our body that can undergo cell division (mitosis), differentiate into specialized cell types, and redivide to produce more stem cells. In adults, stem cells may be obtained from an embryo, the umbilical cord, and bone marrow.

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Statement 2 is correct: Recently an HIV-positive woman who received a blood stem cell transplant to treat acute myeloid leukaemia appears to have been cured of HIV. The stem cells obtained from the umbilical cord blood contain a gene variant that makes them resistant to HIV infection. Hence it is found that Stem cells in umbilical cord blood transplants can completely cure HIV patients.

29. Consider the following statements about Electromagnetic Waves

1. In vacuum, all electromagnetic waves have the same speed.
2. Electromagnetic waves can travel through solid materials.
3. Infrared radiation can be used to relieve muscle pain and tension
4. Infrared waves are absorbed by air and thick fog

How many statements given above are correct?

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

Ans: c (Only three)

Statements 1 & 2 are correct: Properties of Electromagnetic Waves are:

- Electromagnetic waves are produced by accelerated charges.
- They do not require any material medium for propagation and can travel through any region.
- In an electromagnetic wave, the electric and magnetic field vectors are at right angles to each other and to the direction of propagation. Hence electromagnetic waves are transverse in nature.
- The energy in an electromagnetic wave is equally divided between electric and magnetic field vectors.
- They travel in vacuum or free space with a velocity of light (c). [$c = 3 \times 10^8$ m/s]
- The electromagnetic waves being chargeless, are not deflected by electric and magnetic fields.

Statement 3 is correct: Uses of Infra-red waves are:

- Infrared lamps are used in physiotherapy [To relieve muscle pain and tension].
- Infrared photographs are used in weather forecasting.

Statement 4 is incorrect: As infrared radiations are not absorbed by air, thick fog, mist etc, they are used to take photograph of long-distance objects. Infra-red absorption spectrum is used to study the molecular structure.

30. Consider the following statements about Dark Energy

1. Dark Energy is second largest constituent in the universe after dark matter
2. As per Einstein's Theory of Relativity, "empty space" can possess its own energy.
3. As more space comes into existence with time, energy gets diluted and expansion of the universe will be decelerated
4. The effect of gravity supports the effect of dark energy in the expansion of the universe.

How many statements given above are correct?

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

Ans: a (Only one)

Statement 1 is incorrect: Dark matter is a form of invisible matter or mass exists in space only. Dark matter slows down the universe's expansion. Dark matter is ideal for the co-existence of galaxies and the sustainability of the universe. Dark Matter constitute 27% of the Universe. Dark Energy is a hypothetical form of energy that exerts a negative, repulsive pressure, behaving like the opposite of gravity. Dark Energy constitutes 68% of the Universe





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Statement 2 is correct: Dark energy, the mysterious form of energy that makes up about 68% of the universe, has intrigued physicists and astronomers for decades. It has been noted as “the most profound mystery in all of science”. Albert Einstein was the first person to realize that empty space is not nothing. According to his ‘Theory of Relativity’, the first property that he discovered is that it is possible for more space can come into existence, and also his second prediction is that "empty space" can possess its own energy.

Statement 3 is incorrect: As this energy is a property of space itself, it would not be diluted as space expands. As more space comes into existence, more of this energy-of-space would appear. As a result, this form of energy would cause the universe to expand faster and faster and cannot be decelerated

Statement 4 is incorrect: As the Universe expands, gravity as an attractive force pulls on the universe and slows down the expansion over time. But due to the effect of Dark energy, the Universe expands faster as this energy is a part of space itself. Hence, the effect of gravity does not support the effect of dark energy in the expansion of the universe.

31. Consider the following statements about International Liquid Mirror Telescope (ILTM)

1. The ILTM is a Space Telescope placed at Lagrangian Point 2 which is 1.5 mn km away from earth.
2. In ILTM, Mercury is used as the reflective liquid which is protected from wind by a thin transparent film of mylar.
3. They cannot be turned and pointed in any direction
4. ILTM is used to observe the supernova events, asteroids, space debris and others

How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 is incorrect: A unique International Liquid-Mirror Telescope (ILMT) has recently been installed at the Devasthal Observatory campus of the

Aryabhata Research Institute of Observational Sciences (ARIES), an autonomous institute of the Department of Science and Technology (DST), Government of India, in Nainital, Uttarakhand. India's first liquid mirror telescope observes asteroids, supernovae, space debris, and all other celestial objects from an altitude of 2450 meters in the Himalayas. Thus, it is not placed at the Lagrangian Point.

Statement 2 is correct: The ILMT is made up of three components:

- A primary mirror is formed by a rotating container with a highly reflective liquid (mercury) protected from the wind by a thin transparent film of mylar.
- An air compressor operates an air bearing on which the Liquid Mirror sites.
- A drive system

Statement 3 is correct: The ILMT is entirely dedicated to a photometric/Astrometric direct imaging survey. The liquid mirror telescopes cannot be tilted, so they cannot track like conventional telescopes

Statement 4 is correct: India's first liquid mirror telescope observes asteroids, supernovae, space debris, and all other celestial objects from an altitude of 2450 meters in the Himalayas.

32. Erythroblastosis Foetalis is a condition in which second baby of the couple may die in the womb of the mother due to Rhesus (Rh) incompatibility. What may be the probable combination of the blood typology of parents ?

- (a) Father having Rh+ve and Mother having Rh -ve
- (b) Father having Rh+ve and Mother having Rh +ve
- (c) Father having Rh-ve and Mother having Rh -ve
- (d) Father having Rh-ve and Mother having Rh +ve

Ans: a (Father having Rh+ve and Mother having Rh -ve)

Explanation: The Rh factor is a molecule on the surface of red blood cells in some people. Blood is Rh₊ positive if red blood cells have the Rh factor and



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Rh-negative if they do not. An Rh-ve person, if exposed to Rh+ve blood, will form specific antibodies against the Rh antigens. Therefore, the Rh group should also be matched before transfusions. A special case of Rh incompatibility (mismatching) has been observed between the Rh-ve blood of a pregnant mother and with Rh+ve blood of the foetus.

Rh antigens of the foetus do not get exposed to the Rh-ve blood of the mother in the first pregnancy as the two types of blood are well separated by the placenta. However, during the delivery of the first child, there is a possibility of exposure of the maternal blood to small amounts of the Rh+ve blood from the foetus. In such cases, the mother starts preparing antibodies against Rh antigen in her blood.

In the case of her subsequent pregnancies, the Rh antibodies from the mother (Rh-ve) can leak into the blood of the foetus (Rh+ve) and destroy the foetal RBCs. This could be fatal to the foetus or could cause severe anaemia and jaundice in the baby. This condition is called erythroblastosis foetalis. This can be avoided by administering anti-Rh antibodies to the mother immediately after the delivery of the first child.

Erythroblastosis fetalis classically results from Rho(D) incompatibility, which may develop when a woman with Rh-negative blood is impregnated by a man with Rh-positive blood and conceives a fetus with Rh-positive blood, sometimes resulting in hemolysis.

33. Consider the following statements about Aqua Regia

1. It is a mixture of Nitric acid and Sulphuric acid.
2. It is also known as royal water
3. It can dissolve gold

Which of the statements given above are correct?

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

Ans: c (2 and 3 only)

Statement 1 is incorrect: Aqua regia is a solution comprised of a 3:1 mixture of hydrochloric acid (HCL) and nitric acid (HNO₃).

Statement 2 is correct: Aqua regia is a Latin word known as royal water.

Statement 3 is correct: It is commonly used to remove noble metals such as gold, platinum and palladium from substrates, particularly in micro fabrications and microelectronics labs. It is one of the few reagents that can dissolve gold and platinum. Aqua regia solutions are extremely corrosive and may result in explosion or skin burns if not handled with extreme caution.

34. Consider the following statements about Excretory organs of Human body

1. Skin is one of the excretory organs of the human being.
2. Adrenal gland is situated on the top of the kidney
3. Digestion of protein in the intestine produces ammonia which is processed into urea in the liver.

Which of the statements given above are correct?

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

Ans: d (1, 2 and 3)

Statement 1 is correct: Our body needs to excrete some harmful elements and waste. Our body requires some mineral salts to be thrown out in the form of sweating by one of the excretory organs, the skin.

Statement 2 is correct: The adrenal glands play a vital role in the body's fight-or-flight response. They generate stress hormones that activate physiological adaptations necessary to counteract changes in the external environment. There are two triangular adrenal glands located on the top of each kidney

Statement 3 is correct: Ammonia (NH₃) is a waste product bacteria in the intestines primarily make when digesting protein. Normally, ammonia is processed in the liver, where it's transformed into another waste product called Urea. The Urea is then carried to kidneys, where it's eliminated in the urine.

35. Consider the following statements about 'AI for All' Programme



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1. This is a joint initiative between the Ministry of Education, Google and Central Board of Secondary Education (CBSE)
2. It is designed to train anyone to be an AI expert and provides the ability to communicate about it
3. The program can be utilized by senior citizens and the visually impaired also.
4. AI Appreciate component will remove some common misconceptions about AI

How many statements given above are correct?

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

Ans: b (Only two)

Statement 1 is incorrect: The Ministry of Education joined hands with the chip-making giant Intel and Central Board of Secondary Education (CBSE) announce the launch of - 'AI for All' - an initiative that aims to create a basic understanding of Artificial Intelligence (AI) for all Indian citizens.

Statement 2 is correct: AI For All is an online self-learning program designed to raise public awareness about Artificial Intelligence (AI) in the country. It aims to train and make easier to understand AI for people from all walks of life – a student, a stay-at-home parent, and a professional in any field, a senior citizen - basically, anyone interested in getting acquainted with it and wanting to build a 'Digital First Mindset. It does not claim to skill/train or make anyone an AI expert, but is aimed to provide a basic understanding of AI and empowerment enough to communicate about it.

Statement 3 is correct: The program has self-paced content for users with inbuilt questionnaires to help check the knowledge gained. The program can be utilized by anyone including senior citizens and visually impaired. The content is compatible with various talkback applications used by the visually impaired people, making it accessible and helping them get acquainted with Artificial Intelligence.

Statement 4 is incorrect: The program is divided into two sections: AI Aware and AI Appreciate.

AI Aware:

- AI Aware introduces the participant to AI and helps them to realize that AI mimics human intelligence. After going through this section, the participant will be able to:
- Describe what AI is and get to know what it can do.
- Become aware of present-day applications of AI.
- Debunk some common misconceptions about it. AI Appreciate

AI Appreciate: It helps to understand the possibilities, concerns, and principles of responsible AI and AI ethics. Along with understanding these key concepts, the participants will be able to:

- Understand the key domains of AI.
- Impact of AI across various industries.
- Get started with a personal plan to explore AI.

36. Consider the following statements about Electro Magnetic (EM) Waves

1. Microwaves are produced by the Radioactive decay of the nucleus
2. Ultraviolet rays are produced by the movement of inner shell electrons from higher to lower energy levels.
3. Gamma rays have the highest frequency among all the EM waves.

Which of the statements given above are correct?

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

Ans: c (2 and 3 only)

Statement 1 is incorrect: Microwaves are produced by special vacuum tubes (called klystrons, magnetrons and Gunn diodes). They are not produced by the Radioactive decay of the nucleus. Due to their short wavelengths, they are suitable for the radar systems used in aircraft navigation.

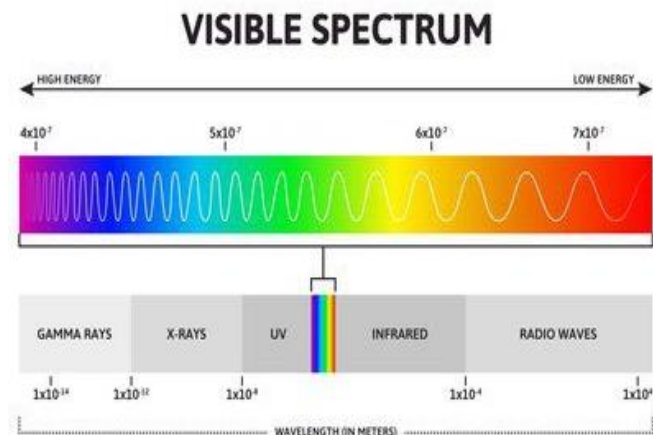
Statement 2 is correct: Ultraviolet (UV) radiation is a form of electromagnetic radiation that comes from the sun and man-made sources like tanning beds and welding torches. When the electrons move back down to a lower shell, the energy is released as light, and the atom returns to a relaxed state. They are produced

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by the movement of inner shell electrons from higher to lower energy levels.

Statement 3 is correct: Gamma rays are produced during the disintegration of radioactive atomic nuclei and the decay of certain subatomic particles. Gamma rays has the highest frequency among all the EM waves.



37. Consider the following statements about the application of National Supercomputing Mission

1. Weather predictions
2. National Security
3. Disaster Management
4. Information repositories

How many of the statements given above are correct?

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

Ans: d (All four)

Explanation: The National Supercomputing Mission was established in 2015 to connect national academic and research institutions to a grid of more than 70 high-performance computing centers at the cost of 4,500 crores over a seven-year period. The Department of Science and Technology (Ministry of Science and Technology) and the Ministry of Electronics and Information Technology (MeitY) are carrying out the mission through the Centre for Development of Advanced Computing (C-DAC) in Pune and the Indian Institute of Science (IISc) in Bengaluru.

Some of the applications of National Supercomputing Mission include

- Climate modelling
- Weather predictions
- Computational Biology
- Molecular Dynamics
- Atomic Energy Simulations.
- National Security
- Seismic Analysis
- Disaster management
- Information repositories

38. Consider the following statements about Metaverse

1. It is a combination of augmented reality and virtual reality
2. Metaverse does not always require wearable headsets to have an immersion experience
3. Non-fungible-tokens can be used as the key to access and experience the Metaverse
4. Anything that can be converted into digital form can be a Non-fungible token

How many statements given above are correct?

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

Ans: d (All four)

Statement 1 is correct: Metaverse, a term first coined in science fiction, combines the prefix "meta," meaning beyond, and "universe." The Metaverse describes an imaginative and prescient field related to 3D digital international, wherein actual and virtual worlds are incorporated with technology, including virtual reality (VR) and augmented reality (AR). There are numerous metaverses already – for example, in digital gaming platforms like The Sandbox and virtual worlds like Decentraland. Augmented reality (AR) integrates digital information with the user's environment in real-time. Virtual Reality (VR) is a computer-generated environment with scenes and objects that appear real, making the user feel immersed in their Surroundings. Thus, Metaverse combines Augmented Reality and Virtual Reality

Statement 2 is correct: Metaverse can be used for immersion experience by using wearable headsets and even without using wearable headsets. For



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example, VRChat, Horizon Worlds, and AltspaceVR. Immersive Technology is any technology that extends reality or creates a new reality by leveraging the 360 space. Immersive Technology create a new reality by completely shutting a user out from the rest of the world and immersing them in a digital environment.

Statement 3 is correct: Non Fungible Tokens serve as a key concept to access and experience the metaverse ecosystem, allowing people to own virtual goods in the form of real estate, items like cars, boats, or even accessories and paintings - all possible through NFTs. For example, if you own a virtual land in the Metaverse (which is quite possible), you gain an NFT as the deed to the virtual property. This means you are the rightful owner and only have exclusive access to enter the location in the Metaverse, allowing access to others.

Statement 4 is correct: Anything that can be converted into a digital form can be an NFT. Everything from drawings, photos, videos, GIFs, music, in-game items, selfies, and even a tweet can be turned into an NFT, which can then be traded online using cryptocurrency. NFTs are unique from other digital forms in that it is backed by Blockchain technology.

39. Consider the following statements about National Mission on Interdisciplinary Cyber-Physical Systems

1. The mission aims to improve the cyber physical system infrastructure in the country by establishing Technology Innovation Hubs.
2. This mission targets academic and Research and Development institutions.
3. Under the mission, first-of-its-kind Internet of Things (IoT) device has been developed to monitor ambient temperature during the transportation of vaccines
4. The Mission is jointly implemented by government of India in collaboration with UNCTAD

How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 & 2 are correct: National Mission on Interdisciplinary Cyber-Physical Systems (NMICPS) is a comprehensive Mission that would address technology development, application development, human resource development & skill enhancement, entrepreneurship, and start-up development in CPS and associated technologies. It is to be implemented by the Department of Science & Technology, which is under the Ministry of Science and Technology. NM-ICPS, which fosters technological solutions in health, education, energy, environment, agriculture, strategic cum security. Industry 4.0 is implemented through 25 Technology Innovation Hubs (TIHs) established in top academic and National Research & Development Institutes. All these hubs are working on developing solutions for people-centric problems. These hubs will focus on generating new knowledge through basic and applied research in areas that are mandated to them. They will be the source of fundamental knowledge/ technologies needed to prepare India for the next generation of technologies

Statement 3 is correct: Under this mission, AmbiTag, the first-of-its-kind Internet of Things (IoT) device that monitors ambient temperature during the transportation of vaccines, including Covid-19, medicines, blood samples, food, and dairy products, meat products, and animal semen, has been developed by researchers at the IIT Ropar, Technology Innovation Hub - AWaDH and startup called ScratchNest.

Statement 4 is incorrect: National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) is a Pan India Mission and covers entire gamut of India that includes Central Ministries, State Governments, Industry and Academia which is to be implemented by Department of Science & Technology. Thus, it is implemented by Government of India and it does not have any collaboration with United Nations Conference on Trade and Development.

40. Consider the following statements

1. Near Field Communication
2. Magnetic Secure Transmission
3. Radio Frequency Identification



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How many of the above technologies are contactless Payment Technologies?

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

Ans: c (Only three)

Explanation: Contactless payment technology allows transactions without requiring physical contact between the card and the terminal. Near-field communication (NFC) is a short-range wireless technology that makes your smartphone, tablet, wearables, payment cards, and other devices even smarter. Near-field communication is the ultimate in connectivity. With NFC, you can transfer information between devices quickly and easily with a single touch—whether paying bills, exchanging business cards, downloading coupons, or sharing a research paper. NFC began in the payment-card industry and is evolving to include applications in numerous industries worldwide.

Magnetic secure transmission, or MST, uses “magnetic” signals to connect the user’s mobile device and the terminal. This process essentially mimics the magnetic connection created when swiping traditional credit cards. The primary advantage of MST technology is that it works on most NFC-ready terminals. MST-enabled devices work with most types of readers that don’t require you to insert cards into the terminal. Users hold their phone next to where a card would be swiped to initiate a connection. In other words, contactless payments work with older, pre-chip terminals using magnetic signals.

Radio-Frequency Identification (RFID) uses radio waves to read and capture information stored on a tag attached to an object. RFID allows the cardholder to wave the RFID card in front of a contactless payment terminal to complete a transaction. The RFID chip in the credit card is not powered and relies on radio frequency (RF) energy transferred from the powered contactless payment terminal to the card to power the chip-on-card. Because contactless purchases do not require a signature or PIN entry, banks set a maximum purchase limit per transaction.

41. Consider the following statements about World Wide Web (WWW)

1. Web 2.0 allows users to simply read content and not really interact with it, but Web 3.0 allows users to read content and interact with it
2. Under Web 2.0 services, it may crash when the servers of a particular platform go offline at the headquarters, but it would not be possible with a Web 3.0 platform
3. Web 4.0 can able to adopt to changing user needs making web more responsive and personalised

Which of the statements given above are correct?

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

Ans: b (Only two)

Statement 1 is incorrect: A Web 2.0 website allows users to read content and interact and collaborate through social media dialogue as creators of user-generated content in a virtual community. But Web 1.0 does not allow users to interact; it just allows users to read the content. Web 3.0 represents the next iteration or phase of the evolution of the web/internet. It is built upon the core concepts of decentralization, openness, and greater user utility. Thus, Web 2.0 and Web 3.0 allow users to read and interact with content.

Statement 2 is correct: Web 3.0 has decentralized elements to bring control back to users instead of creators. Web 2.0 services, for instance, may crash when the servers of a particular platform go offline at the headquarters. This, however, wouldn’t be possible with a Web 3.0 platform that essentially is run by everyone using it in multiple, simultaneously updated copies via a P2P (peer-to-peer) network, like torrents.

Statement 3 is correct: Web 4.0 is expected to be driven by intelligent agents that are capable of understanding user preferences and providing personalized content and services. These agents will be able to learn and adapt to changing user needs, making the web more responsive and efficient. The ultimate goal of Web 4.0 is to create a web that is not only more intelligent but also more intuitive, user-friendly, and easy to navigate.



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42. Consider the following statements about Edge Computing

1. It is a type of centralized cloud computing.
2. It reduces bandwidth requirements at central locations and processes data locally
3. It is more safe from malicious attacks as compared to cloud computing
4. It has lower latency compared to cloud computing

How many statements given above are correct?

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

Ans: b (Only two)

Statement 1 is incorrect: Edge computing is a platform that enables data to be analyzed, processed, and transferred at the edge of a network. The concept is to analyze data locally, closer to where it is stored, in real-time without latency, rather than send it far away to a centralized data center. This minimizes the need for long-distance communications between client and server, which reduces latency and bandwidth usage. Thus, Edge computing is a form of decentralized, distributed computing infrastructure.

Statement 2 is correct: This minimizes the need for long-distance communications between client and server, which reduces latency and bandwidth usage. Thus, Edge computing is a form of decentralized, distributed computing infrastructure.

Statement 3 is incorrect: From a security standpoint, data at the edge can be troublesome, especially when it's being handled by different devices that might not be as secure as centralized or cloud-based systems. Edge computing has some virtual security risks. Remotely accessing these devices could allow hackers to steal data, sabotage operations or gain access to corporate systems. It cannot protect the user's data from any malware attacks, So, Edge computing is considered less safe than cloud computing.

Statement 4 is correct: Edge computing can be called an extension of cloud computing, whereby it differs in the time taken to process the information. In the case of edge computing, the data is analyzed

locally, closer to where it is stored, in real-time, without latency, as compared to cloud computing.

43. Consider the following statements about Digital Embossing Technology

1. It emits fewer pollutants compared to traditional printing technologies
2. This innovative technology has been introduced, designed and implemented in India for the first time by Survey of India
3. Recently it has been used to produce Braille Maps for Visually challenged students

Which of the statements given above are correct?

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

Ans: b (1 and 3 only)

Statement 1 is correct: Digital embossing technology is a technology that eliminates the need for printing plates, moulds, chemicals, and solvents, emitting no pollutants or waste and reducing overall energy usage than traditional printing technologies.

Statement 2 is incorrect: This innovative technology has been introduced, designed and implemented first time in India by National Atlas & Thematic Mapping Organisation (NATMO), functioning as the Attached Office of the Department of Science & Technology not by the Survey of India.

Statement 3 is correct: Braille Maps were produced for visually challenged students from all over the country which was developed using Digital Embossing Technology, enabling them for ease of use, user friendly, better feeling and durable in terms of quality.

44. Consider the following statements about Content Delivery Networks (CDN)

1. It delivers content from the website to users in different geographies
2. CDN can host content and will replace the need for proper web hosting
3. It helps to protect an organization against traffic spikes
4. It reduce the web page load time and bound rates



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How many statements given above are correct?

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

Ans: c (Only three)

Statement 1 is correct: A CDN (Content Delivery Network), also known as a content distribution network, is a network of servers that are geographically distributed and interconnected. They provide cached internet content from a network location near a user's location. To provide digital content to visitors efficiently and securely, regardless of where they are in the world or what device they use.

Statement 2 is incorrect: A CDN's primary purpose is to improve web speed by reducing the time it takes to deliver content and rich media to users. CDN does not host content and can't replace the need for proper web hosting; it does help cache content at the network edge, which improves website performance

Statement 3 is correct: CDNs should protect content providers and users by mitigating many attacks without malicious entities ever compromising delivery and availability. CDNs can handle more traffic and avoid network failures better than the origin server, increasing content availability. Examples of CDNs are: An e-commerce organization uses one to deliver content at busy times of the year when traffic spikes are likely.

Statement 4 is correct: Efficiency - CDNs improve Webpage load times and lower bounce rates. Both benefits prevent consumers from leaving a slow-loading website or e-commerce application.

45. Consider the following statements about National Strategy for Additive Manufacturing

1. It aims to create 50 India-specific technologies for material, machine and software.
2. Through Additive Manufacturing, large volume production of high-value products with complex geometries can be made in a short span of time

Which of the statements given above are correct?

- (a) Only 1

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

Ans: a (Only 1)

Statement 1 is correct: Additive Manufacturing (AM), also known as 3D printing, is the process of manufacturing an object layer by layer. It differs from the traditional subtractive manufacturing techniques involving cutting large blocks of material to form the desired object. AM has the potential to transform manufacturing due to design freedom, shape optimization potential, reduced time-to-market, ease of making changes and low Capex requirements. Additive Manufacturing (AM) has immense potential to revolutionize India's manufacturing and industrial production landscape through digital processes, communication, imaging, architecture and engineering. The Ministry of Electronics and Information Technology (MeitY) formulated the National Strategy on Additive Manufacturing. The strategy aims to increase India's share in global AM to 5% in the next three years. As per the strategy, by 2025, India will aim to achieve certain targets such as 50 India-specific technologies for material, machine, and software, 100 new startups for additive manufacturing, 500 new products, and jobs to at least 1 lakh new skilled workers.

Statement 2 is incorrect: The primary focus of AM in the Aerospace and defence industries has remained on the customization of low-volume of parts and high-value-added products with complex geometries that can be manufactured quickly. AM still has slow build rates and needs to provide an efficient way to scale operations to produce a large volume of parts. Depending on the final product sought, additive manufacturing may take up to 3 hours to produce a shape that a traditional process could create in seconds.

46. Consider the following statements about Magnetic Levitation Technology

1. It uses both magnetic attraction and repulsion between magnets to operate high speed trains
2. Vande Bharat trains in India is using this technology for its high speed operation.

Which of the statements given above are correct?



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

Ans: a (Only 1)

Statement 1 is correct: Magnetic levitation technology is a method whereby an object will be suspended in the air with no support other than magnetic fields. These magnetic fields reverse or counteract the gravitational pull and any other counter-accelerations. This technology uses superconducting magnets, which are electromagnets that are cooled to extreme temperatures during use, dramatically increasing the magnetic field's power. Magnetic levitation (Maglev) technology is of two types

- Electromagnetic suspension (EMS) - uses the attractive magnetic force of a magnet beneath a rail to lift the train
- Electrodynamic suspension (EDS) - uses repulsive force between two magnetic fields to push the train away from the track.

Statement 2 is incorrect: Vande Bharat Express is a India's first Semi High Speed Train, which will provide passengers with aircraft like travelling experience and advanced state-of-the-art safety features including Kavach technology - an indigenously developed Train Collision Avoidance System, Speed, Safety and Service are the hallmarks of this train. Vande Bharat did not use Maglev Technology for its high speed operation. Still in India, Maglev Technology has been under consideration, it is not yet been used.

47. Foods that are high in water content can be cooked more quickly than other foods in a Microwave oven mainly because

- (a) Microwaves are not absorbed easily by the water molecules in food
- (b) Water molecules in the food reflect the microwaves directly against the food
- (c) Microwaves cause water molecules in the food to vibrate
- (d) The water is not heated beyond the boiling temperature in the oven

Ans: c (Microwaves cause water molecules in the food to vibrate)

Explanation: Microwaves are a form of electromagnetic radiation whereby the waves are reflected within the metal interior of the oven that is absorbed by the food. Microwaves cause water molecules in the food to vibrate, producing heat that cooks the food. That's why microwave oven cooks foods with high water content more quickly.

Working Principle of Microwave oven:

- The basic principle of a microwave oven is to generate microwave radiation of appropriate frequency in the working space of the oven where we keep food
- This way, energy is not wasted in heating up the vessel
- In the conventional heating method, the vessel on the burner gets heated first, and then the food inside gets heated because of the transfer of energy from the vessel.
- In the microwave oven, on the other hand, energy is directly delivered to water molecules which are shared by the entire food.

48. Which one of the following statements is correct with reference to the Quantum Key Distribution (QKD) technology ?

- (a) It is a technology to distribute sets of instructions to quantum computers to execute tasks
- (b) It mitigates correction in the quantum errors to improve the performance, size, and reliability of a quantum computer
- (c) It ensures secure communication between two parties using a cryptographic protocol involving components of quantum mechanics
- (d) It explains and predicts the behaviour of atoms and molecules in a way that redefines our understanding of nature.

Ans: c (It ensures secure communication between two parties using a cryptographic protocol involving components of quantum mechanics)

Explanation: Quantum Key Distribution (QKD) is primarily a mechanism to undertake secure communication, which utilizes a cryptographic protocol involving various components of quantum



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mechanics. The Quantum Key Distribution technology enables two communicating sides to come up with random secret keys shared by both of them and known exclusively to them, so only they can use it to encrypt and decrypt messages, thus achieving a very highly-secure communication.

49. Consider the following statements about International Counter Ransomware Initiative (CRI)

1. It is a grouping of 36 countries collaborating to enhance "collective resilience" to ransomware and cooperate across all elements of the ransomware threat.
2. India is not a member of CRI
3. Ransomware is a kind of malware that disguises itself as legitimate software and acts discretely, and creates backdoors to let other malware in.

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

Ans: c (2 and 3 only)

Statement 1 is correct: The International Counter Ransomware Initiative (CRI), is a grouping of 36 countries, which includes India and the European Union to enhance "collective resilience" to Ransomware, disrupt attacks and pursue responsible actors, counter illicit finance that underpins the ransomware ecosystem, work with the private sector against attacks, and cooperate across all elements of the ransomware threat

The CRI was launched in 2022 by the United States, and is led by four pillars: the International Counter Ransomware Task Force (ICRTF), the Diplomacy and Capacity Building Pillar, the Policy Pillar, and the Private Sector Engagement Pillar. The CRI meets annually to review its progress and deliverables, and to coordinate its actions against the ransomware threat.

Statement 2 is incorrect: The members of the International Counter Ransomware Initiative (CRI) are Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Croatia, Czech Republic, Dominican Republic, Estonia, France, Germany, India, Ireland,

Israel, Italy, India Japan, Kenya, Lithuania, Mexico, the Netherlands, New Zealand, Nigeria, Norway, Poland, Republic of Korea, Romania, Singapore, South Africa, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom, United States, and Ukraine, and the European Union—met in Washington, DC.

Statement 3 is incorrect: The trojan is a kind of malware that disguises itself as legitimate software or is included in legitimate software that has been tampered with. It tends to act discretely and create backdoors in security to let other malware in. Hence, Ransomware is a type of malware that prevents or limits users from accessing their system, either by locking the system's screen or by locking the users' files until a ransom is paid to its owner.

50. Consider the following statements about Internet Protocol Version 6 (IPv6)

1. There are 32 bits in IPv6 address compared to 16 bits in IPv4 address.
2. Internet Protocol Security (IPSec) is a part of IPv6 which provides end-to-end security.
3. It provides an enabling platform for the Internet of Things and 5G technology

How many statements given above are correct?

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

Ans: b (Only two)

Statement 1 is incorrect: Internet Protocol version 6 is the most recent version of the Internet Protocol. This communications protocol provides an identification and location system for computers on networks and routes traffic across the Internet. IPv6 (Internet Protocol version 6) is a set of specifications from the Internet Engineering Task Force (IETF) that is essentially an upgrade of IP version 4 (IPv4), a category of IP addresses in IPv4-based routing. The basics of IPv6 are similar to those of IPv4 devices can use IPv6 as the source and destination addresses to pass packets over a network, and tools like ping work for network testing as they do in IPv4, with some slight variations. The main difference between IPv4 and IPv6 is the address size of IP addresses. IPv4 is a



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32-bit address, whereas IPv6 is a 128-bit hexadecimal address. IPv6 provides a large address space and contains a simple header compared to IPv4.

Statement 2 is correct: IPsec (Internet Protocol Security) is a suite of protocols and algorithms for securing data transmitted over the internet or any public network. IPsec is used for protecting sensitive data, such as financial transactions, medical records and corporate communications, as it's transmitted across the network. It's also used to secure virtual private networks (VPNs). IPsec originally defined two protocols for securing IP packets: Authentication Header (AH) and Encapsulating Security Payload (ESP). The former provides data integrity and anti-replay services, and the latter encrypts and authenticates data. IPsec operates at the network layer to provide end-to-end encryption. IPsec authenticates and encrypts data packets sent over both IPv4- and IPv6-based networks.

Statement 3 is correct: 5G IoT is the fifth-generation cellular technology that revolutionizes and enables new capabilities such as Artificial Intelligence (AI), Cloud computing, and the Internet of Things (IoT). IPv6 enables address availability for vast device growth in new areas of technology innovation, such as IoT and 5G.

51. Choose correct one with respect to “Nano DAP (Di-Ammonium Phosphate)”

1. It is a specialized form of DAP designed with the goal of improving the fertilizer's effectiveness in promoting plant growth and development.
2. DAP is the second most consumed fertilizer in the country after urea.
3. Unlike conventional DAP, which comes in liquid form, IFFCO's Nano DAP is in granular form.

Which of the following statements are correct?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 2 only
- (d) All are correct

Answer: (c) 1 and 2 only

Explanation:

Recently, the finance minister in the Interim Budget 2024-25 has announced the expansion of the application of Nano DAP (Di-Ammonium Phosphate) as a Fertilizer on various crops in all agro-climatic zones.

-Nano fertilizers are highly efficient types of fertilizers that provide nutrients like nitrogen to crops through fine granules.

Statement 1 is correct: Nano DAP is a specialized form of DAP designed with the goal of improving the fertilizer's effectiveness in promoting plant growth and development.

In 2023 Indian Farmers Fertiliser Cooperative (IFFCO) launched its Nano DAP, containing 8% Nitrogen and 16% Phosphorus by volume.

Statement 2 is correct: DAP is the second most commonly used fertilizer in India after urea. DAP is a preferred fertilizer in India because it contains both Nitrogen and Phosphorus which are primary macronutrients and part of 18 essential plant nutrients.

Statement 3 is incorrect: Unlike conventional DAP, which comes in granular form, IFFCO's Nano DAP is in liquid form.

Significance of Promoting Nano DAP was it was more efficient than conventional DAP, pocket-friendly; more Convenient for Farmers, reduction of Import Burden and lesser impact on the environment.

52. Which of the following statements regarding “Xenobots” are correct.

1. Xenobots are made from pig cells created by microengineering eggs with RNA.
2. These robots are to be used to detect diseases and deliver drugs to specific areas of the body.
3. Xenobots can heal themselves after being cut.

Which of the following statements are correct?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 2 only
- (d) All are correct

Answer: (b) 2 and 3 only

Explanation:

Statement 1 is incorrect: The scientists have used the stem cells of frogs to create a new living robot. These robots have been named Xenobots.



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-They have been named after the *Xenopus laevis* frog that supplied its cells to create the robot.

-*Xenopus laevis* is an African frog.

-Xenobots are less than 1 millimeter long.

Statement 2 is correct: These robots are to be used to detect diseases and deliver drugs to specific areas of the body.

-Many useful applications of these living robots include searching out nasty compounds or radioactive contamination, gathering microplastic in the oceans, traveling in arteries to scrape out plaque, etc.

Statement 3 is correct: 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.

53. A Nano-technology based low-cost drug Rufinamide, recently seen in the news is used as:

- (a) Antidepressants
- (b) Anti-Cancer Drugs
- (c) Anti-epileptic drugs
- (d) Antimalarial drugs

Answer: (c) Antiepileptic drugs

Explanation:

Option C is correct: The Institute of Nano Science and Technology (INST) operating under Department of Science and Technology has developed a nano-technology based low cost antiepileptic drug Rufinamide

-The drug developed is a part of Atma Nirbhar Bharat Abhiyan. Several nanotechnology initiatives are being increased under the programme.

-The nanotechnology-based industry friendly production of antiepileptic drug Rufinamide will boost the reaction of the drug.

Epilepsy

-A disorder in which nerve cell activity in the brain is disturbed, causing seizures.

-Epilepsy may occur as a result of a genetic disorder or an acquired brain injury, such as a trauma or stroke.

-During a seizure, a person experiences abnormal behavior, involuntary movement of limbs and sensations, sometimes including loss of consciousness.

54. Select the correct statements

1. The India Graphene Engineering and Innovation Centre (I-GEIC) is a research facility focused on developing advanced agricultural techniques for rural communities.
2. Graphene is 200 times stronger than steel.

Select the correct answer:

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

Answer: (b) 2 only

Explanation:

Statement 1 is incorrect: India set up a graphene engineering and innovation center in Kerala to drive commercialisation of the advanced material and to empower emerging tech startups.

I-GEIC will fill the gap between R&D and commercialisation by providing a complete facility to startup and industry. It will nurture the deep/emerging graphene technology and innovation ecosystem that can guide, develop, implement, and support SMEs and startups to commercialize developed graphene technologies for scale adoption

Statement 2 is correct: Graphene is a one-atom-thick layer of carbon atoms arranged in a hexagonal lattice. It is the building-block of Graphite, but graphene is a remarkable substance on its own with a multitude of astonishing properties.

-It is the thinnest, most electrically and thermally conductive material in the world, while also being flexible, transparent and incredibly strong, about 200 times stronger than steel.

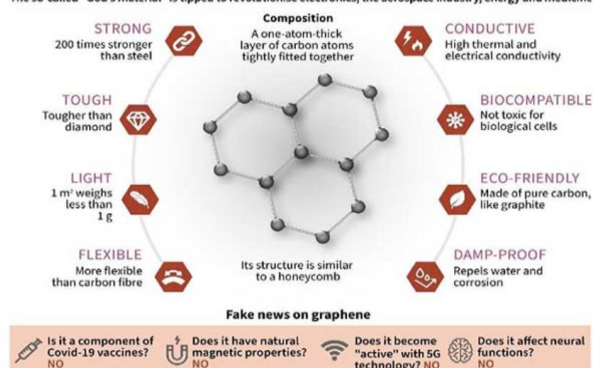
-Often referred to as a wonder material for its extraordinary electrical and electronics properties, graphene could replace Indium and thereby bring down the cost of OLED (organic light-emitting diode) screens in smartphones, studies have shown.

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Graphene, the material of the future

The so-called "God's material" is tipped to revolutionise electronics, the aerospace industry, energy and medicine



55. With reference to microplastics, select the correct statements

1. Microplastics are biodegradable.
2. Microbeads are a type of microplastic.
3. Microplastics are plastic particles less than 100mm in diameter.

Which of the following statements are correct?

- (a) 1 and 2 only
- (b) 2 only
- (c) 1 and 3 only
- (d) All are correct

Answer: (b) 2 only

Statement 1 is incorrect When plastic objects end up as litter, they break down into tiny pieces when exposed to sunlight and other elements. These tiny particles are called "microplastics". These plastics are not biodegradable, meaning they do not decompose. and they've been found in animals, soils, water, and in humans all around the world.

Statement 2 is correct: Primary Microplastics: They are tiny particles designed for commercial use and microfibers shed from clothing and other textiles. E.g. microbeads found in personal care products, plastic pellets and plastic fibers.

Secondary Microplastics: They are formed from the breakdown of larger plastics such as water bottles.

Statement 3 is incorrect: Microplastics are plastic particles less than 5mm in diameter which can be harmful to our ocean and aquatic life.

56. With reference to Pibot, consider the following statements

1. It is the world's first humanoid pilot.

2. It can fly an airplane just like a human pilot by manipulating all the single controls in the cockpit, which is designed for humans.

Select the correct statements:

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

Answer: (c) Both 1 and 2

Explanation:

Statement 1 is correct: A team from the Korea Advanced Institute of Science & Technology (KAIST) is developing a humanoid robot called 'Pibot' that can fly aircraft without cockpit modifications.

Pibot is the world's first humanoid pilot, using AI and robotics to manipulate cockpit controls, even during turbulence. It incorporates cameras for monitoring, the memory of flight charts for navigation, and the ability to communicate with air traffic controllers and humans through voice synthesis (using ChatGPT's language synthesis model)

Statement 2 is correct: Pibot's innovation lies in its capability to pilot aircraft like a human, revolutionizing aviation technology. Pibot can control its arms and fingers to dexterously operate flight instruments, even with severe vibration in an aircraft, using high-precision control technology.

It can memorize aircraft operation and emergency manuals (QRH, an in-cockpit manual for the flight crew to refer to in case of in-flight problems) and respond immediately.

57. REX MKII, seen recently in news, is

- (a) Remote controlled armed robot.
- (b) Unmanned Aerial Vehicle.
- (c) Asteroid sample return mission by NASA.
- (d) None of the above.

Answer: (a) Remote controlled armed robot.

Explanation:

Option a is correct: Recently, Israel Aerospace Industries unveiled a remote-controlled armed robot 'REX MKII', which can patrol battle zones, track infiltrators and open fire.



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-The army robot is capable of patrolling battle zones, tracking infiltrators, and opening fire on enemy targets.

-It is operated by an electronic tablet and can be equipped with two machine guns, cameras and sensors.

-It shall provide logistical assistance to troops by carrying ammunition supplies, critical medical equipment, water, and food, as well as evacuating injured personnel on stretchers.

-The system can also gather intelligence through a situation-awareness system

-The unmanned vehicle is the latest addition to the world of drone technology, which is rapidly reshaping the modern battlefield.

-These semi-autonomous machines allow armies to protect their soldiers, while critics fear this marks another dangerous step toward robots making life-or-death decisions.

58. With reference to 'Vyom Mitra', consider the following statements

1. "Female" robot astronaut which will fly aboard unmanned test missions ahead of the Gaganyaan Mission.
2. It was designed and developed by Defence Research and Development Organisation(DRDO).

How many of the statements given above is/are incorrect?

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

Answer: (a) 1 only

Explanation:

Statement 1 is correct: First 'woman' astronaut, named Vyom Mitra who will ride to space in the first test flight of the human space mission, Gaganyaan is half-humanoid and her body stops at the torso and has no legs. She is capable of switching panel operations, performing Environment Control and Life Support Systems (ECLSS) functions, conversations with the astronauts, recognising them and solving their queries.

The humanoid can detect and give out warnings if the environment changes within the cabin. She will simulate the human functions required for space before real astronauts take off before August 2022. She will be sent in a space capsule around the end of 2020 or early 2021 to study how astronauts respond to living outside earth in controlled zero-gravity conditions.

Statement 2 is incorrect: The humanoid has been developed by the ISRO Inertial Systems Unit, Thiruvananthapuram.

59. Consider the following statements.

1. 'Nanobot' is an informal term to refer to engineered nano machines which are 50–100 nm wide, designed to carry out a very specific function.
2. They can be used very effectively for drug delivery
3. They can tackle issues pertaining to root canal treatments
4. Chances of possible side effects increase with the use of this technology, especially when it comes to healthcare.

How many of the following statements are incorrect?

- (a) One only
- (b) Two only
- (c) Three Only
- (d) All are correct

Answer: (a) One only

Explanation:

Statement 1 is correct: Nanorobots-Nanorobotics describes the technology of producing machines or robots at the nanoscale.

'Nanobot' is an informal term to refer to engineered nano machines that carry out a very specific function and are ~50–100 nm wide.

Statement 2 is correct: They can be used very effectively for drug delivery.

Normally, drugs work through the entire body before they reach the disease-affected area. Using nanotechnology, the drug can be targeted to a precise location which would make the drug much more effective and reduce the chances of possible side effects.



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Statement 3 is correct: Recently, a group of scientists has found a way to tackle issues pertaining to root canal treatments (dental procedures) using nanosized robots.

Root canal treatment is designed to eliminate bacteria from the infected root canal, prevent reinfection of the tooth and save the natural tooth.

Statement 4 is incorrect: Uses of Nanotechnology in Health Care:

-Nanotech detectors for heart attack.

-Nanocarriers for eye surgery, chemotherapy etc.

-Diabetic pads for regulating blood sugar levels.

-Nanosponges are polymer nanoparticles coated with a red blood cell membrane, and can be used for absorbing toxins and removing them from the bloodstream.

-NanoFlares are used for detection of cancer cells in the bloodstream.

-Nanopores are used in making DNA sequencing more efficient.

Nanobots are known to be much more effective and reduce the chances of possible side effects in healthcare.

60. Consider the following statements regarding Quadruped robots.

1. Quadruped robots are also useful in recognizing terrorist activities in unsafe locations.
2. India has emerged as one of the largest exporters of Quadruped robots.

Select the correct answer

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

Answer: (a) 1 only

Explanation:

Statement 1 is correct: Quadruped robots are four-legged robots which can walk or run on uneven and rough terrains.

-For example, in Leh, where soldiers have to navigate through unfavorable conditions, these robots can be used.

-These are also useful in recognizing terrorist activities and other unsafe locations and capturing the

visuals which can be monitored from any part of the country.

-The robots developed can carry 25 kg in payload and walk along with the soldier. These robots can also be used in nuclear plants and other industries as well.

Statement 2 is incorrect: Hyderabad-based Svaya Robotics has developed India's first indigenous quadruped (four-legged) robot and exoskeleton for the defense sector. India currently imports these robots from the US and Switzerland to help strengthen the country's defense capabilities.

61. Consider the following statements with respect to Small Modular Nuclear Reactors

1. Small Modular Nuclear Reactors have a power capacity more than conventional nuclear reactors.
2. Small Modular Reactors (SRMs) are advanced nuclear reactors that can be factory-built unlike the conventional nuclear reactors that are built on-site.
3. Small Modular Reactors can be used for power generation, process heat and desalination.

How many of the above statements is/are correct?

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

Answer: (a) 1 only

Explanation:

Statement 1 is incorrect: Nuclear energy is the fifth-largest source of electricity in India, contributing about 2% of the country's total electricity generation. Small Modular Reactors (SRMs), are advanced nuclear reactors that have a power capacity of up to 300 MW(e) per unit, which is about one-third of the generating capacity of traditional nuclear power reactors.

Statement 2 is correct: SMRs, which can produce a large amount of low-carbon electricity, are, Small: Physically a fraction of the size of a conventional nuclear power reactor.

Modular: Making it possible for systems and components to be factory-assembled and transported as a unit to a location for installation.



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Reactors: Harnessing nuclear fission to generate heat to produce energy.

Their designs incorporate enhanced safety features, reducing the risk of uncontrolled radioactive material release. SMRs can offer a carbon free, clean energy alternative to fossil fuels.

Statement 3 is correct: SMRs are designed to operate for 40-60 years with capacity factors exceeding 90%. They can be used for power generation, process heat, desalination, or other industrial uses.

62. Consider the following statements with respect to Rare Earth Elements

1. Considered "rare" despite their abundance in Earth's crust because they are found in remote and inaccessible locations
2. 92% of rare earth metal imports by value and 97% by quantity were sourced from China.

Select the correct answer:

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

Answer: (b) 2 only

Explanation:

Statement 1 is incorrect: They are called 'rare earth' because earlier it was difficult to extract them from their oxides forms technologically.

They occur in many minerals but typically in low concentrations to be refined in an economical manner.

-These minerals have unique magnetic, luminescent, and electrochemical properties and thus are used in many modern technologies, including consumer electronics, computers and networks, communications, health care, national defense, clean energy technologies etc.

Statement 2 is correct: India has 6% of the world's rare earth reserves, it only produces 1% of global output, and meets most of its requirements of such minerals from China.

-92% of rare earth metal imports by value and 97% by quantity were sourced from China.

63. Consider the following statements.

1. The BESS (Battery Energy Storage Systems) aims to enable the use of stored renewable energy during peak hours.
2. Battery Energy Storage Systems (BESS) works on the principle that it directly transmits electricity over long distances.

Select the incorrect statements

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

Answer: (b) 2 only

Explanation:

Statement 1 is correct: The BESS aims to enable the use of stored renewable energy during peak hours, promoting round-the-clock renewable energy supply. The scheme supports India's ambition to achieve 50% of its energy requirements through renewable and non-fossil energy sources by 2030, while also contributing to carbon emissions reduction.

Statement 2 is incorrect: Battery Energy Storage Systems (BESS) works on the principle that it directly transmits electricity over short distances.

-The Indian government has approved viability gap funding (VGF) to cover up to 40% of the total capital cost for the establishment of a 4,000 MWh battery energy storage system (BESS) in the country.

-This initiative is aligned with India's renewable energy goals, as the country has seen significant growth in solar and wind energy capacity, meeting 25% of its energy demand from renewables, including large hydro plants.

64. Consider the following statements with respect to Indian Renewable Energy Development Agency.

1. It comes under administrative control of the Ministry of New and Renewable Energy (MNRE).
2. It is registered as Non-Banking Financial Company (NFBC) with the Reserve Bank of India (RBI).

Select the correct answer:

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



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Answer: (c) Both 1 and 2

Explanation:

Statement 1 is correct: It is a Mini Ratna (Category-I) non-banking financial institution under the administrative control of Ministry of New and Renewable Energy (MNRE).

Statement 2 is correct: It is a Public Limited Government Company established as a Non-Banking Financial Institution (NBFC) in 1987.

-REDA has been notified as a "Public Financial Institution" under section 4 'A' of the Companies Act, 1956 and registered as NBFC with Reserve Bank of India (RBI).

-REDA is primarily engaged in promoting, developing and extending financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency/conservation.

Objectives:

-To give financial support to specific projects and schemes for generating electricity and/ or energy through new and renewable sources and conserving energy through energy efficiency.

-To maintain its position as a leading organization to provide efficient and effective financing in renewable energy and energy efficiency/ conservation projects.

65.Consider the following statements.

1. Hygroelectricity is type of renewable energy.
2. Hygroelectric charge is likely source of electric charge that exists in thunderstorms and volcanic eruptions.

Which of the above given statements are correct?

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

Answer: (c) Both 1 and 2

Explanation:

Statement 1 is correct: Hygroelectricity is a type of static electricity that forms on water droplets and can be transferred from droplets to small dust particles. The phenomenon is common in the Earth's atmosphere but has also been observed in the steam escaping from boilers

- Hygroelectricity is the generation of electricity from the humidity of the air.

- It is a type of renewable energy that has the potential to be a major source of power in the future. Unlike other renewable energy sources such as solar and wind, air humidity is continuously available, making it a sustainable reservoir of energy.

Statement 2 is correct: Hygroelectric charge is the likely source of the electric charge which, under certain conditions such as exist in thunderstorms, volcanic eruptions and some dust storms, gives rise to lightning.

66.Consider the following statements.

1. The emergence of the Mewar School is associated with a set of Ragamala paintings painted at Chawand in 1605.
2. In the 18th century, Mewar painting shifted towards courtly and secular subjects, including portraiture, court scenes, hunting expeditions and festivals.
3. The Nathdwara School is a subset of the Mewar School of painting.
4. A synthesis of Jain and Gujarati styles is evident in the earliest Mewar painting

Select the correct answer:

- (a) 1 and 4 only
- (b) 2 and 3 only
- (c) 1 and 2 only
- (d) All are correct

Answer: (d)All are correct.

Explanation:

-About Mewar Miniature painting (17th-18th centuries)- It is a school in the Rājasthānī style developed in Mewar (Rajasthan).

About Rajasthani painting:

-It differs from the Mughal painting in its bolder use of color, an abstract and conventionalized conception of the human figure, and an ornamental treatment of landscape.

Two main factors contributed to the development of Rajasthani paintings:

- the patronage of rich Rajputana communities
- the revival of Vaishnavism and the growth of bhakti cults.



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Statement 1 is correct: The emergence of the Mewar School is associated with a set of Ragamala paintings painted at Chawand in 1605 by an artist named Nisardin

Statement 2 is correct: towards courtly and secular subjects, including portraiture, court scenes, hunting expeditions, festivals, zenana activities, and sports.

It is characterized by simple bright color and direct emotional appeal.

-Miniature painting is a small, finely wrought portrait executed on vellum, prepared card, copper, or ivory.

Statement 3 is correct: The Nathdwara School is a subset of the Mewar School of painting.

67. Consider the following statements.

1. Sarna followers are nature worshippers who do not consider themselves Hindus and have been fighting for a separate religious identity for decades.
2. Believers of Sarna faith do not practice idol worship, nor do they adhere to the concept of the Varna system, heaven-hell instead Holy grail of Sarna faith is “Jal (water), Jungle (forest), Zameen (land)” and its followers pray to trees and hills.
3. Sarna is a religious faith predominantly followed by indigenous communities in the Garhwal region of the Himalayas.

Select the correct answer:

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 2 only
- (d) All are correct

Answer: (c) 1 and 2 only

Explanation:

Statement 1 is correct: Sarna followers are nature worshippers who do not consider themselves Hindus and have been fighting for a separate religious identity for decades. So far, the census surveys have included them as “others” in the religion column.

Statement 2 is correct: Believers of Sarna faith do not practice idol worship, nor do they adhere to the concept of the Varna system, heaven-hell, etc. Holy grail of Sarna faith is “Jal (water), Jungle (forest), Zameen (land)” and its followers pray to trees and hills.

Statement 3 is incorrect: Sarna is a religious faith predominantly followed by indigenous communities in the Chota Nagpur Plateau region across states like Jharkhand, Odisha, West Bengal, Bihar, and Chhattisgarh. It holds the distinction of being India's largest tribal religion.

68. Consider the following statements regarding Ecocide

1. It is defined as “as unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts”.
2. India is one of the first countries to criminalize Ecocide after Vietnam and Russia.

Select the correct answer:

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

Answer: (a) 1 only

Explanation:

Statement 1 is correct: It is human impact on the environment causing mass destruction to the environment. It is defined as “as unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts”.

It also refers to as killing one's home or environment refers to acts like port expansion projects, deforestation, illegal sand mining, polluting rivers and releasing untreated sewage, etc., that destroy fragile natural ecosystems and local livelihoods.

Statement 2 is incorrect: There is no international law against ecocide that applies in peacetime, but the Rome Statute makes it a crime.

The Rome Statute of the International Criminal Court (ICC) deals with four atrocities: genocide, crimes against humanity, war crimes, and the crime of aggression. The provision on war crimes is the only statute that can hold a perpetrator responsible for environmental damage, but only if it is intentional and in wartime.



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India has neither signed nor ratified the Rome Statute of the International Criminal Court and has not expressed any official position on the proposal to criminalize ecocide at the international level. However, It is a crime in 11 countries, with 27 others considering laws to criminalize environmental damage that is wilfully caused and harms humans, animals, and plants.

Countries that have criminalized ecocide include Vietnam, Ukraine, Russia etc.

69. Consider the following statements.

1. Phosphorus is one of the micronutrients essential for plant growth which is required by plants for photosynthesis process, energy transfer and nutrient movement within the plant.
2. India is the world's largest importer of Phosphorus, most of it from the cadmium-laden deposits of West Africa.
3. Phosphate rocks are majorly produced only from two States in India, namely Gujarat and Jammu Kashmir
4. Phosphorus is an essential ingredient in fertilisers manufacturing
5. Almost two thirds of the phosphorus we consume leaves in our urine and the rest in faeces

Select the incorrect answer:

- (a) 2 and 5 only
- (b) 2 and 4 only
- (c) 1 and 3 only
- (d) All are correct

Answer: (c) 1 and 3 only

Explanation:

Statement 1 is incorrect: Phosphorus is one of the macronutrients essential for plant growth which is required by plants for:

- Photosynthesis process
- Energy transfer and nutrient movement within the plant
- Strong root development
- Transfer of genetic characteristics

Statement 2 is correct: India is the world's largest importer of Phosphorus, most of it from the cadmium-laden deposits of West Africa.

At most places, Phosphorus coexists with Cadmium, a heavy metal whose removal is expensive.

Statement 3 is incorrect: Phosphate rocks are majorly produced only from two States in India, namely Rajasthan and Madhya Pradesh.

-Some deposits are also present in the central part of peninsular India, Lalitpur (Uttar Pradesh), Mussoorie syncline, and Cuddapah basin (Andhra Pradesh).

Statement 4 is correct Phosphorus is an essential ingredient in fertilisers manufacturing, this is the main reason India imports for agriculture

Statement 5 is correct Almost two thirds of the phosphorus we consume leaves in our urine and the rest in faeces. There may be a possibility to get phosphorus from urban sewage

70. PET46 recently seen in the news is related to.

- (a) Lightweight plastic that is widely used for packaging foods and beverages.
- (b) Deep-sea microorganism, unique in its ability to degrade both long-chain and short-chain plastic molecules.
- (c) Naturally occurring form of crystalline carbon and a native element mineral found in metamorphic and igneous rocks.
- (d) A protein isolated from bacteria that cleaves DNA sequences at sequence-specific sites, producing DNA fragments with a known sequence at each end.

Answer: (b)

Explanation:

Researchers have identified a PET46 from a deep-sea microorganism for the first time PET46 enzyme is unique in its ability to degrade both long-chain and short-chain PET molecules, enabling continuous degradation.

Significance:

- Potentially break down PET waste in the ocean, effectively contributing to efforts to combat plastic pollution.
- Contribute to understanding the ecological role of deep-sea archaea (marine organisms).
- Other PET degrading enzymes - PETase, MHETase, THC_Cut1 etc.

71. Consider the following statements:



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- As per Article 262, Central government may constitute a River Boards for the adjudication of any dispute or complaint with respect to the use, distribution or control over the waters of, or in, any inter-state river or river valley.
- Cauvery Water Disputes Tribunal (CWDT) was the very first inter-state water disputes tribunal to adjudicate the water dispute with respect to the inter-state Cauvery water and river basin.

Select the correct answer:

- 1 only
- 2 only
- Both 1 and 2
- Neither 1 and 2

Answer: d

Explanation:

Recently, the Union Cabinet approved the terms of reference to Krishna Water Disputes Tribunal-II (KWDT-II) under the Inter-State River Water Disputes (ISRWD) Act, 1956 to the use, distribution or control over the waters of, or in, any inter-state river or river valley

Statement 1 is correct: In the exercise of the power conferred by Article 262 of the Constitution, Parliament has enacted two laws:

-Inter-State Water Disputes (ISWD) Act, 1956: Under it, a State Government which has a water dispute with another State Government may request the Central Government to refer the dispute to a tribunal for adjudication.

-River Boards Act, 1956: It was made for the setting up of River Boards by the central government for the regulation and development of inter-state rivers and river valleys.

Statement 2 is incorrect:

River Water Disputes Tribunals History

-The very first inter-state water disputes tribunal was the Krishna Water Disputes Tribunal formed in 1969.

-In 1969, Krishna Water Disputes Tribunal-I (KWDT) was set up under the ISRWD Act, 1956. It divided 2060 TMC (Thousand Million Cubic feet) of Krishna water at 75% dependability.

-The Government of India constituted the Cauvery Water Disputes Tribunal (CWDT) on June 2, 1990, to adjudicate the water dispute between the states of

Tamil Nadu, Karnataka, Kerala and Puducherry with respect to the inter-state Cauvery water and river basin.

72. Choose the incorrect statements about Prompt Corrective Action Framework

- The objective of the framework is to enable Supervisory intervention by RBI over banks at an appropriate time.
- The framework applies to all banks operating in India, including Payments banks and small finance banks (SFBs).
- The RBI introduced the PCA Framework in December 2012 as an early intervention mechanism, inspired by the US Federal Deposit Insurance Corporation's PCA framework.
- RBI will impose discretionary restrictions on the bank on borrowings from the Interbank Market

Select the incorrect answer:

- 1 only
- 2 only
- 3 and 4
- 1 and 4

Answer: (b) 2 only

Explanation:

Statement 1 is correct: PCA is a framework under which banks with weak financial metrics are put under watch by the RBI. The RBI introduced the PCA framework in 2002 as a structured early-intervention mechanism for banks that become undercapitalized due to poor asset quality, or vulnerable due to loss of profitability.

-The RBI has specified certain regulatory trigger points, as a part of PCA Framework, in terms of three parameters, i.e., Capital to Risk Weighted Assets Ratio (CRAR), net Non-Performing Assets (NPA) and Return on Assets (RoA)

It is intended to help alert the regulator as well as investors and depositors if a bank is heading for trouble. The idea is to head off problems before they attain crisis proportions.

Statement 2 is incorrect: Applicability of Prompt Corrective Action: It also includes the foreign banks



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operating through subsidiaries or branches on breach of risk thresholds of the identified indicators.

However, the Small Finance Banks and Payment Banks have been removed from the list of lenders where PCA can be initiated.

Statement 3 is incorrect

The RBI introduced the PCA Framework in December 2002

Statement 4 is incorrect

Mandatory Actions for Banks by RBI

- The bank will not access/renew costly deposits and CDs.
- They will take steps to increase fee-based income.
- The bank will take steps to contain administrative expenses.
- The bank will launch a special drive to reduce the stock of NPAs and contain the generation of fresh NPAs.
- The bank will not enter into new lines of business.
- The bank will reduce/skip dividend payments.
- RBI will impose restrictions on the bank on borrowings from the Interbank Market

73. Which of the following lakes in Brazil, recently made news as it is drying up due to severe drought?

- Lake Iriry
- Lake Juturnaiba
- Lake Puraquequara
- Lake Itaipu

Answer: (c) Lake Puraquequara

Explanation:

Option C is correct: In October 2023, the Amazon River experienced a severe drought, resulting in the depletion of Lake Puraquequara. Consequently, the floating villages in Brazil have transformed into mud flats due to the receding water levels.

Factors Contributing to Drought in the Amazon Rainforest:

El Niño Phenomenon:

Abnormal warming of the Pacific Ocean surface disrupts rainfall patterns.

Leads to reduced humidity and rainfall, worsening drought conditions in the Amazon.

High Water Temperatures in Northern Tropical Atlantic Ocean:

Elevated ocean temperatures cause heated air to rise, hindering cloud formation.

Reduced cloud cover results in sharp drops in rainfall within the Amazon.

Anthropogenic Climate Change:

Human-induced activities like deforestation, agriculture, and logging exacerbate the Amazon's inability to regulate climate and retain moisture.

Destruction of vegetation escalates temperatures, intensifying severe drought cycles.

Mining Activity:

Unregulated mining creates barriers impeding river navigation and releases pollutants and greenhouse gases, affecting the climate.

Alters aquatic and terrestrial ecosystems, compounding environmental impact.

Hydroelectric Dams:

Construction and operation, especially on the Madeira River, disrupt natural river flows, affecting ecosystems and releasing methane gas.

Reservoir creation alters natural river courses, impacting climate and ecosystems.

Transportation Infrastructure:

The construction of highways contributes to increased deforestation, disrupting conserved areas and intensifying climate disruptions in the Amazon.

74. Which of the following committees suggested privatization of some operations in Indian railways?

- Raja Chelliah Committee
- Bibek Debroy committee
- Ramesh Chand Committee
- Rajiv Mehrishi Committee

Answer: (b) Bibek Debroy committee

Explanation:

Option a is incorrect: The Government of India set up a high-powered committee in August 1991, under the chairmanship of Dr Raja J Chelliah. The committee made recommendations for a comprehensive reform of the system of central taxes. The Tax Reform Committee is also known as the Raja Chelliah Committee.

Option b is correct: The committee advocated the establishment of an independent regulator to oversee



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the railway sector. The regulator would be in charge of determining fares, maintaining competition, controlling access to railway assets, and assessing service quality.

Option c is incorrect: A Committee constituted by the Government in 2013 under the Chairmanship of Shri Ramesh Chand with a view to examine the methodological issues in fixing MSP. The Committee in its Report submitted in 2015 suggested certain changes in sampling design among others.

Option d is incorrect: The committee chaired by former CAG Rajiv Mehrishi will measure the impact on the national economy and financial stability of waiving of interest and COVID-19 related moratorium.

75. Choose correct one regarding the Aditya L1 Mission.

1. One of the goals of the mission is to study dynamics of the solar atmosphere, including chromosphere and corona.
2. The Aditya L1 mission will enhance our understanding of how the Sun influences Earth's climate.

Select the correct answer:

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

Answer: (c) Both 1 and 2

Explanation:

Aditya-L1 is the first space based observatory class Indian solar mission to study the Sun from a substantial distance of 1.5 million kilometers. It will take approximately 125 days to reach the L1 point.

Aditya-L1 is also ISRO's second astronomy observatory-class mission after AstroSat (2015).

And recent observatory is X-ray Polarimeter Satellite (XPoSat) (2024)

The spacecraft is planned to be placed in a halo orbit around the Lagrangian point 1 (L1) of the Sun-Earth system.

Statement 1 is correct: The mission aims to provide valuable insights into the solar corona, photosphere, chromosphere, and solar wind.

Statement 2 is correct: The primary objective of Aditya-L1 is to gain a deeper understanding of the Sun's behavior, including its radiation, heat, particle flow, and magnetic fields, and how they impact Earth.

76. Consider the following statements about Bru community

1. They are recognised as a Particularly Vulnerable Tribal Group in Tripura.
2. They are a nomadic tribe involving Hilltop Jhum Cultivation and other food gathering activities.
3. They perform Hojagiri folk dance.

Select the correct answer:

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

Answer: (d)

Explanation:

Statement 1 is correct: Bru or Reang is a community indigenous to the Northeast, living mostly in Tripura, Mizoram, and Assam.

-In Tripura, they are recognised as a Particularly Vulnerable Tribal Group.

-They belong to Indo-Mongoloid racial stock. Their languages have an affinity with Austro-Asiatic groups under the Tibeto-Burman family.

Statement 2 is correct: They are still a nomadic tribe and a large number among them maintain their livelihood involving Hilltop Jhum Cultivation and other food gathering activities.

-They believe in spirits and the existence of a soul.

-By religion they are Hindus and most of their deities are akin to gods and goddesses of the Hindu faith. Among Reangs followers of Vaishnavism are found in good numbers.

-This tribal community traditionally are endogamous and do not marry outside their community.

Statement 3 is correct Dance is an integral part of Reang life. The Hojagiri folk dance of Reang sub tribe is rather well known all over the world

77. Consider the following statements regarding Web3.0.



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1. It is a new kind of internet service that is built using decentralized blockchains.
2. Web3.0 will enable peer to peer (seller to buyer) transactions by eliminating the role of the intermediary.

Select the correct answer:

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

Answer: (c) Both 1 and 2

Explanation:

Statement 1 is correct: The main feature that makes it the foundation for Web3 is decentralization.

Web3 and blockchain technologies are closely related as Web3 tech uses decentralized technologies to establish secure and transparent systems for interacting with the internet.

-Blockchain and Web3 are key parts of the emerging digital economy.

Statement 2 is correct: Decentralized and Fair Internet: Web3 will deliver a decentralized and fair internet where users control their own data.

-Eliminates Intermediaries: With block chain, the time and place of the transaction are recorded permanently.

-Thus, Web3 enables peer to peer (seller to buyer) transactions by eliminating the role of the intermediary.

78. Consider the following statements with respect to 'Stable Coins'

1. It is a digital currency whose value is pegged to a stable asset like US dollar or gold.
2. Tether is one of the many stable coins.

Which of the above given statements are incorrect?

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

Answer: (d) Neither 1 and 2

Explanation:

Statement 1 is correct: Stablecoins are cryptocurrencies whose value is pegged, or tied, to that of another currency, commodity, or financial instrument. Stablecoins aim to provide an alternative

to the high volatility of the most popular cryptocurrencies, including Bitcoin (BTC), which has made crypto investments less suitable for common transactions.

- Stablecoins pursue price stability by maintaining reserve assets as collateral or through algorithmic formulas that are supposed to control supply.

- Stablecoins continue to come under scrutiny by regulators, given the rapid growth of the \$128 billion market and its potential to affect the broader financial system.

Statement 2 is correct: Tether (USDT) is the largest stablecoin by market capitalization. Crypto traders use stablecoins like Tether to make transfers between different cryptocurrencies or to move their investments into or out of fiat currencies. The value of USDT is pegged to the U.S. dollar.

79. Which of the following terms correctly denotes the term "Atlantification"?

- (a) It refers to the intrusion of Arctic waters into the Atlantic Ocean.
- (b) It refers to the intrusion of Atlantic waters into the Arctic Ocean.
- (c) Refers to a situation in which the Arctic Ocean becomes ice-free during the summer, with the sea ice area dropping below 1 million square kilometers.
- (d) None of the above.

Answer: (b)

Explanation:

Option b is correct: Atlantification is the increasing influence of Atlantic water in the Arctic. Warmer and saltier Atlantic water is extending its reach northward into the Arctic Ocean.

-This change in the Arctic climate is most prominent in the Barents Sea, a shallow shelf sea north of Scandinavia, where sea-ice is disappearing faster than in any other Arctic region, impacting the local and global ecosystem.

80. Which of the following rights conferred by the Constitution of India is also available to non-citizens?

- (a) Freedom of speech.
- (b) Right to Constitutional Remedies
- (c) Freedom to acquire Property.



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(d) Equality of opportunity in matters of public employment.

Answer: (b) Right to Constitutional Remedies

Explanation:

Option b is correct: However, except for article 15, 16, 19, 29 and 30, and the right to vote and constitutional posts, every right given in the part 3 of the constitution of India is available to the non-citizens, or is available to every 'person', irrespective of his/her nationality, and not specifically to the citizens.

81. Consider the following statements about 'Dakar Declaration'

1. The Declaration called for urgent global emissions reduction and for operationalizing the new Loss and Damage Fund
2. It was adopted under the aegis of the United Nations Environment Programme.

Select the correct answer:

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

Answer: (a) 1 only

Explanation:

Statement 1 is correct: The Dakar Declaration called for:

- Urgent global emission reductions,
- More climate finance,
- A strong result from the introduction of the new loss fund

An ambitious global review to address gaps in global climate action.

Statement 2 is incorrect: The Dakar 2023 Joint Declaration on Climate Change outlines the expectations and priorities of the least developed countries for the 28th Conference of the Parties (COP28) to the United Nations Framework Convention on Climate Change (UNFCCC).

82. Consider the following statements with respect to "Sickle cell Disease (SCD)"

Statement 1 - SCD is a chronic single gene disorder causing a debilitating systemic syndrome characterized by chronic anaemia, chronic organ

damage and by a significant reduction in life expectancy.

Statement 2 - SCD results in the dysfunctional, sickle shaped white blood cells.

Select the correct answer:

- (a) Statement -1 is true, statement -2 is true; statement -2 is the correct explanation for statement -1.
- (b) Statement -1 is true, statement -2 is true; statement -2 is NOT the correct explanation for statement -1.
- (c) Statement -1 is true, statement -2 is false.
- (d) Statement -1 is false, Statement -2 is true.

Answer : (c) Statement -1 is true, statement -2 is false.

Explanation:

Statement 1 is true: SCD (Sickle cell Disease) is a chronic single gene disorder causing a debilitating systemic syndrome characterized by chronic anemia, acute painful episodes, organ infarction and chronic organ damage and by a significant reduction in life expectancy.

It is a group of inherited red blood cell disorders that affect hemoglobin, the protein that carries oxygen through the body.

-Normally, red blood cells are disc-shaped and flexible enough to move easily through the blood vessels.

-If one has sickle cell disease, their red blood cells are crescent- or "sickle"-shaped.

-These cells do not bend or move easily and can block blood flow to the rest of your body.

-The blocked blood flow through the body can lead to serious problems, including stroke, eye problems, infections, and episodes of pain called pain crises.

-It is an autosomal recessive condition. A person needs two copies of the gene to have the disease. If they have only one copy of the gene, they are said to have sickle cell trait.

Sickle cell disease is a lifelong illness. A blood and bone marrow transplant is currently the only cure for sickle cell disease, but there are effective treatments that can reduce symptoms and prolong life.

Statement 2 is false:- If one has sickle cell disease, their red blood cells are crescent- or "sickle"- shaped, not the white blood cells.



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83. Erg Chech 002, sometimes seen in the news is related to?

- (a) An invasive species responsible for declining frog population.
- (b) The oldest space rocks ever discovered.
- (c) A sub-variant of Covid-19 found in Europe.
- (d) Lunar Mission by Japanese Aerospace Exploration Agency

Answer: (b) The oldest space rocks ever discovered.

Explanation:

Option b is correct: Scientists have conducted an analysis of the Erg Chech 002 meteorite, one of the oldest space rocks ever discovered. The data could provide insights into the early solar system.

- Erg Chech 002 is a meteorite, which is approximately 4.6 billion years old, was found in the Erg Chech region of the Sahara Desert in Algeria in 2020.

-Meteorites like Erg Chech 002 are thought to have formed from material in a disk of gas and dust around the young Sun.

84. Choose the correct answer regarding 'Muthuvan Tribe'

- 1. Population of Muthuvan tribe is limited to fragmented habitats in the Eastern Ghats.
- 2. Traditionally, Muthuvans are nomadic agriculturists, hunters and trappers.

Select the correct answer:

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

Answer: (b) 2 only

Explanation:

Statement 1 is incorrect: In Malayalam, the word Muthuvan means those who carry something on their back. It is said that they carried their children and belongings on their back during their migration to the Western Ghats, hence they were called Muthuvan. The Muthuvan are distributed in Idukki districts and in the adjoining Western Ghats of the Palakkad, Thrissur districts and in hills of Coimbatore and Madurai. They speak a dialect of their own.

Statement 2 is correct: Traditionally the Muthuvans are nomadic agriculturists, hunters and trappers.

Their primary cultivations are coffee, ginger, sugarcane and paddy. The Muthuvan tribe grows ragi, cardamom and lemon grass. Now they are also cultivating banana and tapioca for their daily usage. The Muthuvan are tribal religionists. The present day Muthuvans claim that they are Hindus.

85. Consider the following statements about "Protein-Binders".

- 1. These are biological agents that bind to a specific target protein, helpful in manufacturing a wide range of new food products, especially semi-solid or solid foods.
- 2. These are known to enhance the digestibility of the protein bound and thereby the biological and nutritive value of milk proteins.

Select the correct answer:

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

Answer: (a) 1 only

Explanation:

FSSAI has clarified that addition of protein binders or any other additives in dairy products is not permitted. This clarification came at a time when certain players are adding protein binders to offer thicker texture in dairy products such as curd.

Statement 1 is correct: Protein binders are biological research reagents which bind to a specific target protein to manufacture a wide range of new food products.

- Protein binding can enhance or detract performance.

Statement 2 is incorrect: These are known to affect the digestibility of the protein bound and thus can affect the biological and nutritive value of milk proteins.

-Protein binding also influences the bioavailability and distribution of active compounds.

86. How many pairs of positive integers x, y exist such that $HCF(x, y) + LCM(x, y) = 91$?

- (a) 10
- (b) 9
- (c) 8
- (d) 7



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Ans: c

87. LCM of 2 natural numbers p and q where $p > q$ is 935. What is the maximum possible sum of the digits of q?

- (a) 1
- (b) 6
- (c) 15
- (d) 16

Ans: d

88. Sum of two numbers x, y = 1050. What is the maximum value of the HCF between x and y?

- (a) 350
- (b) 700
- (c) 1050
- (d) 525

Ans: d

89. There are 2 numbers such that $a > b$, $HCF(a, b) = h$ and $LCM(a, b) = l$. What is the LCM of $a - b$ and b?

- (a) 1
- (b) $(a - b) b$
- (c) $(a - b) b / h$
- (d) $h(a - b)$

Ans c

90. There is a number greater than 1 which when divided by 4, 5 and 6 leaves the same remainder of 3 in each case. Find the largest number, smaller than 1000 which satisfy the given condition.

- (a) 957
- (b) 993
- (c) 960
- (d) 963

Ans d

91. For how many value of 'P' the LCM of P and 20 will be 40.

- (a) 1
- (b) 2
- (c) 4
- (d) More than 4

Ans b

92. Find the least number by which 750 should be multiplied, so that it becomes a perfect cube.

- (a) 12
- (b) 24
- (c) 36
- (d) 48

Ans c

93. If $a=0.1039$, then the value of $\sqrt{4a^2 - 4a + 1} + 3a$

- (a) 0.1039
- (b) 0.2078
- (c) 1.1039
- (d) 2.1039

Ans: c

$$\begin{aligned} & \sqrt{4a^2 - 4a + 1} + 3a \\ &= \sqrt{(1)^2 + (2a)^2 - 2 \times 1 \times 2a} + 3a \\ &= \sqrt{(1 - 2a)^2} + 3a \\ &= (1 - 2a) + 3a \\ &= (1 + a) \\ &= (1 + 0.1039) \\ &= 1.1039 \end{aligned}$$

94. What should come in place of question mark in

$$\frac{\sqrt[3]{?}}{2.56} = \frac{100}{?}$$

- (a) 16
- (b) 4
- (c) 64
- (d) 256

Ans: c

$$\frac{\sqrt[3]{?}}{2.56} = \frac{100}{?}$$

$$\therefore ? \times \sqrt[3]{?} = 2.56 \times 100$$

$$\therefore ? \times \sqrt[3]{?} = 2.56 = 4 \times 64$$

The answer to this can be found by simply Comparing right and left side of equation

We know that, $4^3=64$

$$\therefore \sqrt[3]{64}=4$$

$$\therefore ? \times \sqrt[3]{?} = 2.56 = \sqrt[3]{64} \times 64$$

$$\therefore ? = 64$$



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95. Four-fifth of one-eighth of $3/4^{\text{th}}$ of A is 64. What is the cube root of $3/5^{\text{th}}$ of A?

- (a) 5
- (b) 8
- (c) 3
- (d) 4

Ans: b

As per given condition, $\frac{4}{5} \times \frac{1}{8} \times \frac{3}{4} \times A = 64$

$$\therefore A = \frac{64 \times 5 \times 8 \times 4}{4 \times 3}$$

Now we want cube root of $3/5^{\text{th}}$ of A

$$\therefore \sqrt[3]{\frac{3}{5} \times A} = \sqrt[3]{\frac{3}{5} \times \frac{64 \times 5 \times 8 \times 4}{4 \times 3}}$$

$$\therefore A = 8$$

96. What is value of

$$\sqrt{56 + \sqrt{56 + \sqrt{56 + \sqrt{56 + \dots}}}}$$

- (a) 7.48...
- (b) 7
- (c) 8
- (d) None of the above

Ans: c

97. Ajay had some books in his library. He tried packing them in bags in various ways. While packing 85 books in each bag, 9 bags were not filled completely. Also, while packing 58 books in each bag, 13 bags were not enough to pack all the books. But in the end he was able to pack the books in M bags each having M books. How many books did Ajay have?

- (a) 765
- (b) 812
- (c) 729
- (d) 784

Ans: d

Since M bags are there and each has M books, Total books = $M \times M = M^2$

Only options C and D are perfect squares.

729 is a perfect square

But it cannot be answer as condition is that with 58 books in each bag, 13 bags are not sufficient.

$$58 \times 13 = 754 > 729$$

So if 729 is the answer, 13 bags are sufficient.

So answer is Option D = 784

98. Prashant had some pebbles in his treasure. His friend said, that he could arrange all the 17424 pebbles in a two dimensional square matrix. How many rows did he make?

- (a) 132
- (b) 138
- (c) 141.2
- (d) 145.8

Ans: b

Since it is a square matrix, no. of rows = No. of columns

Let number of pebbles in each row be P

$$\therefore \text{Number of rows} = P$$

$$\text{Total Pebbles} = PP = P^2 = 17424$$

$$\therefore P = 132 = \text{No of rows}$$

99. Find the value of X if $X = (0.004096)^{1/6}$

- (a) 0.04
- (b) 0.4
- (c) 4
- (d) 64

Ans: b

The solution might look lengthy but is very easy. $(0.004096)^{1/6} = (0.004096)^{(1/3 * 1/2)}$

Here we need to find cube root first and then square root.

4096 ends with 6. So, cube root will have 6 in the end.

Neglect last 3 digits. We are left with 4

Nearest cube to 4 which is less than 4 is $1^3 = 1$.

So cube root of 4096 = 16

Also there are 6 decimal places.

We want cube root. Hence decimals in cube root will be $6/3 = 2$

$$\text{So } (0.004096)^{(1/3)} = 0.16$$

Now, square root of 16 = 4

There are 2 decimal places and we want square root.

So decimals in square root will be $2/2 = 1$

So, the answer is 0.5

100. Find the HCF and LCM of the polynomials $(a^2 - 5a + 6)$ and $(a^2 - 7a + 10)$

- (a) $(a-2)(a-3)(a-5)$



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- (b) (a-2) (a-2) (a-3)
- (c) (a-3) (a-2) (a-3) (a-5)
- (d) (a-2) (a-2) (a-3) (a-5)²

Ans: a

