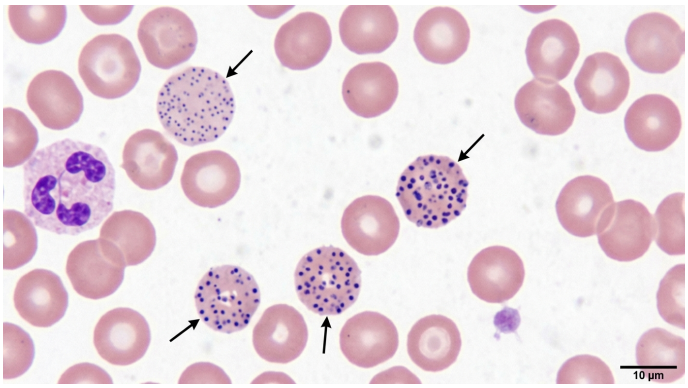
NEET PG Forensic Medicine Sample Paper-1

Duration: 10 Minutes **Maximum Marks: 40**

Instructions

- This paper contains **10** 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 32-year-old factory worker presents with a history of colicky abdominal pain, peripheral neuropathy, and a distinct bluish-purple line along the gingival margin. A peripheral blood smear is obtained to confirm the diagnosis, revealing the characteristic erythrocyte morphology shown in the reference illustration below. Which of the following options correctly describes this cellular abnormality and its underlying biochemical basis?



(A) Heinz bodies caused by acute intravascular oxidative hemolysis.

(B) Howell-Jolly bodies resulting from nuclear remnants in splenic dysfunction.

(C) Basophilic stippling due to the aggregation of ribosomal RNA from pyrimidine 5'-nucleotidase inhibition.

(D) Pappenheimer bodies representing iron-containing siderotic granules in the periphery.

Q2. A registered medical practitioner administers a therapeutic dose of a drug to an emergency patient without verifying the patient's well-documented history of severe drug allergy, resulting in immediate anaphylaxis and death. The court determines that the act constitutes a gross and criminal lack of care. Under which section of the Bharatiya Nyaya Sanhita (BNS, 2023) should the practitioner be charged for causing death by negligence?

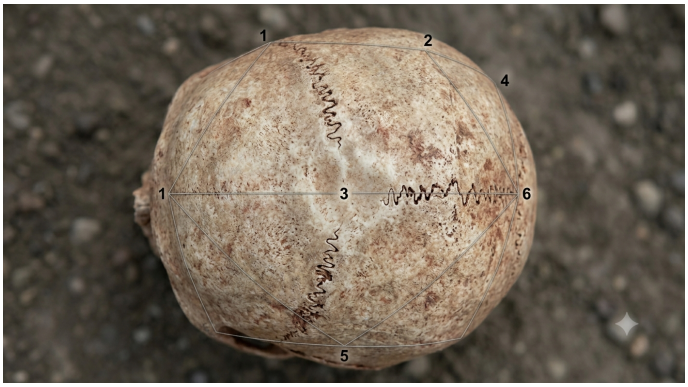
(A) Section 106(1) BNS

(B) Section 100 BNS

(C) Section 115 BNS

(D) Section 304 BNS

Q3. During a forensic skeletal survey of excavated human remains, a medical expert examines the superior aspect of the cranium. Refer to the standard cranial landmark layout shown in the reference image below. If the sutural junction marked at the confluence of the coronal and sagittal sutures is completely obliterated while the rest are patent, which landmark is identified, and what is its standard timeline for closure?



(A) Lambda, closing completely by 3 to 6 months of age.

(B) Bregma, closing completely by 18 to 24 months of age.

(C) Pterion, closing completely by 3 months of age.

(D) Asterion, closing completely by 12 months of age.

Q4. A patient is brought to the casualty ward with altered sensorium, pinpoint pupils, cold clammy skin, and severe respiratory depression. Following an

intravenous bolus of Naloxone, the patient shows immediate improvement but lapses back into respiratory depression 45 minutes later. Which of the following options best explains this pharmacological phenomenon?

(A) Naloxone acts as a partial agonist that causes a delayed ceiling effect on respiratory depression.

(B) Naloxone has a shorter half-life than most target opioids, leading to receptor uncoupling and renarcotization.

(C) Irreversible antagonist action at κ-opioid receptors precipitates delayed withdrawal.

(D) Non-competitive physiological antagonism enhances GABA-B pathways in the respiratory center.

Q5. During a cross-examination in a homicide trial, the defense counsel poses a series of leading questions to a forensic expert to contest the estimated time since death. According to the Indian Evidence Act (IEA), leading questions are legally permitted as a matter of right under which specific scenario and section?

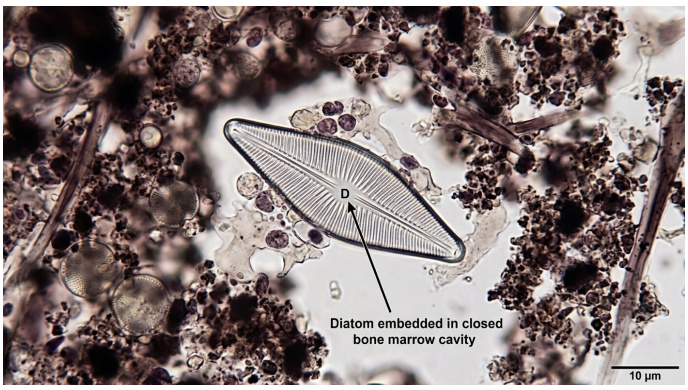
(A) Allowed during Examination-in-chief under Section 141 IEA if the opposite party raises no objection.

(B) Allowed during Re-examination under Section 142 IEA to clear ambiguities introduced during cross-examination.

(C) Allowed during Cross-examination under Section 143 IEA to test the veracity and memory of the witness.

(D) Allowed at any stage under Section 154 IEA solely at the personal discretion of the presiding judge.

Q6. The decomposed body of an adult is retrieved from a freshwater lake. To establish a diagnosis of antemortem drowning, the bone marrow is subjected to acid digestion. Microscopic analysis confirms the presence of the microscopic silica-cased organisms shown in the reference image below. What is the diagnostic significance of finding these structures in the closed bone marrow cavity?



(A) It provides conclusive evidence of antemortem drowning because an intact, active circulation is required to transport them from the lungs to the bone marrow.

(B) It is non-specific, as postmortem passive seepage easily carries these structures into intact marrow cavities.

(C) They only establish that the body was submerged postmortem, provided the lung fluid analysis matches.

(D) Their presence is valid only if the absolute count exceeds 100 per gram of tissue, regardless of the species found in the water body.

Q7. A farmer is brought to the emergency department after accidental exposure to an organophosphate insecticide spray. He presents with excessive lacrimation, salivation, muscle fasciculations, bradycardia, and severe miosis. Which of the following configurations represents the definitive therapeutic approach required to address both the muscarinic symptoms and the underlying biochemical defect?

(A) High-dose Atropine alone to competitively block muscarinic receptors and directly reactivate the enzyme.

(B) Atropine to block muscarinic effects along with Pralidoxime (2-PAM) to reactivate the phosphorylated acetylcholinesterase before aging occurs.

(C) Neostigmine infusions to displace the organophosphate compound from the nicotinic receptors.

(D) Forced alkaline diuresis combined with physiological salt infusions to accelerate renal clearance of the active toxin.

Q8. A person experiencing an acute episode of schizophrenia destroys public property and severely injures a bystander under the delusion that they are executing a divine command. In the context of criminal liability and unsoundness of mind under Indian jurisprudence, which statement is legally accurate?

(A) Medical insanity automatically equates to legal insanity, guaranteeing immediate acquittal under Section 324 IPC.

(B) The individual can claim immunity under Section 84 IPC (Section 22 BNS) only if it is proved that at the time of the act, they were incapable of knowing the nature of the act or that it was wrong or contrary to law.

(C) The burden of proving legal insanity remains entirely on the prosecution throughout the duration of the trial.

(D) Partial delusions or twilight states do not qualify for any legal defense or mitigation under Indian criminal law.

Q9. During a medicolegal autopsy of a drowning victim, the pathologist notes that the lungs are voluminous, pale, doughy to the touch, heavily distended with fluid, and retain their shape even after being removed from the thoracic cavity. Subpleural petechial hemorrhages (Paltauf's hemorrhages) are also noted. What is the precise term for this characteristic pulmonary macro-pathology?

(A) Emphysema aquosum

(B) Atelectasis of immersion

(C) Edema hydrostatica

(D) Emphysema hypertrophicum

Q10. A 24-year-old male is brought to the emergency department with altered mental status, warm dry skin, a flushed face, and a rapid pulse. The attending toxicologist notes the resting pupillary state of the patient under normal ambient room illumination, as represented in the reference image below. Which plant-derived toxin is most consistently associated with this clinical toxidrome?

(A) Cannabis sativa

(B) Datura stramonium

(C) Strychnos nux-vomica

(D) Papaver somniferum

Detailed Solutions

Q1.

Solution

Concept:

Lead poisoning (plumbism) is a significant occupational hazard that impacts multiple organ systems. In the hematological system, lead disrupts heme synthesis by inhibiting key enzymes, which alters erythrocyte morphology. Recognizing these specific cellular changes on a peripheral blood smear is critical for diagnosing heavy metal toxicity in exposed workers.

Solution:

(a) Lead directly inhibits the enzyme pyrimidine 5'-nucleotidase, which is normally responsible for degrading residual ribosomal RNA in reticulocytes.

(b) The inactivation of this enzyme leads to the abnormal aggregation and accumulation of ribosomal RNA throughout the cytoplasm of the erythrocytes.

(c) Under standard Wright-Giemsa staining, these aggregated ribosomes appear as characteristic punctate, bluish granules distributed across the red blood cell, a feature known as basophilic stippling.

(d) Lead also inhibits aminolevulinic acid dehydratase (ALAD) and ferrochelatase, which impairs the incorporation of iron into protoporphyrin, further compromising hemoglobin synthesis and producing microcytic anemia.

(e) Other options represent distinct pathognomonic processes: Heinz bodies signify oxidative denaturation of hemoglobin; Howell-Jolly bodies represent nuclear remnants typically cleared by a functional spleen; and Pappenheimer bodies are iron-containing siderosomes found in sideroblastic anemias.

Final Answer: Aggregation of ribosomal RNA from pyrimidine 5'-nucleotidase inhibition.

Answer: (C)

Go Back to Question 1

Q2.

Solution

Concept:

Medical negligence leading to patient mortality falls under criminal liability when a practitioner's actions show gross rashness or unwarranted carelessness. The Indian legal framework penalizes acts that cause death without the intention to cause death or knowledge that the act is likely to cause death, transitioning from traditional codes to updated statutes.

Solution:

(a) Causing death by negligence was historically prosecuted under Section 304A of the Indian Penal Code (IPC), which dealt with rash or negligent acts not amounting to culpable homicide.

(b) With the implementation of the Bharatiya Nyaya Sanhita (BNS, 2023), this provision has been replaced by Section 106(1) BNS, which specifically governs causing death by negligence.

(c) Administering a documented contraindicated medication without reviewing a patient's medical history demonstrates a severe breach of duty and a gross lack of reasonable care expected from a qualified clinician.

(d) In legal proceedings, the prosecution must establish that the negligence was gross and directly caused the patient's demise, satisfying the criteria for criminal liability rather than mere civil tort.

(e) Section 100 BNS relates to culpable homicide, Section 115 BNS governs voluntarily causing hurt, and Section 304 historically addressed punishment for culpable homicide not amounting to murder, making Section 106(1) the precise charge.

Final Answer: Section 106(1) BNS.

Answer: (A)

Go Back to Question 2

Q3.

Solution

Concept:

Forensic anthropology utilizes the skull vault and cranial sutures to determine biological profiles, including age at death. Suture closure follows a predictable chronological sequence, making the identification of specific cranial landmarks and their fusion status a primary tool for age estimation in skeletal remains.

Solution:

(a) The junction at the confluence of the coronal suture and the sagittal suture is anatomically designated as the bregma, which corresponds to the site of the anterior fontanelle in infants.

(b) In a living infant, the anterior fontanelle or bregmatic area provides a clinical window to assess hydration status and intracranial pressure, normally closing anatomically between 18 to 24 months of age.

(c) In forensic skeletal examinations, ectocranial and endocranial suture obliteration are evaluated; the complete obliteration of the bregma while other areas remain unclosed indicates a specific age threshold.

(d) The lambda represents the junction of the sagittal and lambdoid sutures at the posterior fontanelle, which closes much earlier, typically by 3 to 6 months of age.

(e) The pterion is the H-shaped junction of the frontal, parietal, temporal, and sphenoid bones, while the asterion is the junction of the parietal, temporal, and occipital bones, making bregma the correct landmark.

Final Answer: Bregma, closing completely by 18 to 24 months of age.

Answer: (B)

Go Back to Question 3

Q4.

Solution

Concept:

Acute opioid toxicity presents with a classic clinical triad of central nervous system depression, pinpoint pupils (miosis), and respiratory depression. Management requires the timely administration of specific opioid receptor antagonists, though clinicians must carefully monitor the pharmacokinetic differences between the toxin and the antidote.

Solution:

(a) Naloxone is a pure, competitive antagonist with a high affinity for mu-opioid receptors, allowing it to displace opioid agonists and rapidly reverse life-threatening respiratory depression.

(b) A critical limitation of Naloxone is its relatively short plasma half-life, which ranges between 30 to 90 minutes when administered intravenously.

(c) Many common opioid agonists, such as morphine, heroin, or sustained-release formulations, possess a significantly longer duration of action and half-life than Naloxone.

(d) As Naloxone is metabolized and cleared from the systemic circulation, the remaining opioid molecules reoccupy the vacant mu receptors, causing the patient to relapse into a comatose state, a process known as renarcotization.

(e) This pharmacokinetic mismatch necessitates continuous clinical vigilance and potentially repeated boluses or a continuous intravenous infusion of Naloxone to maintain adequate respiratory drive and prevent fatal relapse.

Final Answer: Competitive antagonist at μ-opioid receptors with a shorter half-life than most opioids.

Answer: (B)

Go Back to Question 4

Q5.

Solution

Concept:

In medicolegal trials, court testimony follows strict procedural rules governed by the Indian Evidence Act (IEA). Forensic experts must understand the legal parameters of examination-in-chief, cross-examination, and re-examination, particularly regarding when leading questions can be posed to test testimony.

Solution:

(a) A leading question is defined under Section 141 of the Indian Evidence Act as any question which suggests the specific answer that the examining party desires or expects to receive.

(b) According to Section 142 of the IEA, leading questions are generally prohibited during the Examination-in-chief or Re-examination if objected to by the adverse party, unless permitted by the court for introductory or undisputed matters.

(c) Section 143 of the Indian Evidence Act explicitly states that leading questions may be asked during Cross-examination as a matter of statutory right by the opposing counsel.

(d) The primary purpose of cross-examination is to test the accuracy, credibility, and veracity of the witness's statements and to expose any bias or inconsistencies in the expert's forensic conclusions.

(e) Section 154 of the IEA relates to a party questioning their own witness when the witness turns hostile, which requires court permission, distinguishing it from standard cross-examination rights under Section 143.

Final Answer: Allowed during Cross-examination under Section 143 IEA.

Answer: (C)

Go Back to Question 5

Q6.

Solution

Concept:

Differentiating antemortem drowning from postmortem submersion is a challenging aspect of forensic pathology, especially in decomposed bodies. The diatom test relies on the physiological mechanism of inhalation and circulation to transport aquatic micro-organisms into closed organ systems.

Solution:

(a) Diatoms are microscopic, unicellular, photosynthetic algae characterized by a rigid, acid-resistant cell wall composed of silica, which allows them to survive acid digestion during laboratory extraction.

(b) When a conscious individual drowns, the forceful inhalation of water carries diatoms into the pulmonary alveoli, where they rupture the alveolar-capillary membrane due to mechanical pressure.

(c) An intact, actively functioning cardiovascular system is necessary to transport these entering diatoms from the pulmonary bed into the systemic circulation, distributing them to distant deep organs like the bone marrow, brain, and liver.

(d) If a dead body is thrown into water, the absence of active respiration and systemic circulation prevents diatoms from penetrating the closed marrow cavity of intact long bones, ruling out postmortem seepage.

(e) Finding diatoms exclusively in the lungs is inconclusive because passive water entry can occur postmortem, whereas finding them in intact bone marrow confirms an antemortem drowning event.

Final Answer: Proves antemortem drowning because an intact, active circulation is required for distant transport.

Answer: (A)

Go Back to Question 6

Q7.

Solution

Concept:

Organophosphate toxicity represents a critical toxidrome caused by exposure to agricultural pesticides. These compounds act as potent neurotoxins by inhibiting cholinesterase enzymes, resulting in an accumulation of acetylcholine and overstimulation of both muscarinic and nicotinic receptors.

Solution:

(a) Organophosphates bind to the active site of the acetylcholinesterase enzyme, causing irreversible phosphorylation that renders the enzyme incapable of degrading acetylcholine at the synaptic cleft.

(b) This continuous accumulation of acetylcholine triggers a severe cholinergic toxidrome characterized by SLUDGE symptoms (Salivation, Lacrimation, Urination, Defecation, Gastrointestinal motility, Emesis) and killer B's (Bradycardia, Bronchospasm, Bronchorrhea).

(c) Definitive management requires Atropine, a competitive muscarinic antagonist, administered in escalating doses to reverse life-threatening bradycardia, bronchospasm, and central respiratory depression.

(d) Atropine provides symptomatic relief at muscarinic sites but cannot correct the underlying enzyme defect or treat nicotinic signs like muscle fasciculations and respiratory muscle paralysis.

(e) Oximes, such as Pralidoxime (2-PAM), are administered concurrently to bind to the organophosphate residue and reactivate the phosphorylated acetylcholinesterase enzyme before the chemical bond undergoes irreversible aging.

Final Answer: Atropine to block muscarinic effects and Pralidoxime (2-PAM) to reactivate the enzyme.

Answer: (B)

Go Back to Question 7

Q8.

Solution

Concept:

The defense of insanity in criminal law evaluates an individual's mental capacity at the exact moment an offense is committed. Indian jurisprudence distinguishes between medical insanity and legal insanity, establishing strict statutory criteria to determine whether a psychiatric condition exempts an individual from criminal liability.

Solution:

(a) Section 84 of the Indian Penal Code (IPC), which corresponds to Section 22 of the Bharatiya Nyaya Sanhita (BNS, 2023), codifies the legal framework for the defense of unsoundness of mind, drawing from the historic M'Naghten rules.

(b) Medical insanity encompasses any diagnosed psychiatric disorder, such as schizophrenia, but legal insanity requires a higher standard of cognitive impairment during the commission of the criminal act.

(c) To claim total immunity, it must be proved that the unsoundness of mind rendered the individual completely incapable of knowing the nature of the act, or that it was wrong, or contrary to established law.

(d) The legal burden of proving the defense of insanity lies on the accused under Section 105 of the Indian Evidence Act, reversing the standard presumption of sanity.

(e) Delusions or partial insanity only offer a valid defense if the delusional reality, if true, would have legally justified the individual's actions, making generalized medical diagnoses insufficient for an automatic acquittal.

Final Answer: Claims immunity under Section 84 IPC if incapable of knowing the act was wrong or contrary to law.

Answer: (B)

Go Back to Question 8

Q9.

Solution

Concept:

Autopsy findings in drowning cases involve distinct macroscopical and microscopical changes in the respiratory system. Internal examination of the thoracic cavity helps pathologists differentiate drowning from other modes of death by evaluating the fluid dynamics and air trapping inside the pulmonary tissue.

Solution:

(a) During the process of active drowning, the victim inhales large volumes of water mixed with surfactant and mucus, creating a thick, tenacious froth that obstructs the airways.

(b) When water enters the lungs, it mixes with air and alveolar secretions under the influence of violent respiratory struggles, leading to hyperdistension and a loss of elastic recoil.

(c) The term emphysema aquosum describes lungs that are highly voluminous, heavy, doughy, pale, and fluid-distended, which retain their configuration and indentations from the ribs even after removal from the chest cavity.

(d) This condition is distinguished from drowning in dry conditions (dry drowning) or rapid secondary edema, as the lungs physically bulge out of the thoracic incision due to extensive water trapping.

(e) Paltauf's hemorrhages are subpleural ecchymoses resulting from the rupture of alveolar walls under increased intrapulmonary pressure, which frequently accompanies the classic picture of emphysema aquosum.

Final Answer: Emphysema aquosum.

Answer: (A)

Go Back to Question 9

Q10.

Solution

Concept:

Deliriant plant poisons produce a distinct toxidrome by altering autonomic nervous system function. Recognizing ocular manifestations, such as pupillary changes alongside systemic features like dry flushed skin and altered sensorium, is vital for identifying the specific botanical toxin responsible.

Solution:

(a) Datura stramonium contains potent anticholinergic alkaloids, primarily atropine, scopolamine, and hyoscyamine, which act as competitive antagonists at central and peripheral muscarinic acetylcholine receptors.

(b) The blockage of muscarinic receptors in the sphincter pupillae muscle of the eye prevents parasympathetic constriction, resulting in marked, symmetrical, and fixed pupillary dilation (mydriasis).

(c) This ocular state leads to blurred vision and photophobia due to cycloplegia, which is a core component of the classic anticholinergic diagnostic triad often summarized as blind as a bat, mad as a hatter, red as a beet, hot as a hare, and dry as a bone.

(d) Other plant options present contrasting toxidromes: Cannabis sativa produces conjunctival injection with variable pupillary changes; Strychnos nux-vomica contains strychnine which causes spinal convulsions without primary fixed mydriasis; and Papaver somniferum produces classic opioid pinpoint pupils (miosis).

Final Answer: Datura stramonium, causing marked mydriasis due to competitive antagonism of muscarinic receptors.

Answer: (B)

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	A	3	B	4	B	5	C
6	A	7	B	8	B	9	A	10	B