UPCATET General Studies Sample Paper-6

Duration: 10 Minutes **Maximum Marks: 80**

Instructions

- This paper contains **20** Multiple Choice Questions.
- Each correct answer carries **+4** mark. Incorrect answer: **−1** marks. Only **one** correct option.
- Unattempted questions carry **0** marks.
- Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.

Q1. A physiological researcher measures the net photosynthesis rate of an elite C4 crop (e.g., Zea mays) under extreme ambient conditions. If the intercellular carbon dioxide concentration (C_i) drops drastically due to sudden stomatal closure, which of the following initial biochemical responses best distinguishes this C4 species from a classic C3 species?

(A) Accelerated rates of photorespiration

(B) Immediate saturation of RuBisCO

(C) Sustained PEP-carboxylase fixation

(D) Rapid decarboxylation in bundle-sheath

Q2. A precision agricultural soil-core column is subjected to a heavy influx of synthetic ammonium sulfate fertilizer over multiple cultivation cycles. In a sub-surface anaerobic horizon lacking effective micro-aerophilic venting, which specific microbiological transition mechanism is primarily responsible for the ultimate gaseous loss of applied nitrogen directly to the atmosphere?

(A) Dissimilatory nitrate reduction

(B) Anaerobic ammonium oxidation (Anammox)

(C) Assimilatory sulfate reduction

(D) Chemoautotrophic nitrification

Q3. An environmental monitoring station records a sharp spike in Ground-Level Ozone (O_3) across an industrial agricultural belt. Assuming constant solar UV influx, which specific radical chain-termination reaction sequence involving volatile organic compounds (VOCs) and nitrogen oxides (NO_x) would most effectively suppress this tropospheric ozone accumulation window?

(A) Photolysis of nitrogen dioxide

(B) Formation of Peroxyacetyl Nitrates

(C) Hydroxyl radical attack on methane

(D) Rapid photolytic cleavage of water

Q4. Consider the thermodynamic phase behavior of water within ultra-fine capillary structures of unsaturated clay soils during deep sub-zero winter cooling. The structural restriction of the clay matrix alters the standard free energy of the water, preventing ice crystal nucleation at normal thermal thresholds. This state of water is formally classified as:

(A) Chemisorbed hydration film

(B) Supercooled capillary water

(C) Osmotic boundary water

(D) Crystalline permafrost matrix

Q5. During the rigorous transition of the agrarian land revenue framework in the North-Western Provinces (modern-day Western Uttar Pradesh) during the 1830s, Holt Mackenzie's initial conceptualizations were formalized under Regulation IX of 1833. Who was the colonial administrator who practically overhauled this settlement system by introducing scientific field mapping, soil classification, and realistic rental value estimates?

(A) Jonathan Duncan

(B) Robert Merttins Bird

(C) Thomas Law

(D) Sir Antony MacDonnell

Q6. A geographic transect across the Terai-Bhabar geomorphic transition zone of northern Uttar Pradesh reveals a distinct hydrological anomaly. Streams flowing southward from the outer Shiwalik foothills completely disappear from the surface in the Bhabar tract only to forcefully resurface downstream in the Terai zone. This surface disappearance in the Bhabar is fundamentally caused by:

(A) High clay content crusting

(B) Massive unconfined limestone caverns

(C) Highly porous coarse boulder scree

(D) Extensive deep-rooted riparian forests

Q7. Analyze the structural architectural components of early medieval temples found within the Lalitpur district of the Bundelkhand region in Uttar Pradesh. The Dashavatara Temple at Deogarh stands as a critical evolutionary milestone because it introduces which structural configuration for the first time in North Indian temple architecture?

(A) Octagonal sanctum sanctorum

(B) Fully developed Curvilinear Shikhara

(C) Hypostyle pillared assembly hall

(D) Twin-garbhagriha layout

Q8. The post-1857 revolutionary network in Oudh (Awadh) was heavily anchored by localized taluqdari resistance pockets. Which specific fortress settlement located in the modern Rae Bareli-Amethi tract became infamous in British military records for offering the most stubborn tactical defense under the leadership of Rana Beni Madho Baksh?

(A) Shankarpur Fort

(B) Chinar Garh

(C) Kalpi Bastion

(D) Shahgarh Citadel

Q9. The Bundelkhand upland region of South-Western Uttar Pradesh features a distinct red soil complex locally designated as 'Parwa' and 'Rakar'. From a purely pedogenic and geomorphological perspective, these specific soil units are derived directly from the weathering of which underlying geological basement formation?

(A) Vindhyan Sedimentary Sandstones

(B) Archean Granitoid Gneiss

(C) Deccan Basaltic Traps

(D) Quaternary Alluvial Silt

Q10. Under the structural provisions of the Constitution of India, if the Governor of Uttar Pradesh reserves a state legislative bill concerning mandatory agrarian land acquisition compensation for the consideration of the President, and the President subsequently directs the Governor to return the bill via a message under Article 201, what is the precise statutory timeline within which the State Legislature must reconsider this bill?

(A) Exactly six weeks

(B) Exactly three months

(C) Within a period of six months

(D) No rigid constitutional timeline

Q11. During the historical implementation phase of the First Five-Year Plan (1951–1956) in post-independence India, the state of Uttar Pradesh launched the pioneering Community Development Blocks. The spatial and administrative planning hierarchy for economic decentralization was modeled primarily on the successful pre-independence rural reconstruction pilot project known as the:

(A) Wardha Scheme of Education

(B) Etawah Pilot Project

(C) Firka Development Scheme

(D) Sriniketan Experiment

Q12. In the context of fiscal federalism and the structural distribution of resources, when the Union Government calculates the horizontal devolution pool for states, it applies a specific 'Demographic Performance' criterion. This performance vector is mathematically determined based on a state's success in controlling its Total Fertility Rate (TFR) relative to the population benchmark data of which specific census year?

(A) 1971 Census Data

(B) 2001 Census Data

(C) 2011 Census Data

(D) Average of 1991–2011 Data

Q13. Consider the legal dynamics of statutory marketing frameworks for agricultural commodities in Upper India. If an agricultural marketing board exercises its powers under the state-level APMC acts to regulate a specific primary produce, which constitutional item or entry from the Seventh Schedule provides the primary legislative competence for this intervention?

(A) Entry 14, State List (Agriculture)

(B) Entry 28, State List (Markets/Fairs)

(C) Entry 33, Concurrent List (Trade)

(D) Entry 26, State List (Intra-state trade)

Q14. The international GI (Geographical Indication) registry recently updated its schedule for artisanal handicraft clusters from Eastern Uttar Pradesh. Identify the distinct historical craft cluster originating from the Mirzapur-Chunar zone that relies entirely on a unique non-vitrified, low-temperature baked local slip-clay, producing a characteristic deep monochrome dark metallic finish:

(A) Nizamabad Black Pottery

(B) Gorakhpur Terracotta Craft

(C) Khurja Glazed Stoneware

(D) Chinhat Ceramic Ware

Q15. In international sport shooting events, a competitive athlete from Uttar Pradesh recently secured an Olympic quota berth using an advanced pneumatic air pistol system. From a biomechanical perspective, what is the maximum permissible trigger-pull weight configuration legally mandated by the International Shooting Sport Federation (ISSF) rules for the 10m Air Pistol qualification round?

(A) Minimum 500 grams weight

(B) Minimum 1000 grams weight

(C) Exactly 1360 grams weight

(D) No lower weight restriction

Q16. The classical music landscape of Uttar Pradesh is deeply anchored in institutional genealogies. The historic 'Gauhar Jan' recordings of the early 20th century permanently altered the performing grammar of the Thumri genre within the Purab Ang tradition. Which historical princely court in modern Uttar Pradesh served as the ultimate patronage crucible for refining this specific structural style?

(A) Rampur-Sahaswan Court

(B) Wajid Ali Shah's Awadh Court

(C) Banaras Royal Durbar

(D) Banda Bundela Court

Q17. The Ministry of New and Renewable Energy recently approved a major green energy corridor project mapping across the barren topography of Bundelkhand. A technical challenge encountered in setting up ultra-mega solar parks in Jhansi and Jalaun districts is the high thermal coefficient of PV modules. What physical phenomenon occurs to silicon solar cells when ambient daytime temperatures exceed 45 degrees Celsius?

(A) Open-circuit voltage drops

(B) Short-circuit current stops

(C) Bandgap energy increases

(D) Electron mobility drops to zero

Q18. An agricultural remote sensing payload captures multi-spectral raster images of western UP districts to calculate the Normalized Difference Vegetation Index (NDVI). To successfully differentiate healthy green vegetative canopy from dry, fallow topsoil, the sensor array must compute the ratio of electromagnetic reflectance values using which two distinct wavelength bands?

(A) Thermal Infrared and Green

(B) Near-Infrared and Visible Red

(C) Short-Wave Infrared and Blue

(D) Ultraviolet-A and Microwave X-band

Q19. In the context of secure digital data transmissions for state-sponsored rural banking and direct benefit transfers (DBT) via UPI systems, which cryptographic protocol primitive is fundamentally responsible for ensuring 'Non-Repudiation', meaning a sending party cannot falsely deny the authenticity of their transmitted transaction payload?

(A) Symmetric AES-256 block cipher

(B) Public-key Asymmetric Encryption

(C) Private-Key SHA-3 Hashing

(D) Digital Signature via Private Key

Q20. A network administrator configuration profile for an agricultural database cluster utilizes an IPv6 addressing architecture to scale up IoT sensor deployments across farm fields. What is the exact bit-length allocation of an IPv6 address header, and how many hexadecimal fields are used to represent it structurally?

(A) 64 bits structured into 4 fields

(B) 128 bits structured into 8 fields

(C) 256 bits structured into 16 fields

(D) 128 bits structured into 4 fields

Detailed Solutions

Q1.

Solution

Concept: C_4 plants possess an evolutionary, space-separated carbon fixation mechanism (Kranz anatomy) designed to bypass the inefficiencies of photorespiration under low intercellular CO_2 concentrations (C_i).

Solution:

Let's analyze the biochemical workflow when stomata close:

(a) When C_i drops, a classic C_3 plant suffers because its primary carboxylating enzyme, RuBisCO, begins fixing oxygen instead of CO_2, accelerating wasteful photorespiration.

(b) In a C_4 plant like *Zea mays*, initial carbon fixation is performed in the mesophyll cells by **Phosphoenolpyruvate carboxylase (PEP-carboxylase)**.

(c) PEP-carboxylase has an exceptionally high affinity for bicarbonate ions (HCO_3^-) and lacks affinity for oxygen (O_2).

(d) Therefore, even when stomatal closure drops C_i drastically, C_4 plants can maintain **sustained PEP-carboxylase fixation**, capturing trace CO_2 and concentrating it into the bundle-sheath cells to keep RuBisCO working efficiently.

Final Answer: Sustained PEP-carboxylase fixation

Answer: (C)

Go Back to Question 1

Q2.

Solution

Concept: The nitrogen cycle contains several biological pathways that transform fixed nitrogen compounds back into gaseous forms (N_2 or N_2O), allowing them to escape from the soil matrix back into the atmosphere.

Solution:

Let's analyze the microbial mechanisms under specific anaerobic conditions:

(a) Continuous applications of ammonium sulfate fertilizer load the soil with ammonium ions (NH_4^+).

(b) In sub-surface anaerobic layers lacking oxygen, standard aerobic nitrification cannot occur.

(c) Under these conditions, specific specialized autotrophic bacteria drive the **Anaerobic ammonium oxidation (Anammox)** pathway.

(d) In the Anammox process, bacteria utilize nitrite (NO_2^-) as an electron acceptor to directly oxidize ammonium (NH_4^+) into dinitrogen gas (N_2):

$$NH_4^+ + NO_2^- \rightarrow N_2 + 2H_2O$$

(e) This reaction shortcut acts as the primary pathway driving the ultimate gaseous loss of applied ammonium nitrogen directly to the atmosphere in perennially unvented, anoxic soil zones.

Final Answer: Anaerobic ammonium oxidation (Anammox)

Answer: (B)

Go Back to Question 2

Q3.

Solution

Concept: Tropospheric ozone (O_3) accumulation is driven by a radical catalytic cycle involving volatile organic compounds (VOCs) and nitrogen oxides (NO_x). Radical chain-termination reactions disrupt this loop by transforming active radical species into stable reservoir molecules.

Solution:

Let's evaluate the chemical impacts of the termination steps:

(a) The photolysis of NO_2 is the primary reaction that *generates* ground-level ozone, while the interaction of hydroxyl radicals with methane propagates the radical pool.

(b) To halt ozone accumulation, the highly reactive intermediate radicals must be chemically bound and removed from the active catalytic loop.

(c) The **formation of Peroxyacetyl Nitrates (PAN)** serves as an effective chain-termination sequence:

$$RCOOO^{\bullet} + NO_2 \rightleftharpoons RCOOO\text{-}NO_2 \text{ (PAN)}$$

(d) By trapping organic peroxyacyl radicals and nitrogen dioxide (NO_2) into a stable chemical reservoir, this termination path effectively removes the essential ingredients needed to sustain the ozone-producing cycle, suppressing tropospheric ozone spikes.

Final Answer: Formation of Peroxyacetyl Nitrates

Answer: (B)

Go Back to Question 3

Q4.

Solution

Concept: The physical behavior of water within ultra-fine soil capillaries is altered by spatial restrictions and surface interactions, which lower the chemical potential of the liquid below that of bulk water.

Solution:

Let's evaluate the thermodynamic phase change under sub-zero cooling:

(a) In dense, unsaturated clay matrices, water is confined within extremely narrow pore spaces.

(b) This microstructural confinement and intense surface tension force prevent water molecules from easily organizing into a crystalline ice lattice, suppressing the nucleation process.

(c) As a result, the water remains in a liquid state well below 0°C.

(d) This specific thermodynamic state is classified as **supercooled capillary water**. It allows water to remain fluid and mobile within fine soil pores despite freezing environmental temperatures.

Final Answer: Supercooled capillary water

Answer: (B)

Go Back to Question 4

Q5.

Solution

Concept: The Mahalwari land revenue system in the North-Western Provinces was originally conceived by Holt Mackenzie via Regulation VII of 1822, but its complicated procedures made it practically unworkable on the ground.

Solution:

Let's identify the administrator who reformed the settlement system:

(a) To fix the early failures of the Mahalwari framework, Lord William Bentinck's administration enacted Regulation IX of 1833.

(b) **Robert Merttins Bird** was appointed to oversee the revenue settlement of the North-Western Provinces.

(c) Known as the "Father of Land Settlement in Northern India," Bird practically overhauled the system by introducing systematic field mapping, detailed soil classification schemes, and realistic estimates of rental values. His technical and administrative reforms made the revenue machinery functional across western Uttar Pradesh.

Final Answer: Robert Merttins Bird

Answer: (B)

Go Back to Question 5

Q6.

Solution

Concept: The sub-Himalayan piedmont region of northern India is divided into two distinct geomorphic belts running parallel to the Shiwalik foothills: the *Bhabar* and the *Terai*.

Solution:

Let's analyze the hydrological dynamics of this transition zone:

(a) The **Bhabar** tract is a narrow belt situated directly at the base of the hills, formed by rivers depositing heavy sediments as they lose momentum upon entering the plains.

(b) This terrain consists of **highly porous coarse boulder scree**, gravels, and un-sorted pebbles.

(c) When streams flow out of the Shiwaliks into this boulder belt, the immense porosity allows the water to completely sink into the ground, causing surface streams to disappear.

(d) This underground water flows down the piedmont gradient until it encounters the fine clay and silt deposits of the **Terai** zone, where it forcefully resurfaces to create a marshy wetland ecosystem.

Final Answer: Highly porous coarse boulder scree

Answer: (C)

Go Back to Question 6

Q7.

Solution

Concept: The Gupta-era Dashavatara Temple at Deogarh (located in Lalitpur district, Uttar Pradesh) is a seminal monument in the evolution of classical Hindu temple architecture.

Solution:

Let's look at the architectural innovations introduced at Deogarh:

(a) Early Gupta temples were simple, flat-roofed, single-room square structures (such as Temple No. 17 at Sanchi).

(b) The Dashavatara Temple marks a significant evolutionary jump by introducing a **fully developed Curvilinear Shikhara** (a tapering mountain-like spire over the central sanctum).

(c) Though the upper portions of this tower are partially ruined, its tiered architectural design represents the earliest known prototype of the classic North Indian *Nagara* temple spire style.

Final Answer: Fully developed Curvilinear Shikhara

Answer: (B)

Go Back to Question 7

Q8.

Solution

Concept: Following the capture of Lucknow by British forces in early 1858, the 1857 Uprising shifted into a prolonged guerrilla war led by local taluqdars (landlords) inside their fortified rural strongholds across Awadh.

Solution:

Let's look at the historical records of the Oudh campaign:

(a) Rana Beni Madho Baksh, the prominent taluqdar of Shankarpur, emerged as an unyielding leader of the rural resistance in southern Awadh.

(b) His fortified home base, **Shankarpur Fort**, became infamous in British military records.

(c) Surrounded by dense thorny jungles and protected by heavy mud ramparts, this fortress settlement held off columns led by Sir Colin Campbell. It stood out as one of the most stubborn tactical defense operations during the pacification of the region.

Final Answer: Shankarpur Fort

Answer: (A)

Go Back to Question 8

Q9.

Solution

Concept: The composition of residual soils is heavily shaped by the mineral profile of the underlying bedrock from which they weather over geological time.

Solution:

Let's trace the origin of the Bundelkhand red soil complex:

(a) The uplands of south-western Uttar Pradesh are geologically defined by the ancient **Archean Granitoid Gneiss** complex (the Bundelkhand Craton).

(b) Long-term subaerial weathering of these felsic granites and foliated gneisses releases significant amounts of iron-bearing minerals like biotite and feldspars.

(c) The oxidation and hydration of these iron minerals yield ferric oxides, giving the resulting **Parwa** and **Rakar** soils their characteristic reddish tint and coarse, sandy-loam texture.

Final Answer: Archean Granitoid Gneiss

Answer: (B)

Go Back to Question 9

Q10.

Solution

Concept: Article 201 of the Constitution of India details the procedural rules when a state legislative bill is reserved by a Governor for the consideration of the President.

Solution:

Let's analyze the statutory timelines laid down in Article 201:

(a) When a bill is reserved for the President, the President can either assent to the bill, withhold assent, or direct the Governor to return it to the state legislature with a message requesting reconsideration.

(b) Article 201 explicitly states that when a bill is returned via such a message, the State House or Houses must reconsider it accordingly.

(c) It lays down a strict, mandatory window for this legislative action: the bill must be reconsidered **within a period of six months** from the date of receiving the message.

Final Answer: Within a period of six months

Answer: (C)

Go Back to Question 10

Q11.

Solution

Concept: Before launching nationwide community development programs in 1952, the Indian government evaluated several regional rural development pilot experiments to build an effective administrative model.

Solution:

Let's trace the origin of the Community Development Block layout:

(a) In 1948, Albert Mayer (an American architect and town planner) initiated the **Etawah Pilot Project** in Mahewa village, Uttar Pradesh, with backing from the provincial government.

(b) The project introduced a unified approach to rural reconstruction, focusing on improving agricultural techniques, sanitation, and literacy through a dedicated "Village Level Worker" (Gram Sevak).

(c) The outstanding success of the **Etawah Pilot Project** provided the spatial, operational, and administrative blueprint used to structure the Community Development Blocks nationwide during the First Five-Year Plan.

Final Answer: Etawah Pilot Project

Answer: (B)

Go Back to Question 11

Q12.

Solution

Concept: Finance Commissions use horizontal devolution formulas to distribute the states' share of central taxes fairly, balancing historical baseline populations with rewards for demographic control.

Solution:

Let's examine the population benchmarks used by recent Finance Commissions:

(a) To prevent penalizing states that successfully implemented family planning policies, the 14th Finance Commission used 1971 population data alongside 2011 data.

(b) The **15th Finance Commission** moved away from the 1971 metrics, using **2011 Census Data** as the exclusive population criteria for tax division.

(c) To balance this shift, the commission introduced a dedicated **Demographic Performance** criterion (weighted at 12.5%). This parameter measures a state's success in lowering its Total Fertility Rate (TFR) relative to the benchmark numbers established in the **2011 Census Data**, rewarding states that managed population growth effectively.

Final Answer: 2011 Census Data

Answer: (C)

Go Back to Question 12

Q13.

Solution

Concept: The Seventh Schedule of the Constitution of India divides legislative responsibilities between the Union and the States across three distinct tracks: the Union List, the State List, and the Concurrent List.

Solution:

Let's locate the legislative authority behind Agricultural Produce Market Committees (APMCs):

(a) While Entry 14 of the State List covers agricultural research and production, it does not govern commercial market areas.

(b) Legislative authority over commercial marketplaces, trade centers, and local fairs is granted under **Entry 28 of the State List (Markets and Fairs)**.

(c) State governments exercise their constitutional powers under Entry 28 to enact APMC regulations, establish notified market yards, and supervise primary agricultural wholesale transactions within their borders.

Final Answer: Entry 28, State List (Markets/Fairs)

Answer: (B)

Go Back to Question 13

Q14.

Solution

Concept: Uttar Pradesh features several distinctive pottery and ceramic craft traditions, each defined by localized clay deposits, unique glazes, and specialized firing techniques.

Solution:

Let's evaluate the characteristics of the regional pottery styles:

(a) Khurja is celebrated for its glazed white industrial stoneware, while Gorakhpur is world-famous for its reddish terracotta figures.

(b) The **Nizamabad** cluster (located in Azamgarh district, close to the Mirzapur-Chunar zone) is renowned for its iconic **Black Pottery**.

(c) This craft uses a fine local slip-clay. The pieces are fired at low temperatures in a sealed, oxygen-deprived kiln (reduction firing). Before firing, the pottery is rubbed with mustard oil, trapping smoke inside the clay pores to produce its signature **deep monochrome dark metallic finish**.

Final Answer: Nizamabad Black Pottery

Answer: (A)

Go Back to Question 14

Q15.

Solution

Concept: The International Shooting Sport Federation (ISSF) sets precise mechanical rules for competitive firearms to ensure athletic fairness and safety across all qualification levels.

Solution:

Let's identify the technical weapon rules for the air pistol discipline:

(a) For the 10m Air Pistol event, dimensions, sight lines, and overall pistol weight are tightly regulated.

(b) To prevent athletes from altering the trigger mechanism for an effortless release, the ISSF mandates a strict minimum pressure threshold.

(c) The rules specify that the trigger-pull configuration must support a **minimum 500 grams weight**.

(d) Judges test this parameter before the qualification round using a certified weight set; if the trigger releases under a weight lighter than 500 grams, the firearm fails inspection.

Final Answer: Minimum 500 grams weight

Answer: (A)

Go Back to Question 15

Q16.

Solution

Concept: The *Purab Ang* (Eastern Style) of Thumri developed as a distinct classical vocal genre in eastern Uttar Pradesh, characterized by expressive, slow-paced emotional rendering (*Bol-banao*).

Solution:

Let's identify the historical center that shaped the Purab Ang style:

(a) While the Rampur-Sahaswan court focused heavily on classical Khayal, and Lucknow laid foundations for Kathak-linked Thumri, the **Banaras Royal Durbar** served as the key center for perfecting the independent Purab Ang vocal grammar.

(b) Under the patronage of the Kings of Kashi, artists refined local folk melodies into a classical art form.

(c) This environment nurtured legendary thumri exponents and early recording pioneers like Gauhar Jan, standardizing the deep emotional expressions that define the Banaras musical lineage.

Final Answer: Banaras Royal Durbar

Answer: (C)

Go Back to Question 16

Q17.

Solution

Concept: The power output of a silicon photovoltaic (PV) cell is determined by the product of its operating voltage and current ($P = V \times I$). These electrical characteristics change systematically as temperature fluctuates.

Solution:

Let's analyze the physical changes that occur when solar cells overheat:

(a) When ambient temperatures rise above 45°C, the internal temperature of a silicon cell can climb past 70°C.

(b) This extreme heat causes thermal agitation within the semiconductor lattice, decreasing the energy bandgap.

(c) While a narrower bandgap slightly increases the short-circuit current (I_{sc}), it triggers a major increase in the recombination rate of photo-generated charge carriers.

(d) This high recombination rate causes the **open-circuit voltage (V_{oc})** to drop sharply. Because voltage decreases far more than current increases, the overall power conversion efficiency of the solar module falls during extreme summer days.

Final Answer: Open-circuit voltage drops

Answer: (A)

Go Back to Question 17

Q18.

Solution

Concept: The Normalized Difference Vegetation Index (NDVI) is a remote sensing index used to assess the density and health of green vegetation canopy by analyzing satellite light reflectance data.

Solution:

Let's analyze the spectral signature of healthy plant leaves:

(a) Healthy green vegetation absorbs light across the visible spectrum, particularly within the **Visible Red** band, where chlorophyll uses it to power photosynthesis.

(b) Conversely, the internal mesophyll structure of healthy leaves strongly reflects light in the **Near-Infrared (NIR)** band to avoid heat damage. Fallow topsoil, by contrast, exhibits a linear reflectance across these bands.

(c) To exploit this contrast, NDVI sensors measure light values from these two specific regions, calculating the normalized ratio:

$$\text{NDVI} = \frac{\text{NIR} - \text{Red}}{\text{NIR} + \text{Red}}$$

(d) This equation yields high positive values for healthy green canopies, separating them clearly from dry, barren soils.

Final Answer: Near-Infrared and Visible Red

Answer: (B)

Go Back to Question 18

Q19.

Solution

Concept: Non-repudiation ensures that a party in a digital transaction cannot falsely deny sending a message or initiating a financial payload, providing legal accountability for electronic banking systems.

Solution:

Let's isolate the cryptographic primitive that enforces non-repudiation:

(a) Symmetric algorithms like AES-256 use a single shared key for encryption and decryption, meaning either party could have generated the data, which fails to provide non-repudiation.

(b) A **Digital Signature via Private Key** solves this issue using public-key cryptography.

(c) The sender passes the transaction data through a hashing function and signs the resulting hash using their secret, unique private key.

(d) Because this private key is controlled exclusively by the sender, and the signature can be verified by anyone using the corresponding public key, this process proves the transaction originated from that specific sender, establishing non-repudiation.

Final Answer: Digital Signature via Private Key

Answer: (D)

Go Back to Question 19

Q20.

Solution

Concept: The IPv6 addressing standard was designed by the Internet Engineering Task Force (IETF) to replace IPv4, expanding the available IP address space to support billions of global IoT devices.

Solution:

Let's review the architectural structure of an IPv6 header address:

(a) Unlike the older 32-bit IPv4 standard, an IPv6 address uses a **128-bit** bit-length allocation.

(b) This 128-bit string is structurally organized into **8 distinct blocks/fields**.

(c) Each individual field contains a 16-bit boundary segment represented by four hexadecimal digits, with the blocks separated by colons (e.g., `2001:0db8:85a3:0000:0000:8a2e:0370:7334`), providing a massive address pool for distributed network sensors.

Final Answer: 128 bits structured into 8 fields

Answer: (B)

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	B	3	B	4	B	5	B
6	C	7	B	8	A	9	B	10	C
11	B	12	C	13	B	14	A	15	A
16	C	17	A	18	B	19	D	20	B