1. Consider the following statements:

Statement I: Compressed Biogas (CBG), after purification and compression, possesses the same chemical composition and fuel characteristics as conventional fossil-based Compressed Natural Gas (CNG).

Statement II: Raw biogas is a renewable, carbon-neutral gaseous fuel composed predominantly of carbon dioxide, along with smaller quantities of methane and trace gases.

Which one of the following is correct in respect of the above statements?

A. Both Statement I and Statement II are correct and Statement II is the correct explanation for Statement I.
B. Both Statement I and Statement II are correct and Statement II is not the correct explanation for Statement I.
C. Statement I is correct but Statement II is incorrect.
D. Statement I is incorrect but Statement II is correct.

Answer: C

Explanation:

Statement I is **correct**. Raw biogas undergoes purification to remove carbon dioxide, hydrogen sulfide, moisture, and other impurities before being compressed. The resulting **Compressed Biogas (CBG)** contains over 90% methane, making it chemically comparable to conventional fossil-derived **Compressed Natural Gas (CNG)** and suitable for use in the same vehicles and infrastructure.

Statement II is **incorrect** because biogas is composed **primarily of methane (CH_4)**, generally constituting about 50–70% of the mixture, while carbon dioxide forms the second-largest component. Therefore, it cannot be described as being predominantly composed of carbon dioxide.

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2. Consider the following statements regarding NIDAR 2.0:

1. NIDAR 2.0 serves as the flagship drone innovation platform under the Ministry of Electronics and Information Technology's (MeitY) **SwaYaan** initiative.
2. Under **Track 1**, participating engineering students are required to develop fully autonomous swarm drones capable of undertaking disaster-response operations.
3. **Track 2** focuses on designing drones capable of autonomous navigation in dark, GPS-denied indoor environments.
4. The initiative has been launched jointly by MeitY and the **Drone Federation of India (DFI)**.

Which one of the following conclusions based on the above statements is correct?

A. All four statements are correct.
B. None of the statements is correct.
C. Three statements are correct, including Statement 1.
D. Only one statement is correct.

Answer: C

Explanation:

Statement 1 is **correct**. **NIDAR 2.0 (National Innovation Challenge for Drone Application and Research)** is the flagship innovation programme under MeitY's **SwaYaan** initiative, aimed at strengthening India's indigenous drone ecosystem.

Statement 2 is **correct**. **Track 1** requires engineering students to develop autonomous swarm drones capable of disaster management tasks such as locating survivors, mapping affected areas, and delivering emergency supplies without dependence on conventional communication systems.

Statement 3 is **incorrect**. The challenge of autonomous navigation in dark, GPS-denied indoor environments also falls under **Track 1**, whereas **Track 2** is dedicated to developing indigenous flight controllers and autopilot systems based on the **VEGA processor architecture**.

Statement 4 is **correct**. The initiative has been launched in collaboration with the **Drone Federation of India (DFI)** to foster industry-academia cooperation and promote self-reliance in drone technologies.

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3. Consider the following statements regarding the Ladakh Autonomous Hill Development Council (LAHDC):

Statement I: The Council exercises statutory executive authority over the allotment, use, and occupation of government land vested in it.

Statement II: The Deputy Commissioner of the district functions as the Chief Executive Officer (CEO) of the Council.

Statement III: The Council is empowered to impose and collect specified local taxes, fees, and other levies.

Which of the following relationships among the above statements is/are correct?

1. Statement II provides the legal basis for the executive powers described in Statement I.
2. Statement III contradicts the decentralized administrative framework reflected in Statement I.
3. Statements I and III together demonstrate the Council's decentralized administrative and financial authority.

Select the correct answer using the code given below.

A. 1 only
B. 1 and 2 only
C. 2 and 3 only
D. 3 only

Answer: D

Explanation:

Statement I is **correct** because the LAHDC has statutory executive authority over the allotment, use, and occupation of government land vested in the Council under the relevant legislation.

Statement II is also **correct**. The **Deputy Commissioner** serves as the **Chief Executive Officer (CEO)** of the Council, ensuring coordination between the district administration and the elected Council. However, this administrative arrangement does not constitute the legal source of the Council's land-related powers. Therefore, **Relationship 1 is incorrect**.

Statement III is **correct** because the Council is empowered to levy and collect specified local taxes and fees. These financial powers complement its executive responsibilities rather than contradict them. Hence, **Relationship 2 is incorrect**, while **Relationship 3 is correct**, as Statements I and III together reflect the Council's decentralized administrative and fiscal autonomy.

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4. Consider the following statements regarding the atmospheric transformation of Sulfur Dioxide (SO_2):

Statement I: In the atmosphere, sulfur dioxide undergoes oxidation reactions with water vapour and oxygen, resulting in the formation of secondary sulfate aerosols.

Statement II: These sulfate aerosols constitute a major fraction of fine particulate matter (PM2.5) and significantly contribute to adverse human health impacts.

Which one of the following is correct in respect of the above statements?

A. Statement I is correct but Statement II is incorrect.
B. Statement I is incorrect but Statement II is correct.
C. Both Statement I and Statement II are correct.
D. Neither Statement I nor Statement II is correct.

Answer: C

Explanation:

Statement I is **correct**. Sulfur dioxide emitted from industrial activities, thermal power plants, and volcanic eruptions undergoes atmospheric oxidation in the presence of water vapour and oxygen to produce sulfuric acid and **secondary sulfate aerosols**.

Statement II is also **correct**. Sulfate aerosols are a major constituent of **PM2.5**, enabling them to penetrate deep into the lungs and bloodstream. Exposure to these fine particles is associated with respiratory illnesses, cardiovascular diseases, strokes, and premature mortality. Additionally, sulfate aerosols contribute to **acid rain**, which degrades soil quality and damages freshwater ecosystems.

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5. Consider the following statements:

Statement I: India has introduced the **'SHANTI' Vision** as the principal strategic framework guiding its campaign for election to the United Nations Security Council (UNSC) as a non-permanent member for the **2028–29** term.

Statement II: The acronym **SHANTI** stands for **Securing Holistic Advancement through Norms, Trust and Integrity**.

Which one of the following is correct in respect of the above statements?

A. Both Statement I and Statement II are correct and Statement II is the correct explanation for Statement I.
B. Both Statement I and Statement II are correct and Statement II is not the correct explanation for Statement I.
C. Statement I is correct but Statement II is incorrect.
D. Statement I is incorrect but Statement II is correct.

Answer: B

Explanation:

Statement I is **correct**. India has unveiled the **SHANTI Vision** as the guiding strategic framework for its campaign for a non-permanent seat on the **United Nations Security Council (UNSC)** for the **2028–29** term.

Statement II is also **correct**. The acronym **SHANTI** expands to **Securing Holistic Advancement through Norms, Trust and Integrity**.

However, Statement II **does not explain** why SHANTI serves as the campaign's foundational vision. It merely provides the literal expansion of the acronym. The rationale behind adopting the SHANTI framework lies in India's emphasis on strengthening multilateralism, addressing global conflicts, promoting trust, and amplifying the concerns of the Global South. Hence, both statements are correct, but Statement II is **not** the correct explanation for Statement I.

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6. Consider the following statements regarding Debrigarh Wildlife Sanctuary:

Statement I: The vegetation of Debrigarh Wildlife Sanctuary is predominantly characterized by tropical dry deciduous forests interspersed with extensive grasslands.

Statement II: The sanctuary holds historical significance as **Veer Surendra Sai** established a strategic guerrilla base within its rugged hill ranges during his resistance against British rule.

Which one of the following is correct in respect of the above statements?

A. Statement I is correct but Statement II is incorrect.
B. Statement I is incorrect but Statement II is correct.
C. Both Statement I and Statement II are correct.
D. Neither Statement I nor Statement II is correct.

Answer: C

Explanation:

Statement I is **correct**. Debrigarh Wildlife Sanctuary in Odisha is primarily covered by **tropical dry deciduous forests** along with extensive grasslands. These habitats support a rich diversity of herbivores and provide suitable ecological conditions for numerous wildlife species.

Statement II is also **correct**. The sanctuary possesses considerable historical importance as **Veer Surendra Sai**, one of Odisha's prominent freedom fighters, established a strategic guerrilla base at **Barapathara** within its rugged hills while resisting the British East India Company.

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7. Which one of the following processes best explains the necessity of scrubbing raw biogas before compressing it into Compressed Biogas (CBG)?

A. Reducing the pressure required for the methanogenesis stage during anaerobic digestion.

B. Removing carbon dioxide, hydrogen sulfide, and moisture to increase methane concentration beyond 90 percent.

C. Converting complex organic matter into soluble compounds through acidogenic bacteria.

D. Eliminating aerobic microorganisms remaining after anaerobic digestion.

Answer: B

Explanation:

Raw biogas contains substantial amounts of **carbon dioxide (CO_2), hydrogen sulfide (H_2S), and water vapour**, which reduce its calorific value and may corrode storage tanks, pipelines, and engines. Therefore, **scrubbing** is carried out to remove these undesirable components and enrich the methane concentration to **more than 90%**, producing **Compressed Biogas (CBG)** that is chemically comparable to fossil-derived **Compressed Natural Gas (CNG).**

Option A is incorrect because **methanogenesis** is a biological stage occurring inside the anaerobic digester before gas purification.

Option C is incorrect because it refers to the **acidogenesis** stage of anaerobic digestion rather than post-production gas purification.

Option D is incorrect because anaerobic digestion occurs in the absence of oxygen, and removal of aerobic microorganisms is not the purpose of the scrubbing process.

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8. Consider the following statements regarding the Ladakh Autonomous Hill Development Council (LAHDC):

Statement I: The Ladakh Autonomous Hill Development Council has been constituted as a **body corporate** under the relevant legislation.

Statement II: As a body corporate, the Council possesses perpetual succession, a common seal, and the legal capacity to acquire property, enter into contracts, and sue or be sued in its own name.

Which one of the following is correct in respect of the above statements?

A. Both Statement I and Statement II are correct and Statement II is the correct explanation for Statement I.
B. Both Statement I and Statement II are correct and Statement II is not the correct explanation for Statement I.

C. Statement I is correct but Statement II is incorrect.
D. Statement I is incorrect but Statement II is correct.

Answer: A

Explanation:

Statement I is **correct**. The **Ladakh Autonomous Hill Development Council (LAHDC)** is established as a **body corporate** under the relevant legislation, giving it a legal identity distinct from both the government and its individual members.

Statement II is also **correct**. A body corporate is legally characterized by **perpetual succession**, the possession of a **common seal**, and the authority to own property, enter into contracts, and sue or be sued in its own name. These are the defining legal attributes of corporate status and directly explain why the Council is recognized as a body corporate.

Hence, Statement II correctly explains Statement I.

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9. During the process of anaerobic digestion, biogas is generated through a sequence of biochemical stages. In this context, consider the following pairs:

Stage of Anaerobic Digestion	Associated Biochemical Process
1. Hydrolysis	Conversion of volatile fatty acids into methane-rich biogas
2. Acidogenesis	Transformation of complex organic polymers into soluble organic compounds
3. Methanogenesis	Utilization of intermediate volatile fatty acids by methanogenic archaea to produce methane

How many of the pairs given above are correctly matched?

A. Only one pair
B. Only two pairs
C. All three pairs
D. None of the pairs

Answer: A

Explanation:

Pair 1 – Incorrect. During **hydrolysis**, complex organic substances such as carbohydrates, proteins, and lipids are broken down into soluble sugars, amino acids, and fatty acids. Methane formation does not occur during this stage.

Pair 2 – Incorrect. The conversion of complex polymers into soluble compounds takes place during **hydrolysis**, not acidogenesis. During **acidogenesis**, the soluble products formed during hydrolysis are converted into volatile fatty acids (VFAs), alcohols, hydrogen, carbon dioxide, and other intermediate compounds.

Pair 3 – Correct. During **methanogenesis**, methanogenic archaea utilize acetate and other intermediate compounds, including volatile fatty acids, to generate methane, completing the anaerobic digestion process.

Therefore, **only one pair is correctly matched.**

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10. With reference to the practical applications of Artificial Intelligence (AI) models and agentic workflows, consider the following pairs:

Application Area	Primary Function
1. Advanced Cyber Security	Automated identification of software vulnerabilities and generation of security patches
2. Physics-Based Media Generation	Simulation of realistic motion to edit videos and develop interactive virtual environments
3. No-Code Software Engineering	Building, testing, and deploying multi-agent software systems using natural language instructions

How many of the pairs given above are correctly matched?

A. 1 and 2 only
B. 2 and 3 only
C. 1 and 3 only
D. 1, 2 and 3

Answer: D

Explanation:

Pair 1 – Correct. Modern AI systems can automatically analyze extensive codebases, identify software vulnerabilities, recommend fixes, and assist developers in generating and deploying security patches.

Pair 2 – Correct. Advanced generative AI models incorporate an understanding of physical motion, gravity, and object interactions to create realistic video edits and immersive virtual environments.

Pair 3 – Correct. AI-powered no-code and agentic development platforms can generate, test, debug, and deploy complete multi-agent software applications directly from natural language prompts, significantly reducing manual programming effort.

Hence, **all three pairs are correctly matched.**

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11. Consider the following statements:

Statement I: The unilateral enforcement of maritime blockades against commercial energy shipments by a country may generate diplomatic tensions with neutral states engaged in lawful international trade.

Statement II: The **United Nations Convention on the Law of the Sea (UNCLOS)** safeguards the right of innocent passage for neutral commercial vessels through international waters and important maritime straits.

Which one of the following is correct in respect of the above statements?

A. Both Statement I and Statement II are correct and Statement II is the correct explanation for Statement I.
B. Both Statement I and Statement II are correct and Statement II is not the correct explanation for Statement I.
C. Statement I is correct but Statement II is incorrect.
D. Statement I is incorrect but Statement II is correct.

Answer: A

Explanation:

Statement I is **correct**. When a country unilaterally imposes maritime blockades on commercial energy exports, actions against neutral merchant vessels can create diplomatic disputes with third-party trading nations whose commercial interests are affected.

Statement II is also **correct**. **UNCLOS** guarantees the principle of **innocent passage** for neutral commercial ships through international waters and key maritime straits, thereby protecting the freedom of international navigation.

Statement II correctly explains Statement I because unilateral enforcement measures that interfere with internationally recognized navigation rights under UNCLOS are likely to trigger diplomatic objections and strain bilateral relations with affected countries.

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12. Consider the following statements regarding the Varya AI Model:

1. **Varya** is India's first indigenous distilled foundation AI model designed for text-to-video and image-to-video generation.
2. The model utilizes **machine learning distillation** to compress a large foundation model into a lightweight architecture capable of generating videos in significantly fewer computational steps.
3. The model has been trained using Indian cultural contexts, enabling accurate representation of regional attire, festivals, languages, and food traditions.

Which one of the following conclusions based on the above statements is correct?

A. Only one statement is correct.
B. None of the statements is correct.
C. Two statements are correct, including Statement 3.
D. All three statements are correct.

Answer: D

Explanation:

Statement 1 is **correct**. **Varya**, unveiled under the Ministry of Electronics and Information Technology (MeitY), is India's first indigenous distilled AI video-generation model, developed by **Avataar**.

Statement 2 is **correct**. It employs **machine learning distillation**, which compresses a large AI foundation model into a lightweight version capable of producing high-quality videos in only a few computational steps, significantly improving speed and reducing costs.

Statement 3 is **correct**. Unlike many global AI models, Varya has been trained using Indian datasets, enabling it to accurately portray regional festivals, traditional clothing, local cuisines, languages, and cultural practices.

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13. How does an El Niño event typically modify the oceanic and atmospheric conditions over the equatorial Pacific Ocean?

A. It strengthens the easterly trade winds, enhancing cold-water upwelling along the western coast of South America.

B. It weakens or reverses the trade winds, allowing warm surface waters to shift eastward and suppressing cold-water upwelling near Peru and Ecuador.

C. It shifts the principal zone of convection westward toward Indonesia, leading to a decline in global temperatures.

D. It deepens the thermocline in the western Pacific and strengthens the normal Walker Circulation.

Answer: B

Explanation:

Under normal conditions, persistent easterly trade winds push warm surface waters toward the western Pacific, allowing cold, nutrient-rich waters to upwell along the South American coast.

During an **El Niño** event, these trade winds weaken or reverse, enabling warm surface waters to migrate eastward across the Pacific Ocean. The accumulation of warm water deepens the thermocline in the eastern Pacific, suppresses the normal upwelling of cold water, weakens the **Walker Circulation**, and shifts convection and thunderstorm activity eastward. These changes influence weather patterns across the globe and often contribute to higher global average temperatures.

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14. Consider the following statements regarding the herbicide Paraquat:

Statement I: Consumption of even a small quantity of Paraquat can result in irreversible cellular injury, progressive pulmonary fibrosis, and multiple organ failure.

Statement II: Administration of supplemental oxygen through mechanical ventilation reduces oxidative damage in patients suffering from Paraquat poisoning.

Statement III: Paraquat is a selective contact herbicide that destroys only particular categories of grassy weeds.

Which one of the following is correct in respect of the above statements?

A. Both Statements II and III are correct and both explain Statement I.

B. Both Statements II and III are correct, but only one explains Statement I.

C. Only one of Statements II and III is correct and it explains Statement I.

D. Neither Statement II nor Statement III is correct.

Answer: D

Explanation:

Statement I is **correct**. Paraquat is an extremely toxic herbicide. Even small quantities can cause irreversible cellular injury, severe lung fibrosis, and progressive multi-organ failure. There is no specific antidote.

Statement II is **incorrect** because supplemental oxygen may actually worsen Paraquat poisoning by promoting the formation of **reactive oxygen species (ROS)**, thereby accelerating oxidative lung damage.

Statement III is **incorrect** because Paraquat is a **non-selective contact herbicide**, capable of destroying almost all green plant tissues with which it comes into contact.

Therefore, neither Statement II nor Statement III is correct.

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15. Consider the following pairs of major launch vehicles and their corresponding space agencies or nations:

Launch Vehicle	Space Agency / Nation
1. H3 Rocket	European Space Agency (ESA)
2. Ariane 6	Japan Aerospace Exploration Agency (JAXA)
3. LVM3	Indian Space Research Organisation (ISRO)
4. Long March 5	China National Space Administration (CNSA)

How many of the pairs given above are correctly matched?

A. Only one pair

B. Only two pairs

C. Only three pairs

D. All four pairs

Answer: B

Explanation:

Pair 1 – Incorrect. H3 Rocket is Japan's next-generation launch vehicle developed by **JAXA** and Mitsubishi Heavy Industries, not by the European Space Agency.

Pair 2 – Incorrect. Ariane 6 is Europe's flagship launch vehicle developed under the **European Space Agency (ESA)** and Arianespace, not by Japan.

Pair 3 – Correct. LVM3 is ISRO's operational heavy-lift launch vehicle used for lunar missions, commercial launches, and human spaceflight preparations.

Pair 4 – Correct. Long March 5 is China's flagship heavy-lift launch vehicle operated under the **China National Space Administration (CNSA)**.

Hence, **only two pairs are correctly matched.**

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16. Consider the following statements:

Statement I: Generative AI systems developed using machine learning distillation generally require lower computational resources while delivering faster processing performance.

Statement II: Machine learning distillation compresses a large foundation model into a lightweight architecture capable of producing high-quality outputs through substantially fewer computational steps.

Which one of the following is correct in respect of the above statements?

A. Both Statement I and Statement II are correct and Statement II is the correct explanation for Statement I.

B. Both Statement I and Statement II are correct and Statement II is not the correct explanation for Statement I.

C. Statement I is correct but Statement II is incorrect.

D. Statement I is incorrect but Statement II is correct.

Answer: A

Explanation:

Statement I is **correct**. Distilled generative AI models significantly reduce computational requirements, improve execution speed, and lower operational costs, making advanced AI applications more accessible.

Statement II is also **correct**. **Machine learning distillation** transfers knowledge from a large foundation model into a compact, optimized model that achieves comparable performance while requiring far fewer computational steps.

Statement II directly explains Statement I because the reduced computational cost and faster inference achieved by distilled AI models are the direct result of compressing the original model into a more efficient architecture.