UPCATET General Studies Sample Paper-5

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 precision agricultural laboratory measures the moisture tension of a heavily compacted clay-loam soil plot in western Uttar Pradesh using a tensiometer. If the instrument records a soil moisture tension reading of exactly 3.2 bars ($pF \approx 3.5$), what is the dominant thermodynamic state of the soil water, and can a standard cereal crop effectively extract it?

(A) Gravitational water; highly available to crops

(B) Capillary water; readily available to crops

(C) Capillary water; reaching the permanent wilting point range

(D) Hygroscopic water; completely unavailable to crops

Q2. During a deep-well irrigation pump test, an engineer observes cavitation forming near the impeller blades of a centrifugal pump system. Which localized thermodynamic and fluid dynamic condition directly causes this destructive phenomenon?

(A) Local kinetic pressure exceeding the stagnation pressure limit

(B) Local static pressure dropping below the vapor pressure of the water

(C) Sudden extreme elevation of the dissolved oxygen saturation point

(D) Thermal expansion coefficient crossing the critical threshold limit

Q3. An environmental monitoring station in the Indo-Gangetic plain analyzes a winter photochemical smog event. The mass spectrometer identifies high concentrations of peroxyacetyl nitrate (PAN). Which precise reaction sequence yields this secondary phytotoxic pollutant in the troposphere?

(A) Direct photolysis of sulfur dioxide under intense infrared rays

(B) Reaction of hydroxyl radicals with pristine methane gas columns

(C) Interaction of oxidized volatile organic compounds (VOCs) with nitrogen dioxide (NO_2) driven by UV light

(D) Catalytic decomposition of stratospheric ozone slipping into the boundary layer

Q4. Consider the modern biochemical pathway of systemic acquired resistance (SAR) triggered in a tomato plant (‘Solanum lycopersicum‘) after a localized fungal attack. Which signaling molecule is synthesized at the infection site and translocated vascularly to induce defense genes in distant, uninfected leaves?

(A) Indole-3-acetic acid (IAA)

(B) Methyl salicylate (MeSA)

(C) Abscisic acid (ABA)

(D) Gibberellic acid (GA_3)

Q5. The dynamic geomorphology of the Yamuna-Chambal ravine network (Badland topography) across the Etawah and Agra districts of Uttar Pradesh is primarily driven by which specialized destructive geological process?

(A) Deep wind deflation and aeolian abrasion cycles

(B) Advanced sheet and rill erosion progressing into severe gully headcut migration

(C) Karst dissolution of underlying crystalline limestone strata

(D) Glacio-fluvial deposition over structural grabens

Q6. In the context of ancient Indian history, the specific archaeological site of Hulaskhera located in the Lucknow district of Uttar Pradesh has yielded significant

structural and cultural remains. To which distinct historical chronological eras do these major structural phases belong?

(A) Early Harappan to Late Harappan transitions exclusively

(B) Pre-Mauryan down to the Kushan and Gupta periods

(C) Mesolithic microlithic hunter-gatherer sequences only

(D) Early medieval Chalukyan maritime outpost horizons

Q7. Analyze the soil profile of the 'Bangar' old alluvium zones found extensively throughout the central plains of Uttar Pradesh. What is the defining mineralogical and structural characteristic that differentiates it sharply from the 'Khadar' lowlands?

(A) Complete absence of any silica or quartz grains

(B) High accumulation of nodular calcium carbonate deposits known as 'Kankar'

(C) Perpetual annual organic silt replenishments via active floodwaters

(D) Highly acidic pH values ranging systematically between 3.5 and 4.5

Q8. During the decisive 1857 uprising in Uttar Pradesh, the revolutionary forces at Bareilly were organized and led by an eminent figure who established a formal administrative authority. Identify this leader:

(A) Begum Hazrat Mahal

(B) Kunwar Singh

(C) Khan Bahadur Khan Rohilla

(D) Maulana Ahmadullah Shah

Q9. A structural geologist tracks the spatial extent of the 'Bundelkhand Gneiss' complex across southern Uttar Pradesh. Which specific mineral suite and precise geological eon define the absolute crystalline baseline of this ancient shield formation?

(A) Paleozoic glauconitic shales and sandstone units

(B) Archean pink granites, foliated gneisses, and migmatites

(C) Cenozoic basaltic sheet lava flows containing zeolites

(D) Mesozoic fossiliferous marine limestone and oolites

Q10. Under the foundational structural framework of the Commission for Agricultural Costs and Prices (CACP) in India, which specific economic criterion is mathematically weighted highest to arrive at the final statutory Minimum Support Price (MSP) recommendations for major food grains?

(A) International market parity indices of luxury cash crops

(B) Comprehensive cost of production including paid-out costs, family labor, and imputed rent/interest ($A2 + FL$ and $C2$ metrics)

(C) Inter-sectoral price terms of trade relative to heavy industrial machinery only

(D) Consumer Price Index (CPI) trends of urban elite populations

Q11. The 73rd Constitutional Amendment Act introduced a mandatory three-tier Panchayati Raj matrix. Which specific body within this architecture is explicitly designed by constitutional mandate to serve as a direct democratic assembly of all registered village voters?

(A) Gram Panchayat Executive Board

(B) Block Development Council

(C) Gram Sabha

(D) Zila Parishad Working Committee

Q12. If the Reserve Bank of India (RBI) executes a sustained series of 'Sterilization' operations via the Open Market Operations (OMO) window, what is its primary structural macroeconomic objective?

(A) Artificially inflating the fiscal deficit of state governments

(B) Neutralizing the inflationary impact of excess domestic liquidity caused by large foreign capital inflows

(C) Directly printing physical fiat currency notes to clear sovereign debt bonds

(D) Forcing commercial banks to lower their statutory liquidity ratios to zero

Q13. The historical 'Command Area Development Programme' (CADP) launched in India in the mid-1970s was structurally engineered to rectify which critical macro-agricultural bottleneck?

(A) Total absence of hybrid high-yielding variety seeds in remote tribal blocks

(B) The massive utilization gap between created irrigation potential and actual field-level utilization

(C) Sudden drop in global export demand for Basmati rice varieties

(D) Lack of institutional short-term credit availability from commercial banks

Q14. The iconic 'Kathak' classical dance tradition of Uttar Pradesh flourished spectacularly under the direct patronage of the royal court of Awadh. Which specific ruler is credited with institutionalizing the Lucknow Gharana, emphasizing expressive *Bhava* and *Thumri* compositions?

(A) Nawab Asaf-ud-Daula

(B) Nawab Shuja-ud-Daula

(C) Nawab Wajid Ali Shah

(D) Nawab Saadat Ali Khan

Q15. Under the current revised guidelines of the prestigious Rajiv Gandhi Khel Ratna Award (now Major Dhyan Chand Khel Ratna Award), what is the precise standard evaluation window considered for assessing an athlete's spectacular and outstanding performance across international events?

(A) A continuous calendar period of immediately preceding 4 years

(B) A single lifetime career achievement evaluation spanning 20 years

(C) The performances recorded strictly within the last 12 calendar months

(D) Performances limited only to the consecutive Olympic Games cycle

Q16. The Geographical Indication (GI) registry recently certified 'Sanjhi Craft' from a historical region of Uttar Pradesh. This unique traditional art form involves

which specialized design technique?

(A) Intricate hand-knitting of pure sheep wool carpets

(B) Hand-chiseling of soft soapstone artifacts

(C) Exquisite stenciling and intricate paper-cutting templates depicting devotional themes around Mathura

(D) High-temperature baking of black clay pottery using mustard oil glazes

Q17. The international ' Ramsar Convention ' has newly designated specific wetlands from Uttar Pradesh due to their global ecological value. What primary hydrobiological criterion must a wetland satisfy to qualify as a site of international importance under Criterion 2 of the framework?

(A) It must contain high-grade commercial mineral deposits worth mining

(B) It must support vulnerable, endangered, or critically endangered species or threatened ecological communities

(C) It must be completely artificial and independent of natural rainfall cycles

(D) It must support a human population density of over ten thousand individuals per square kilometer

Q18. In modern computing architectures, how does the integration of a 'Translation Lookaside Buffer' (TLB) fundamentally optimize memory management speeds inside the central processing unit?

(A) By directly caching frequently used arithmetic floating-point operators

(B) By functioning as a high-speed hardware cache for virtual-to-physical address translations

(C) By physically compressing active application files before storage in the hard disk drive

(D) By executing background malware scans on arriving network packets

Q19. Consider a dual-band Wi-Fi router operating concurrently at 2.4 GHz and 5 GHz radio frequencies. Which technical trade-off accurately defines their relative performance limits?

(A) 5 GHz offers higher data throughput rates but suffers shorter effective range and weaker solid obstacle penetration compared to 2.4 GHz.

(B) 2.4 GHz has significantly higher data bandwidth but is totally unable to penetrate open air spaces.

(C) 5 GHz consumes less power and achieves three times the physical transmission distance of 2.4 GHz through solid concrete walls.

(D) Both frequencies possess mathematically identical data transmission capacities and wave attenuation coefficients.

Q20. In cryptographic network security frameworks, what is the precise mathematical mechanism that guarantees non-repudiation when using a standard Asymmetric Digital Signature?

(A) The sender signs the document hash using their public key, and the recipient verifies it with a private key.

(B) The sender encrypts the entire document using a shared symmetric pre-master secret key.

(C) The sender signs the document hash using their unique private key, and anyone can verify it using the sender's corresponding public key.

(D) The data packet is randomly fragmented and routed across multiple independent proxy networks.

Detailed Solutions

Q1.

Solution

Concept: Soil water energy status is quantified by soil moisture tension (suction). As a soil dries, the remaining water is held tightly in smaller pores by capillary and adsorptive forces, increasing the energy (tension) that plant roots must exert to extract it.

Solution:

Let's analyze the classification of soil water based on moisture tension:

(a) **Gravitational water** occurs at very low tension (< 0.33 bars) and drains freely under gravity.

(b) **Capillary water** is retained in micro- and mesopores against gravity within the range of field capacity (~ 0.33 bars, $pF \approx 2.5$) up to the permanent wilting point (~ 15 bars, $pF \approx 4.2$).

(c) A recorded reading of **3.2 bars** ($pF \approx 3.5$) means the soil water is firmly classified as **capillary water**.

(d) Although it has dried significantly past the optimal "readily available" zone (0.33 to 1.0 bar), it remains below the 15-bar threshold. This state represents water that is **reaching the permanent wilting point range**, where standard cereal crops experience severe moisture stress and find it highly difficult, though still physically possible, to extract the remaining water.

(e) **Hygroscopic water** occurs at tensions above 31 bars ($pF \geq 4.5$) and is completely unavailable.

Final Answer: Capillary water; reaching the permanent wilting point range

Answer: (C)

Go Back to Question 1

Q2.

Solution

Concept: Cavitation is a destructive fluid dynamic phenomenon that occurs inside hydraulic machinery, such as centrifugal pumps, when changes in fluid velocity alter local pressure fields.

Solution:

Let's trace the physical causes of cavitation:

(a) According to Bernoulli's principle, as liquid accelerates rapidly around the leading edges of centrifugal impeller blades, its local kinetic energy rises, causing an immediate drop in local static pressure.

(b) If this **local static pressure drops below the vapor pressure of the water** at its current operating temperature, the liquid reaches its boiling threshold locally, causing it to flash into vapor bubbles.

(c) As these vapor bubbles flow into higher-pressure zones further along the impeller blade, they collapse or implode violently within microseconds.

(d) These micro-implosions generate intense localized shock waves and micro-jets that chip away at the metal surfaces, causing pitting, structural vibrations, and mechanical failure.

Final Answer: Local static pressure dropping below the vapor pressure of the water

Answer: (B)

Go Back to Question 2

Q3.

Solution

Concept: Peroxyacetyl nitrate (PAN) is a powerful eye irritant and phytotoxic secondary pollutant found in photochemical smog. It is not emitted directly from tailpipes or chimneys but forms via chemical reactions in the atmosphere.

Solution:

Let's examine the chemical production of PAN in the troposphere:

(a) Sunlight (UV radiation) drives the photolysis of nitrogen dioxide (NO_2), initiating a chain reaction that breaks down volatile organic compounds (VOCs) like unburned hydrocarbons.

(b) The oxidation of these VOCs yields highly reactive peroxyacyl radicals ($RCOOO^{\bullet}$).

(c) Under continuous urban pollution conditions, these organic peroxyacyl radicals react directly with ambient **nitrogen dioxide (NO_2)**:

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

(d) This temperature-dependent equilibrium traps NO_2 and organic radicals, building up high concentrations of **PAN** during stagnant winter smog events.

Final Answer: Interaction of oxidized volatile organic compounds (VOCs) with nitrogen dioxide (NO_2) driven by UV light.

Answer: (C)

Go Back to Question 3

Q4.

Solution

Concept: Systemic Acquired Resistance (SAR) is a long-term, whole-plant resistance mechanism triggered by a localized pathogen attack, preparing distant, uninfected tissues to defend against subsequent infections.

Solution:

Let's track the vascular signaling molecules involved in SAR:

(a) Following a localized pathogen invasion, salicylic acid (SA) levels spike near the infection site.

(b) To transmit this warning signal to distant tissues, a portion of this salicylic acid is enzymatically converted into a volatile, lipophilic ester called **Methyl salicylate (MeSA)**.

(c) **MeSA** enters the phloem and is translocated vascularly throughout the plant to distant, uninfected leaves.

(d) Once it arrives in healthy tissue, **MeSA** is converted back into active salicylic acid, triggering a signaling cascade that upregulates pathogenesis-related (PR) defense genes and establishes systemic immunity.

Final Answer: Methyl salicylate (MeSA)

Answer: (B)

Go Back to Question 4

Q5.

Solution

Concept: Badland topography, exemplified by the extensive ravine networks along the Yamuna and Chambal rivers in Agra and Etawah, is an extreme geomorphological landscape created by accelerated water erosion running through deep, unconsolidated alluvial soils.

Solution:

Let's analyze the geological development of these ravines:

(a) The semi-arid climate of southwestern Uttar Pradesh features intense, seasonal monsoon downpours falling on easily erodible alluvial banks.

(b) When heavy rain falls on bare or degraded soil, it initiates **sheet erosion**, which quickly concentrates into distinct channels via **rill erosion**.

(c) As water volume increases, these rills deepen into steep ravines through severe **gully headcut migration** (where the head of the gully carves backward into the flat plains).

(d) Over time, this backward cutting creates a highly dissected, uncultivable network of deep mazes and ridges known as badland topography.

Final Answer: Advanced sheet and rill erosion progressing into severe gully headcut migration

Answer: (B)

Go Back to Question 5

Q6.

Solution

Concept: Hulaskhera is an important archaeological site situated in the Mohanlalganj tehsil of Lucknow district, Uttar Pradesh. Systematic excavations here have mapped a long, continuous sequence of human occupation in the central Ganga valley.

Solution:

Let's look at the chronological stratification verified at Hulaskhera:

(a) Excavations at Hulaskhera do not reveal Paleolithic or Harappan structures; instead, they show a continuous sequence beginning in the early first millennium BCE.

(b) The site contains distinct cultural and structural layers stretching from the **Pre-Mauryan phase** (indicated by Black Slipped Ware and Painted Grey Ware), down through the **Maurya, Sunga, Kushan, and Gupta periods**.

(c) Notable structural discoveries from the Kushan period include a massive, 200-meter-long baked brick road, complex residential layouts, and silver punch-marked coins, making it a key site for studying regional urbanization over these centuries.

Final Answer: Pre-Mauryan down to the Kushan and Gupta periods

Answer: (B)

Go Back to Question 6

Q7.

Solution

Concept: The Indo-Gangetic plain is geomorphologically split into two primary types of alluvial soils based on their age, elevation, and deposition patterns: *Bangar* and *Khadar*.

Solution:

Let's compare the characteristics of *Bangar* and *Khadar* soils:

(a) *Khadar* consists of newer, lighter-colored alluvium deposited in low-lying floodplains. It is replenished by fresh, fertile organic silt during annual monsoon floods.

(b) *Bangar* represents the older, mature alluvium that forms higher terraced plains situated well above current flood limits.

(c) Because *Bangar* soils occupy older, well-drained terraces that have undergone extended weathering, they feature a high accumulation of nodular, impure calcium carbonate concretions known locally as **Kankar**. This mineralogical profile differentiates *Bangar* plains from the un-calcified, silt-rich *Khadar* lowlands.

Final Answer: High accumulation of nodular calcium carbonate deposits known as 'Kankar'

Answer: (B)

Go Back to Question 7

Q8.

Solution

Concept: During the 1857 Uprising, different regions across Northern India organized independent administrations led by local leaders, chiefs, or displaced royals who unified resistance efforts against the East India Company.

Solution:

Let's match the historical figures to their respective revolutionary centers:

(a) Begum Hazrat Mahal led the uprising from Lucknow in Awadh.

(b) Kunwar Singh organized the resistance forces in Jagdispur, Bihar.

(c) Maulana Ahmadullah Shah was a prominent leader and strategist who operated primarily around Faizabad.

(d) In the Rohilkhand region, **Khan Bahadur Khan Rohilla** (the grandson of Hafiz Rahmat Khan) took command at **Bareilly**. He established a formal administration, minted currency, and successfully organized defensive lines against British forces until Bareilly was recaptured in May 1858.

Final Answer: Khan Bahadur Khan Rohilla

Answer: (C)

Go Back to Question 8

Q9.

Solution

Concept: The Bundelkhand upland in southern Uttar Pradesh represents the northernmost extension of the Indian peninsular shield. Its basement complex features some of the oldest solid crustal formations in South Asia.

Solution:

Let's identify the geological composition and age of this shield formation:

(a) The absolute crystalline baseline of this region is composed of the **Bundelkhand Granite** or **Bundelkhand Gneiss** complex.

(b) This complex is made of highly stable **pink granites, foliated gneisses, schists, and migmatites** that have been altered by multiple tectonic events.

(c) Radiometric dating places the formation of these crystalline rocks squarely in the **Archean Eon** (approximately 2.5 to 3.3 billion years ago), long before the deposition of younger Paleozoic or Mesozoic sedimentary formations.

Final Answer: Archean pink granites, foliated gneisses, and migmatites

Answer: (B)

Go Back to Question 9

Q10.

Solution

Concept: The Commission for Agricultural Costs and Prices (CACP) recommends the Minimum Support Price (MSP) for covered crops by evaluating several economic indicators, including supply and demand, market price trends, and the inter-sectoral terms of trade.

Solution:

Let's examine how MSP recommendations are calculated:

(a) While multiple market variables are considered, the foundational metric that carries the highest mathematical weight is the **comprehensive cost of production**.

(b) The CACP calculates multiple cost levels, focusing primarily on:

- A2: Direct paid-out expenditures (seeds, fertilizers, fuel, hired labor, land rent).
- A2+FL: Direct paid-out costs plus the imputed value of unpaid family labor.
- C2: A comprehensive cost metric that adds the imputed rent of owned land and interest on owned fixed capital to A2+FL.

(c) The cost of production (A2+FL and C2) forms the mandatory baseline used to ensure that the statutory MSP provides farmers a guaranteed return of at least 50% over their production costs.

Final Answer: Comprehensive cost of production including paid-out costs, family labor, and imputed rent/interest (A2 + FL and C2 metrics)

Answer: (B)

Go Back to Question 10

Q11.

Solution

Concept: The 73rd Constitutional Amendment Act, 1992, added Part IX to the Constitution of India, providing a standardized three-tier structure for rural local self-governance (Panchayati Raj Institutions).

Solution:

Let's analyze the constitutional definitions of these rural bodies:

(a) The Zila Parishad operates at the district level, the Block Development Council (Panchayat Samiti) functions at the intermediate/block level, and the Gram Panchayat serves as the elected executive committee at the village level.

(b) Under Article 243(b), the Constitution mandates the establishment of the **Gram Sabha**.

(c) The **Gram Sabha** is defined as a foundation-level statutory body consisting of **all individuals registered as voters** in the electoral rolls of a village area. This makes it a direct democratic assembly where village residents can review budgets, track expenditures, and hold the elected Gram Panchayat accountable.

Final Answer: Gram Sabha

Answer: (C)

Go Back to Question 11

Q12.

Solution

Concept: Sterilization refers to a monetary policy tool used by a central bank (like the RBI) to counteract the domestic macroeconomic effects of large, volatile foreign capital inflows.

Solution:

Let's trace the mechanics of a sterilization operation:

(a) When foreign investors pour capital into an emerging market, the RBI buys foreign currency (dollars) to prevent the Indian Rupee from appreciating excessively, which would hurt exports.

(b) To buy these dollars, the RBI injects fresh liquid rupees into the domestic banking system. This sharp expansion of the monetary base can trigger domestic inflation.

(c) To neutralize this side effect, the RBI conducts a series of **sterilization operations** through its Open Market Operations (OMO) window.

(d) The bank sells government securities to commercial banks, absorbing the excess domestic rupee liquidity. This operation keeps the money supply stable and prevents domestic inflationary pressures.

Final Answer: Neutralizing the inflationary impact of excess domestic liquidity caused by large foreign capital inflows

Answer: (B)

Go Back to Question 12

Q13.

Solution

Concept: The Command Area Development Programme (CADP) was launched by the Government of India during the Fifth Five-Year Plan (1974–1975) to maximize economic returns from massive public investments in major and medium irrigation projects.

Solution:

Let's isolate the core agricultural issue that CADP was designed to fix:

(a) By the 1970s, India had constructed large dams and main canal arteries, creating a substantial nominal "irrigation potential."

(b) However, there was a major bottleneck: because field channels, land leveling systems, and drainage networks were incomplete, farmers could not access this water efficiently.

(c) This created a **massive utilization gap between created irrigation potential and actual field-level utilization**.

(d) The **CADP** was engineered specifically to bridge this gap by funding on-farm development works—such as constructing field channels, leveling land, and installing drainage lines—ensuring canal water reached individual agricultural plots.

Final Answer: The massive utilization gap between created irrigation potential and actual field-level utilization

Answer: (B)

Go Back to Question 13

Q14.

Solution

Concept: Kathak is the classical dance form of Northern India, deeply rooted in the storytelling traditions of ancient bards. During the 18th and 19th centuries, it transitioned from temple courtyards into royal courts, leading to the development of distinct stylistic schools (*gharanas*).

Solution:

Let's identify the royal patron who shaped the Lucknow Gharana:

(a) While previous Nawabs built famous monuments across Lucknow, **Nawab Wajid Ali Shah** (the last ruler of Awadh) was a passionate patron of the performing arts.

(b) Under his personal supervision, Kathak was re-engineered within the Lucknow court.

(c) He studied dance under Thakur Prasad and supported master dancers like Bindadin Maharaj. He emphasized the integration of expressive **Bhava** (emotional mime) paired with delicate **Thumri** love lyrics—many of which he composed himself under the pen name *Akhtarpiya*—institutionalizing the elegant style of the Lucknow Gharana.

Final Answer: Nawab Wajid Ali Shah

Answer: (C)

Go Back to Question 14

Q15.

Solution

Concept: The Major Dhyan Chand Khel Ratna Award is the highest sporting honor awarded annually by the Ministry of Youth Affairs and Sports in India to recognize outstanding achievements in international sports.

Solution:

Let's review the current statutory selection criteria for the Khel Ratna:

(a) To ensure objective and consistent evaluation, the Ministry uses a structured points system managed by an expert selection committee.

(b) The revised guidelines specify that the committee must evaluate an athlete's achievements across a **continuous calendar period of the immediately preceding 4 years**.

(c) This four-year window accounts for performance consistency across major international competitions, including the Olympic Games, Asian Games, Commonwealth Games, and World Championships, rather than focusing on a single hot streak or an entire lifetime career achievement.

Final Answer: A continuous calendar period of immediately preceding 4 years

Answer: (A)

Go Back to Question 15

Q16.

Solution

Concept: Sanjhi Craft is a historic traditional art form practiced for centuries in the Braj region (principally around Mathura) of Uttar Pradesh, closely tied to devotional Vaishnava traditions.

Solution:

Let's examine the artistic technique that defines Sanjhi Craft:

(a) Sanjhi does not involve weaving wool or firing clay; it is a highly specialized art of **paper stenciling**.

(b) Master craftsmen use custom, fine scissors to cut intricate patterns into paper sheets without drawing them first.

(c) These handmade paper stencils depict complex **devotional themes around Krishna's life** and lila. The stencils are placed on flat surfaces or water floors, and dry colored powders are sifted through the openings to create beautiful, temporary floor patterns, a technique recognized by its recent Geographical Indication (GI) certification.

Final Answer: Exquisite stenciling and intricate paper-cutting templates depicting devotional themes around Mathura

Answer: (C)

Go Back to Question 16

Q17.

Solution

Concept: The Ramsar Convention on Wetlands uses nine specific criteria to designate Wetlands of International Importance, evaluating their ecological, hydrological, and biological roles within a global framework.

Solution:

Let's look at the statutory requirements for Criterion 2 of the Ramsar framework:

(a) Criterion 1 looks at representative, rare, or unique natural wetland types, while Criteria 5 and 6 focus on specific waterbird population counts.

(b) **Criterion 2** addresses biodiversity and species conservation. To qualify under this criterion, a wetland **must support vulnerable, endangered, or critically endangered species or threatened ecological communities**.

(c) This designation ensures international legal protection for sites that serve as vital refuges for globally threatened plants or animals, helping preserve vulnerable populations from extinction.

Final Answer: It must support vulnerable, endangered, or critically endangered species or threatened ecological communities

Answer: (B)

Go Back to Question 17

Q18.

Solution

Concept: In modern computing systems, virtual memory decouples an application's address space from physical DRAM, providing memory protection and flexible allocation. However, translating a virtual memory address to a physical address requires scanning hierarchical page tables stored in main memory, which can slow down processing speeds.

Solution:

Let's analyze how a Translation Lookaside Buffer (TLB) works:

(a) To avoid searching slow main memory page tables for every single memory access, the CPU integrates a specialized internal hardware component called a **Translation Lookaside Buffer (TLB)**.

(b) The TLB functions as a **high-speed hardware cache for virtual-to-physical address translations**.

(c) When the CPU requests a virtual memory address, it checks the TLB first. A TLB hit allows the address translation to finish in a single clock cycle, bypassing slow page table lookups in main memory and significantly accelerating overall execution speeds.

Final Answer: By functioning as a high-speed hardware cache for virtual-to-physical address translations

Answer: (B)

Go Back to Question 18

Q19.

Solution

Concept: Dual-band Wi-Fi routers transmit data using two distinct microwave frequency bands: 2.4 GHz and 5 GHz. The choice between them involves fundamental electromagnetic trade-offs dictated by wave mechanics and free-space path loss equations.

Solution:

Let's compare the performance trade-offs of these two frequencies:

(a) According to electromagnetic wave principles, higher-frequency waves travel with a shorter wavelength ($\lambda = \frac{c}{f}$). This allows the 5 GHz band to pack data more densely, delivering significantly higher throughput and bandwidth.

(b) However, shorter wavelengths attenuate faster when interacting with physical objects. As a result, the **5 GHz band suffers from a shorter effective range and weaker solid obstacle penetration** (such as concrete walls or floors) compared to the longer wavelengths of the 2.4 GHz band.

(c) Conversely, the 2.4 GHz band covers a wider area and penetrates obstacles more effectively, but it provides lower maximum data transfer speeds and encounters more signal interference.

Final Answer: 5 GHz offers higher data throughput rates but suffers shorter effective range and weaker solid obstacle penetration compared to 2.4 GHz.

Answer: (A)

Go Back to Question 19

Q20.

Solution

Concept: Non-repudiation is a cryptographic security property ensuring that a party to a transaction or communication cannot falsely deny the authenticity of their signature or the origination of a message.

Solution:

Let's trace the asymmetric key mechanics that guarantee non-repudiation:

(a) In a standard public-key infrastructure (PKI) digital signature scheme, a sender owns a unique mathematical key pair: a kept-secret private key and a freely distributed public key.

(b) To sign a document, the sender runs the text through a cryptographic hashing function, then **signs (encrypts) this document hash using their unique private key**.

(c) Because the private key is held exclusively by the owner, no one else can forge this signature.

(d) **Anyone can verify the signature using the sender's corresponding public key**. If the decrypted hash matches the document's computed hash, it proves mathematically that the message was created by the holder of that specific private key, preventing the sender from denying their signature.

Final Answer: The sender signs the document hash using their unique private key, and anyone can verify it using the sender's corresponding public key.

Answer: (C)

Go Back to Question 20

Answer Key

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