FMGE Anatomy Sample Paper – 3

Duration: 60 Minutes **Maximum Marks: 40**

Instructions

- This paper contains **40 Multiple Choice Questions** modelled on the **Anatomy** section of FMGE.
- Each correct answer carries **+1 mark**. There is **no negative marking** – attempt all questions.
- Questions follow the clinically integrated pattern of the FMGE examination.
- Click a question number in the answer key to navigate to its solution.

FMGE Anatomy – Q1 to Q40

Q1. A 45-year-old man presents to the emergency department with severe chest pain radiating to his left arm and jaw. The attending physician explains that the pain is "referred" because visceral afferents from the heart share a common spinal cord segment with somatic afferents from the arm. Which dermatome level primarily mediates referred cardiac pain to the inner aspect of the left arm?

(A) C5–C6

(B) C8–T1

(C) T4–T5

(D) T1–T2 ← correct

Q2. A physical therapist notes that a patient has lost explosive speed following a hamstring injury but retains good endurance capacity. She explains that the torn muscle had a pennate fibre arrangement. Which of the following statements about pennate muscles is **CORRECT**?

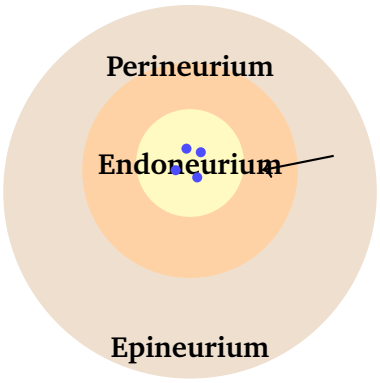
(A) Pennate muscles have fibres running parallel to the tendon, maximising range of movement

(B) Pennate muscles contain more motor units per unit volume than fusiform muscles, generating greater force ← correct

(C) The physiological cross-sectional area of a pennate muscle equals its anatomical cross-sectional area

(D) Unipennate muscles have greater pennation angle than multipennate muscles, providing higher speed of contraction

Q3. A 28-year-old motorcyclist sustains a penetrating wound to his thigh. Histological examination of the damaged nerve reveals disruption of the innermost connective tissue layer surrounding individual axons. Identify this layer and the barrier it maintains.



(A) Endoneurium; it forms the blood-nerve barrier around individual axons ← correct

(B) Perineurium; it forms the blood-nerve barrier around individual fascicles

(C) Epineurium; it provides the outermost metabolic barrier for the entire nerve trunk

(D) Myelin sheath; it acts as the primary diffusion barrier for ionic transport

Q4. A dental student is studying the articulation between the root of a tooth and its bony socket. This joint allows no movement and is held by dense fibrous periodontal tissue. Which type of fibrous joint does this represent?

(A) Suture — held by Sharpey's fibres between flat skull bones

(B) Syndesmosis — permits limited movement (“amphiarthrosis”)

(C) Gomphosis — peg-in-socket fibrous joint unique to tooth roots ← correct

(D) Symphysis — secondary cartilaginous joint at the midline

Q5. A 60-year-old woman with severe atherosclerosis undergoes gradual occlusion of the popliteal artery proximal to the knee. Surprisingly, distal limb perfusion is maintained. Which anatomical arrangement is responsible for this collateral flow?

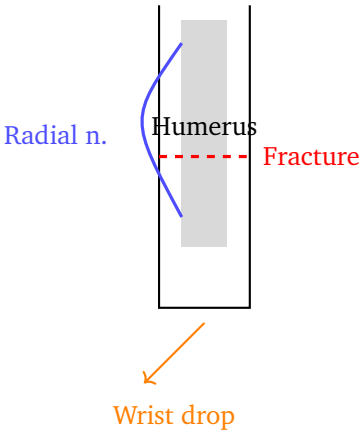
(A) End-arteries with no collateral branches around the knee

(B) Watershed territories that redirect flow through the tibioperoneal trunk

(C) Venous plexuses that provide retrograde arterial filling distal to occlusion

(D) Genicular anastomosis — a rich network of superior, middle, and inferior genicular arteries around the knee ← correct

Q6. A 35-year-old carpenter fractures the shaft of his humerus in its mid-third. Post-injury, he cannot extend his wrist or fingers, but sensation over the dorsum of the hand is preserved except for a small strip over the lateral thenar eminence. The likely nerve injured and the specific deficit are:



(A) Median nerve at elbow; loss of opposition of thumb with preserved wrist extension

(B) Ulnar nerve at medial epicondyle; claw hand with loss of intrinsic muscle function

(C) Radial nerve in the spiral groove; pure motor wrist drop with sensory sparing over dorsal hand ← correct

(D) Posterior interosseous nerve at arcade of Frohse; finger drop without wrist drop

Q7. A 10-year-old boy sustains a supracondylar fracture of the humerus. After malunion, his forearm deviates medially when the elbow is extended. Which of the following correctly describes the normal carrying angle and the child's deformity?

(A) Normal carrying angle is 5–7° valgus; lateral deviation is cubitus valgus

(B) Normal carrying angle is 15–20° valgus; medial deviation is also termed cubitus valgus

(C) Normal carrying angle is 10–15° valgus; the child has cubitus valgus (increased angle)

(D) Normal carrying angle is 10–15° valgus; medial deviation constitutes cubitus varus (gunstock deformity) ← correct

Q8. A 50-year-old seamstress develops numbness and tingling in her thumb, index, and middle fingers, worse at night. Examination reveals wasting of thenar muscles. Which structure forms the roof of the canal through which the compressed nerve passes, and what are its medial and lateral bony attachments?

(A) Flexor retinaculum; attaches medially to pisiform and hook of hamate, laterally to scaphoid tubercle and trapezium ← correct

(B) Extensor retinaculum; attaches to radius laterally and ulna medially, forming six compartments

(C) Palmar aponeurosis; spans the entire palm, forming the floor of the carpal tunnel

(D) Palmar carpal ligament; a thin superficial band proximal to the flexor retinaculum

Q9. A first-year medical student is practising pulse palpation. She correctly identifies the radial pulse at the wrist and the dorsalis pedis pulse on the dorsum of the foot. Which comparison of these two pulse points is **CORRECT**?

(A) The radial pulse is palpated medial to the flexor carpi radialis tendon, lateral to the radial styloid

(B) The dorsalis pedis artery is the continuation of the anterior tibial artery, palpated lateral to the extensor hallucis longus tendon ← correct

(C) Both arteries are terminal branches of the same parent vessel (popliteal artery)

(D) The radial pulse is absent in approximately 15% of the normal population due to a high-bifurcation variant

Q10. A 25-year-old cricketer dislocates his glenohumeral joint anteriorly while bowling. His surgeon explains that the shoulder is inherently unstable because the glenoid is shallow, and that dynamic stability depends on four muscles. Which combination provides the most important dynamic stabilisation?

(A) Long head of biceps brachii, coracobrachialis, deltoid, and pectoralis major

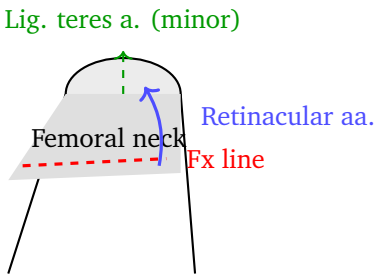
(B) Deltoid, teres major, latissimus dorsi, and pectoralis minor

(C) Supraspinatus, infraspinatus, teres minor, and subscapularis (rotator cuff) ← correct

(D) Trapezius, serratus anterior, rhomboids, and levator scapulae (scapular stabilisers)

Q11. A 70-year-old woman falls and sustains an intracapsular fracture of the femoral neck. Six months later, imaging reveals avascular necrosis of the

femoral head. Which vessel, disrupted by the fracture, is the primary blood supply to the femoral head in adults?



(A) Medial circumflex femoral artery via its obturator branch to the ligamentum teres

(B) Lateral circumflex femoral artery via ascending branch to the greater trochanter

(C) Obturator artery, which is the dominant supply throughout adult life

(D) Medial circumflex femoral artery via retinacular (capsular) branches ascending under the synovium ← correct

Q12. A 40-year-old diabetic man presents with weakness of knee extension and an absent knee jerk. He also has sensory loss over the anteromedial thigh and the medial aspect of the leg. Which nerve root levels and muscle group are involved?

(A) L2–L4 via femoral nerve; quadriceps femoris with saphenous nerve providing the medial leg sensation ← correct

(B) L4–L5 via common peroneal nerve; tibialis anterior causing foot drop

(C) L5–S1 via sciatic nerve; hamstrings causing reduced knee flexion

(D) L1–L2 via lateral cutaneous nerve of thigh; pure sensory loss (meralgia paraesthetica)

Q13. A surgeon performing a posterior approach to the hip joint inadvertently damages the nerve that exits the greater sciatic foramen above the piriformis. Which muscle is most likely to show weakness post-operatively, and what is the resultant gait pattern?

(A) Gluteus maximus (inferior gluteal nerve); hip extension weakness causing difficulty climbing stairs

(B) Gluteus medius and minimus (superior gluteal nerve); Trendelenburg gait with pelvic drop to the opposite side ← correct

(C) Piriformis (nerve to piriformis); external rotation deficit causing "piriformis syndrome"

(D) Obturator internus (nerve to obturator internus); inner hip rotation weakness

Q14. During a posterior approach to the hip in a 55-year-old with osteoarthritis, the surgeon must ligate branches of the cruciate anastomosis. Which four vessels contribute to this important collateral network around the hip?

(A) Superior gluteal, inferior gluteal, obturator, and medial circumflex femoral arteries

(B) Profunda femoris, superficial femoral, obturator, and superior gluteal arteries

(C) Medial circumflex femoral, lateral circumflex femoral, inferior gluteal, and first perforating branch of profunda femoris ← correct

(D) Medial circumflex femoral, lateral circumflex femoral, superior gluteal, and obturator arteries

Q15. A 22-year-old footballer "rolls" his ankle inward while landing. He has point tenderness over the anterior talofibular ligament. Which of the following correctly describes the ankle (talocrural) joint and the mechanism of this injury?

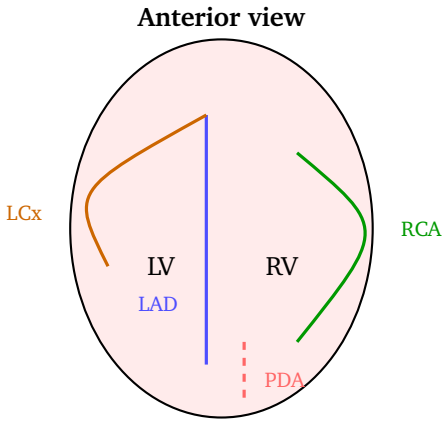
(A) The talocrural joint is a condyloid joint; plantar flexion is the primary movement that tightens the lateral collateral ligament

(B) Inversion sprains most commonly rupture the deltoid (medial) ligament, which is the strongest ankle ligament

(C) The posterior talofibular ligament is the most commonly injured in inversion sprains because it is taut in dorsiflexion

(D) The talocrural joint is a hinge (modified ginglymus) joint; the anterior talofibular ligament is most vulnerable in plantar flexion combined with inversion ← correct

Q16. A 58-year-old man sustains an acute inferoposterior myocardial infarction (ST elevation in leads II, III, aVF). Angiography reveals a dominant right coronary artery system. Which arteries are occluded, and which territory do they supply?



(A) Right coronary artery and posterior descending (interventricular) artery; inferior wall and posterior left ventricular wall ← correct

(B) Left circumflex artery and obtuse marginal branches; lateral and posterior wall of the left ventricle

(C) Left anterior descending and diagonal branches; anterior wall and septum

(D) Both circumflex artery and RCA; biventricular compromise

Q17. During cardiac surgery on a 65-year-old, the surgical team identifies the site of impulse initiation in the right atrium. A stab wound near the junction of the superior vena cava and the right atrium could damage this structure. Which of the following correctly identifies its location?

(A) Interatrial septum at the fossa ovalis; innervated solely by parasympathetic fibres

(B) Inferior aspect of the right atrium near the inferior vena cava orifice

(C) Junction of the superior vena cava and the right atrium, in the sulcus terminalis ← correct

(D) Coronary sinus ostium in the posterior wall of the right atrium

Q18. A 30-year-old man sustains a stab wound to the chest. In the ED, he presents with muffled heart sounds, hypotension, and distended neck veins. The physician diagnoses cardiac tamponade. Blood has accumulated in which space to cause this clinical picture?

(A) Between the fibrous pericardium and the parietal pleura (paracardiac space)

(B) Between the visceral and parietal layers of the serous pericardium (pericardial cavity) ← correct

(C) Between the myocardium and the epicardium, forming an intramyocardial haematoma

(D) Within the transverse pericardial sinus, compressing the aorta and pulmonary trunk

Q19. During a clinical examination, a medical student palpates the sternal angle (angle of Louis) to identify a specific rib. He then counts inferiorly to locate rib 5 for a thoracocentesis. Which statements about the rib cage classification and the sternal angle are **CORRECT**?

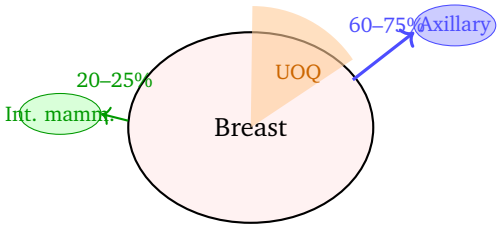
(A) Ribs 1–7 are true ribs; ribs 8–10 are floating ribs; ribs 11–12 are false ribs

(B) The sternal angle articulates with the cartilage of rib 3 and marks the T3/T4 disc level

(C) True ribs (1–7) attach via a *common* costal cartilage to the sternum; floating ribs (8–10) have no anterior attachment

(D) True ribs (1–7) attach directly to the sternum via individual costal cartilages; floating ribs (11–12) have no anterior attachment; the sternal angle marks the T4/T5 disc and articulates with rib 2 ← correct

Q20. A 48-year-old woman is diagnosed with carcinoma of the upper outer quadrant of the right breast. Her surgeon explains the lymphatic drainage pattern to plan a sentinel lymph node biopsy. Which of the following correctly describes the primary lymphatic drainage of the breast?



(A) 60–75% drains to the axillary nodes (predominantly Level I pectoral/anterior group); medial quadrants also drain to internal mammary nodes ← correct

(B) 60–75% drains directly to the internal mammary (parasternal) nodes regardless of quadrant

(C) Lymphatic drainage is exclusively to Level III (infraclavicular/apical) axillary nodes

(D) Supraclavicular nodes are the primary drainage for all quadrants of the breast

Q21. During a splenectomy for traumatic rupture, the surgeon must divide the ligamentous attachments of the spleen. Careless ligation of the vessels within the gastrosplenic ligament could damage which structure(s)?

(A) The tail of the pancreas and splenic artery in the splenorenal ligament

(B) The left gastro-omental (gastroepiploic) artery and the inferior mesenteric vein

(C) The short gastric arteries and left gastro-omental vessels contained within the gastrosplenic ligament ← correct

(D) The splenic vein and portal vein lying in the free edge of the lesser omentum

Q22. A 55-year-old undergoes a subtotal gastrectomy. The surgeon must divide the blood supply along both curvatures. Which artery runs along the **lesser curvature** of the stomach within the lesser omentum?

(A) Left gastro-omental (gastroepiploic) artery, a branch of the splenic artery

(B) Left gastric artery (from coeliac trunk) and right gastric artery (from proper hepatic) running along the lesser curvature ← correct

(C) Right gastro-omental artery from the gastroduodenal artery runs along the lesser curvature

(D) Short gastric arteries from the splenic artery supply the lesser curvature

Q23. During an ERCP procedure, the endoscopist navigates the scope through the duodenum to identify the ampulla of Vater. Which part of the duodenum contains the major duodenal papilla, and what are the relations of the second part of the duodenum?

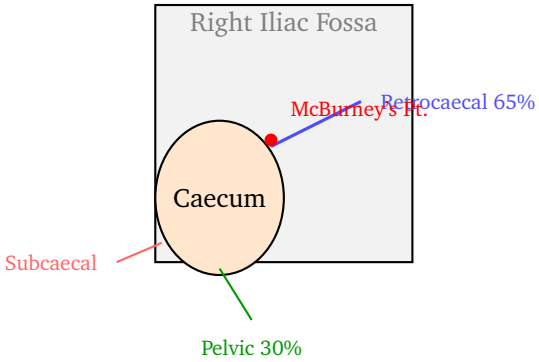
(A) First (superior) part; the duodenal cap lies anterior to the bile duct and portal vein

(B) Third (horizontal/inferior) part; it crosses the vertebral column at L2–L3 level

(C) Fourth (ascending) part; the suspensory muscle (ligament of Treitz) marks its end

(D) Second (descending) part; it lies to the right of the head of pancreas and contains the major duodenal papilla at its posteromedial wall ← correct

Q24. A 19-year-old man presents with acute appendicitis. The surgeon finds the appendix tucked behind the caecum during laparotomy. During the procedure she notes that McBurney's point overlies the base of the appendix, which is consistently located even when the tip varies.



(A) Retrocaecal is the most common position (∼65%), and McBurney's point is the junction of the lateral and middle thirds of the line from ASIS to umbilicus ← correct

(B) Pelvic position is the most common; McBurney's point marks the midpoint between ASIS and pubic symphysis

(C) Subcaecal position is the most common; McBurney's point lies at the midpoint of the line from ASIS to umbilicus

(D) Preileal position is the most common; tenderness at McBurney's point is pathognomonic of pelvic appendix

Q25. A radiologist describes the CT findings of a right renal mass to a surgical team. She notes the close anterior relations of the right kidney. Which of the following correctly compares the anterior relations of the right and left kidneys?

(A) Right kidney: liver, spleen, and descending colon; Left kidney: suprarenal gland, stomach, and jejunum

(B) Right kidney: duodenum and ascending colon; Left kidney: spleen, tail of pancreas, and transverse colon only

(C) Right kidney: suprarenal gland (superomedially), liver (superolaterally), duodenum (medially), and right colic flexure; Left kidney: suprarenal gland, stomach, spleen, tail of pancreas, and left colic flexure ← correct

(D) Both kidneys have identical anterior relations because they are symmetrically placed retroperitoneal organs

Q26. A neurosurgeon is counselling a patient about a tumour at the orbital apex. She explains that two important bony channels transmit structures into the orbit. Which structures pass through the **optic canal** versus the **superior orbital fissure**?

(A) Optic canal: CN II and ophthalmic artery; Superior orbital fissure: CN III, IV, V1, VI, and ophthalmic veins — but CN V2 also passes through the superior orbital fissure

(B) Optic canal: CN II only; Superior orbital fissure: CN III, IV, V1, VI, ophthalmic artery, and superior ophthalmic vein

(C) Optic canal: CN II and ophthalmic vein; Superior orbital fissure: CN III, IV, V1, VI, and ophthalmic artery

(D) Optic canal: CN II and ophthalmic artery; Superior orbital fissure: CN III, IV, V1 (nasociliary, frontal, lacrimal divisions), CN VI, and superior ophthalmic vein ← correct

Q27. A 7-year-old child with untreated otitis media develops post-auricular swelling, tenderness, and protrusion of the ear. CT reveals mastoid air cell opacification. During mastoidectomy, the most critical structure at risk of injury is:

(A) The sigmoid sinus, which lies on the posterior surface of the petrous temporal bone anterior to the mastoid

(B) The facial nerve (CN VII) in the mastoid segment, which runs vertically downward in the posterior wall of the facial canal before exiting the stylomastoid foramen ← correct

(C) The chorda tympani nerve, which runs through the middle ear cavity and is at risk during the mastoidectomy approach

(D) The internal carotid artery, which passes through the carotid canal in the petrous temporal bone

Q28. A surgeon performs a superficial parotidectomy for a pleomorphic adenoma. During dissection of the inferior pole of the gland (the “tail of the

parotid"), she encounters a sensory nerve that has wrapped around the posterior border of the sternocleidomastoid muscle. This nerve is:

(A) Great auricular nerve (C2–C3), which supplies sensation to the overlying skin of the parotid region and the lower ear ← correct

(B) Lesser occipital nerve (C2), which supplies the scalp behind the ear

(C) Auriculotemporal nerve (V3), which carries secretomotor fibres to the parotid from the otic ganglion

(D) Transverse cervical nerve (C2–C3), which wraps anteriorly across the neck

Q29. A 35-year-old construction worker sustains a laceration of the scalp. The wound bleeds profusely. The attending surgeon explains the five layers of the scalp and warns the junior resident about the "dangerous area" of the scalp. Which layer constitutes the dangerous area, and why?

(A) Layer 1 (Skin): because the scalp arteries run superficially and bleed when cut

(B) Layer 2 (dense Connective tissue): because the emissary veins in this layer drain to the dural sinuses

(C) Layer 4 (loose Areolar tissue): because infection can spread freely between the orbital margins and mastoid processes, and emissary veins connect it to the intracranial dural sinuses ← correct

(D) Layer 5 (Pericranium): because it is avascular and provides the pathway for subperiosteal abscesses

Q30. A 10-year-old boy presents to the clinic with recurrent epistaxis. Physical examination reveals dilated blood vessels on the anteromedial surface of the nasal septum. Which vessels form this clinically important anastomotic plexus, and what is it called?

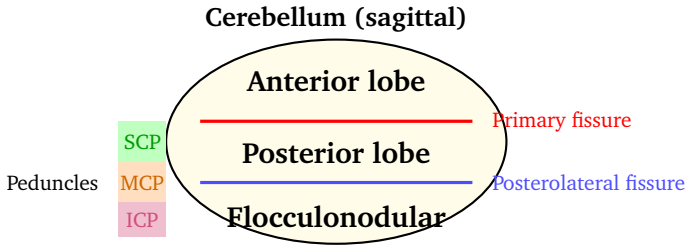
(A) Posterior ethmoidal artery, posterior septal branches of sphenopalatine artery, and palatine arteries; Woodruff's area

(B) Superior labial artery and greater palatine artery only; Woodruff's area on the posterior septum

(C) Anterior ethmoidal artery only; a watershed zone on the superior concha

(D) Kiesselbach's plexus (Little's area) on the anteroinferior nasal septum: anastomosis of anterior ethmoidal, posterior ethmoidal, sphenopalatine, and superior labial arteries ← correct

Q31. A 55-year-old alcoholic man presents with broad-based gait, truncal ataxia, and nystagmus. MRI shows atrophy of the anterior and superior vermis. Which lobe of the cerebellum is primarily affected, and through which peduncle does the cerebellar cortex communicate with the cerebral cortex?



(A) Flocculonodular lobe (archicerebellum); communicates via the inferior cerebellar peduncle (restiform body)

(B) Anterior lobe (paleocerebellum/spinocerebellum); the cortex-to-cortex loop uses the superior cerebellar peduncle (brachium conjunctivum) via thalamus ← correct

(C) Posterior lobe (neocerebellum/cerebrocerebellum); communicates via the middle cerebellar peduncle (brachium pontis)

(D) Anterior lobe; communicates via the inferior cerebellar peduncle carrying proprioceptive spinocerebellar tracts

Q32. A 68-year-old man presents with ipsilateral oculomotor (CN III) palsy and contralateral hemiplegia. MRI reveals a midbrain lesion affecting the base of the cerebral peduncle and surrounding structures. Which key midbrain structure lies in the tegmentum and is involved in coordination and motor control?

(A) Red nucleus in the midbrain tegmentum, which is part of the rubrospinal tract system ← correct

(B) Substantia gelatinosa, which modulates pain transmission in the dorsal horn

(C) Inferior olive, which relays climbing fibres from the spinal cord to the cerebellum

(D) Nucleus ambiguus, which contains motor neurons for CN IX and X

Q33. A 62-year-old hypertensive man develops facial weakness after a right hemispheric stroke. Examination shows weakness of the lower left face only, with preserved forehead wrinkling bilaterally. Which of the following explains this finding?

(A) Lower motor neuron (LMN) lesion of the left facial nerve; the entire left hemiface is weak

(B) Lower motor neuron lesion of the right facial nerve; loss of all right facial muscles

(C) Upper motor neuron (UMN) lesion of the right facial nucleus; the upper face (frontalis) is spared because the upper facial nucleus receives bilateral cortical input, while the lower facial nucleus receives only contralateral input ← correct

(D) Upper motor neuron lesion of the left facial nucleus; forehead involvement would be expected

Q34. A 45-year-old woman presents with sudden-onset severe headache and photophobia. CT shows blood in the basal cisterns. Angiography reveals a saccular aneurysm at the most commonly affected site in the Circle of Willis. At which location do most intracranial berry aneurysms arise, and what communicating artery is typically involved?

(A) Basilar artery tip; between the posterior cerebral arteries

(B) Junction of the internal carotid and posterior communicating artery; posterior communicating aneurysm

(C) Junction of the internal carotid and ophthalmic artery; the aneurysm compresses the optic nerve

(D) Anterior communicating artery complex, at the junction between anterior cerebral arteries — the single most common site ← correct

Q35. A newborn is noted at birth to have a small dimple and tuft of hair over the lumbar spine, but neurological examination is normal. Spine radiograph shows incomplete fusion of the posterior vertebral arch at L5. Which neural tube defect does this represent, and how does it differ from more severe forms?

(A) Spina bifida occulta: failure of posterior vertebral arch fusion without herniation of meninges or cord; skin is intact and neurological function is preserved ← correct

(B) Meningocele: herniation of meninges only through the bony defect, without neural tissue involvement

(C) Myelomeningocele: herniation of cord and meninges, the most severe form with significant neurological deficit

(D) Anencephaly: failure of cranial neural tube closure; incompatible with sustained extrauterine life

Q36. A 3-day-old neonate presents with bilious vomiting and abdominal distension. Contrast study reveals the duodenojejunal junction (ligament of Treitz) on the right side of the abdomen, and the caecum near the epigastrium. Which embryological event has failed, and what are the immediate mechanical consequences?

(A) Failure of gut elongation; results in short-bowel syndrome

(B) Failure of the vitelline duct to obliterate; results in a Meckel's diverticulum

(C) Failure of normal 270° counterclockwise rotation of the midgut; results in Ladd's bands compressing the duodenum and risk of midgut volvulus around the superior mesenteric artery ← correct

(D) Failure of lateral folding; results in gastroschisis with herniation of bowel through the anterior abdominal wall

Q37. A neonate presents with severe respiratory distress at birth. Chest X-ray reveals herniated bowel loops in the left hemithorax. Surgeons explain that failure of a specific structure to close the pericardioperitoneal canal led to this defect. Which of the following correctly lists the four embryological components of the diaphragm?

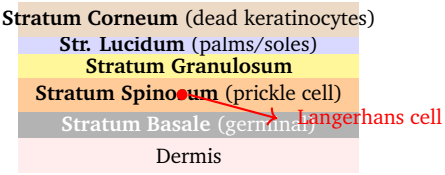
(A) Septum transversum (entire diaphragm), pleuroperitoneal membranes, and thoracic wall mesoderm

(B) Septum transversum (central tendon), two pleuroperitoneal membranes, oesophageal mesentery (dorsal mesentery), and musculature from cervical myotomes (C3–C5) ingrowth ← correct

(C) Pleuropericardial membranes (dorsal), septum transversum (lateral), and rib costal cartilages

(D) Septum transversum and pleuropericardial membranes only; musculature is contributed by lumbar myotomes

Q38. A dermatopathologist examines a biopsy from the palm of the hand. She identifies five distinct layers of the epidermis and a specific population of dendritic antigen-presenting cells. Which cell type performs immune surveillance in the epidermis, and in which layer does it reside?



(A) Melanocytes in the stratum basale; they perform immune surveillance via MHC class I presentation

(B) Merkel cells in the stratum basale; they are mechanoreceptors that can also present antigens

(C) Langerhans cells in the stratum spinosum; they are MHC class II-expressing dendritic cells derived from bone marrow ← correct

(D) Keratinocytes in the stratum granulosum; they release cytokines to perform innate immune surveillance

Q39. A pathologist examines a cervical lymph node biopsy from a patient with infectious mononucleosis. He notes reactive follicles with germinal centres and expansion of the paracortical zone. Which statement about lymph node histology is **CORRECT**?

(A) The paracortex (deep cortex) is the T-cell zone; it expands in delayed-type hypersensitivity and viral infections; post-capillary high endothelial venules (HEVs) allow lymphocyte homing here ← correct

(B) The outer cortex (primary and secondary follicles) is the primary T-cell zone; B cells reside in the paracortex

(C) The medullary cords contain predominantly plasma cells and macrophages, and are the site of B-cell activation

(D) The subcapsular sinus is lined by endothelial cells and is the primary site of T-cell—antigen interaction

Q40. A 24-year-old medical student is reviewing a histological section of spleen. Her professor asks her to identify the white pulp and describe the arrangement of lymphoid tissue around the artery. Which of the following correctly describes the organisation of splenic white pulp?

(A) The white pulp consists entirely of B-cell follicles without any T-cell zones

(B) The periarterial lymphatic sheath (PALS) surrounds the central artery and is the primary B-cell zone

(C) The marginal zone lies inside the PALS, separating it from the red pulp

(D) The periarterial lymphatic sheath (PALS) is a T-cell zone surrounding the central artery; B-cell follicles (Malpighian corpuscles) are attached to or adjacent to the PALS; the marginal zone separates white from red pulp ← correct

Detailed Solutions

Q1.

Solution

Concept — Referred pain and dermatome referral patterns: Referred pain occurs when visceral afferent fibres converge on the same spinal cord segments as somatic afferents from the skin (convergence-projection theory). The heart's afferents travel with sympathetic fibres entering T1–T5 segments; the T1–T2 segment also receives somatic input from the inner arm, explaining referral there.

Step 1 — Mechanism: Visceral afferents from the heart run with sympathetic fibres to synapse in spinal segments T1–T5. The brain interprets the signal as coming from the somatic territory sharing those segments.

Step 2 — Localisation: T1–T2 segment receives somatic afferents from the medial (inner) aspect of the upper arm via the medial cutaneous nerve of the arm, explaining left inner arm pain.

Why other options are wrong:

- Option A (C5–C6): shoulder and lateral arm dermatome; not the cardiac referral segment.
- Option B (C8–T1): although T1 is included, C8 is the ring/little finger level, not the primary cardiac referral.
- Option C (T4–T5): more relevant to chest-wall referral from inferior heart, not specifically inner arm.

Final Answer: Cardiac visceral afferents sharing T1–T2 segments cause referred pain to the inner left arm $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 1

Q2.

Solution

Concept — Pennate muscles and force generation: Pennate muscles have fibres arranged at an angle (pennation angle) to the tendon. This allows packing of more fibres (and sarcomeres in parallel) per unit of anatomical cross-section, increasing the physiological cross-sectional area (PCSA) and force-generating capacity, at the cost of reduced range of movement compared with fusiform muscles.

Step 1 — PCSA vs anatomical CSA: In pennate muscles, PCSA $>$ anatomical CSA

because fibres run obliquely; more motor units can be recruited per unit volume.

Step 2 — Force vs speed trade-off: Greater PCSA → greater force but shorter effective fibre length → reduced velocity of shortening.

Why other options are wrong:

- Option A: Parallel-fibred (fusiform) muscles run parallel to tendon, maximising range; pennate fibres are oblique.
- Option C: In pennate muscles, PCSA *exceeds* anatomical CSA (the reverse of this statement).
- Option D: Higher pennation angle increases force but *decreases* speed; unipennate vs multipennate distinction is separate from this effect.

Final Answer: Pennate muscles pack more fibres per unit volume → greater force ⇒ B

Answer: (B) Go Back to Q 2

Q3.

Solution

Concept — Blood-nerve barrier and peripheral nerve layers: A peripheral nerve is surrounded by three connective tissue layers: endoneurium (innermost, around individual axons), perineurium (middle, around fascicles), and epineurium (outermost, enclosing the whole nerve). The blood-nerve barrier, analogous to the blood-brain barrier, is formed by the perineurium around fascicles and by tight junctions in endoneurial capillary endothelium around individual axons.

Step 1 — Layer identification: The innermost layer surrounding individual nerve fibres is the **endoneurium** (loose connective tissue containing Schwann cells, fibroblasts, and endoneurial capillaries).

Step 2 — Barrier function: Endoneurial capillaries have tight junctions forming the blood-nerve barrier; the perineurium also contributes a second barrier line around each fascicle.

Why other options are wrong:

- Option B: Perineurium surrounds a *fascicle* (group of fibres), not individual axons.
- Option C: Epineurium is the outermost layer enclosing the entire nerve trunk — not a metabolic barrier.

- Option D: Myelin is a Schwann cell product insulating the axon, not a connective tissue barrier layer.

Final Answer: Endoneurium surrounds individual axons and maintains the blood-nerve barrier ⇒ A

Answer: (A) Go Back to Q 3

Q4.

Solution

Concept — Fibrous joint classification (gomphosis): Fibrous joints are united by dense fibrous tissue with no synovial cavity. Three types exist: (1) sutures (between skull bones), (2) syndesmoses (bone-to-bone by interosseous membrane/ligament, slight movement), and (3) gomphosis (peg-in-socket, unique to teeth in alveolar sockets, held by the periodontal ligament).

Step 1 — Gomphosis definition: The word derives from Greek "gomphos" (bolt/nail). The root of each tooth is the "peg"; the alveolar socket is the "socket"; the periodontal ligament (containing Sharpey's fibres) holds them together.

Step 2 — No movement: Gomphosis is a synarthrosis (no movement), as is a suture.

Why other options are wrong:

- Option A: Sutures join flat skull bones and are also held by Sharpey's fibres, but are NOT peg-in-socket joints.
- Option B: Syndesmosis allows limited movement (amphiarthrosis) — it does not describe the tooth-socket articulation.
- Option D: Symphysis is a *secondary cartilaginous* (fibrocartilaginous) joint (e.g., pubic symphysis, intervertebral disc), not a fibrous joint.

Final Answer: The tooth-in-socket articulation is a gomphosis ⇒ C

Answer: (C) Go Back to Q 4

Q5.

Solution

Concept — Arterial anastomoses around joints: True anastomoses around joints allow collateral flow when one artery is occluded. The knee has a rich genicular anastomosis formed by five genicular arteries (superior medial and lateral, middle, inferior medial and lateral genicular arteries) supplemented by the descending genicular artery and the anterior tibial recurrent artery.

Step 1 — Genicular network: Superior medial + lateral genicular, inferior medial + lateral genicular, and middle genicular arteries all anastomose around the patella and joint capsule, providing collateral flow when the popliteal artery is occluded gradually.

Step 2 — Clinical relevance: Gradual occlusion (chronic atherosclerosis) allows time for collateral development, maintaining perfusion. Acute occlusion (embolism) may not allow time for collaterals.

Why other options are wrong:

- Option A: The knee is specifically NOT served by end-arteries; rich collaterals exist precisely here.
- Option B: Watershed territories describe cerebral cortex supply, not musculoskeletal collaterals.
- Option C: Veins do not provide retrograde arterial filling (no arteriovenous bypass under normal conditions).

Final Answer: Genicular anastomosis provides collateral blood flow around the obstructed popliteal artery $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 5

Q6.

Solution

Concept — Radial nerve in the spiral groove and wrist drop: The radial nerve winds around the humerus in the spiral (radial) groove in the mid-shaft, then pierces the lateral intermuscular septum. Injury here affects the motor supply to extensors of the wrist, fingers, and thumb (wrist drop) but spares the posterior cutaneous nerve of the forearm (already given off) and, crucially, preserves sensation over the anatomical snuff box and dorsal thumb web (which may be reduced but is not completely absent because the superficial radial branch is affected variably).

Step 1 — Nerve anatomy: In the spiral groove, the radial nerve gives motor branches to triceps (already given off, so triceps is *spared*), then proceeds to supply brachioradialis, extensor carpi radialis longus and brevis. Below the lateral epicondyle it divides into the superficial sensory branch and the posterior interosseous nerve (deep motor branch).

Step 2 — Sensory sparing: Fracture in the mid-shaft (spiral groove) lesion: the superficial radial nerve (sensory to dorsum of hand) continues distally intact in most cases, explaining the sensory sparing described. The small lateral thenar area (supplied by the superficial radial branch) may be lost.

Why other options are wrong:

- Option A: Median nerve injury causes loss of thumb opposition and thenar wasting, not wrist drop.
- Option B: Ulnar nerve injury causes claw hand with intrinsic muscle loss (ring and little finger), not wrist drop.
- Option D: Posterior interosseous nerve injury (at the arcade of Frohse) causes finger/thumb drop only; the wrist can still extend because ECRL and ECRB are spared (they arise above the arcade).

Final Answer: Radial nerve injury in the spiral groove $\rightarrow$ pure motor wrist drop with sensory sparing $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q 6

Q7.

Solution

Concept — Carrying angle and cubitus valgus/varus: The carrying angle is the angle formed between the long axis of the arm and forearm when the elbow is fully extended and supinated. Normal: 10–15° (some sources 5–15°) with the forearm deviating laterally from the arm (valgus). Cubitus varus ("gunstock deformity") is medial deviation; cubitus valgus is increased lateral deviation.

Step 1 — Normal angle: The standard accepted range is 10–15° valgus (larger in women due to wider pelvis / anatomical adaptation).

Step 2 — Deformity classification: Malunion after supracondylar fracture often produces **cubitus varus** (medial deviation of forearm), the commonest elbow malunion deformity in children.

Why other options are wrong:

- Option A: Quotes 5–7° which is below the accepted normal range; also misidentifies the deformity direction.
- Option B: States 15–20° which is too large and then incorrectly calls medial deviation "valgus".
- Option C: Correctly states 10–15° but wrongly calls medial deviation "valgus" (valgus = lateral deviation).

Final Answer: Normal carrying angle 10–15° valgus; medial deviation post-fracture = cubitus varus ⇒ D

Answer: (D) Go Back to Q 7

Q8.

Solution

Concept — Flexor retinaculum and carpal tunnel syndrome: The flexor retinaculum (transverse carpal ligament) is a thick fibrous band forming the roof of the carpal tunnel. Its bony attachments are: **Medially**: pisiform and hook of hamate. **Laterally**: tubercle of scaphoid and crest of trapezium.

Step 1 — Contents of carpal tunnel: Flexor pollicis longus (1), flexor digitorum superficialis (4), flexor digitorum profundus (4), and the **median nerve**. The ulnar nerve and artery pass superficial to the retinaculum in Guyon's canal.

Step 2 — Clinical presentation: Thenar wasting + night tingling in median nerve territory (thumb, index, middle, and lateral half of ring finger) = classic carpal tunnel syndrome.

Why other options are wrong:

- Option B: Extensor retinaculum is on the dorsum of the wrist and forms the six extensor compartments; it attaches to radius and ulna.
- Option C: Palmar aponeurosis is a fibrous expansion of the palmaris longus tendon in the palm; it is NOT the roof of the carpal tunnel.
- Option D: Palmar carpal ligament is a superficial fascial thickening proximal to (and separate from) the flexor retinaculum.

Final Answer: Flexor retinaculum (pisiform/hamate medially; scaphoid/trapezium laterally) roofs the carpal tunnel ⇒ A

Answer: (A) Go Back to Q 8

Q9.

Solution

Concept — Arterial pulse points (radial vs dorsalis pedis): The radial artery is palpated at the distal forearm, lateral to the flexor carpi radialis tendon (not medial). The dorsalis pedis artery is the continuation of the anterior tibial artery as it crosses the ankle joint; it is palpated between the extensor hallucis longus and extensor digitorum longus tendons (lateral to EHL).

Step 1 — Dorsalis pedis: Anterior tibial artery crosses the ankle midway between malleoli and continues as dorsalis pedis on the dorsum of the foot, lateral to the EHL tendon.

Step 2 — Absence rates: The dorsalis pedis artery is absent (replaced by perforating peroneal) in approximately 3–12% of individuals, not 15%. The radial artery is almost never absent (less than 1%).

Why other options are wrong:

- Option A: The radial pulse is felt *lateral* to flexor carpi radialis, between the FCR tendon and the radial styloid — not medial to FCR.
- Option C: Radial artery is a branch of the brachial; it does not share the popliteal artery as a parent vessel.
- Option D: Radial artery absence rate of 15% is grossly exaggerated.

Final Answer: Dorsalis pedis = continuation of anterior tibial artery, lateral to EHL $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q 9

Q10.

Solution

Concept — Glenohumeral joint stability — rotator cuff: The glenohumeral joint is the most commonly dislocated major joint. Its shallow glenoid (only covers one-third of the humeral head) provides minimal bony stability. Static stabilisers: glenoid labrum, glenohumeral ligaments, joint capsule. Dynamic stabilisers: the four rotator cuff muscles (SITS — Supraspinatus, Infraspinatus, Teres minor, Subscapularis).

Step 1 — Rotator cuff function: Each muscle compresses the humeral head into the glenoid, maintaining centration. Supraspinatus initiates abduction; infraspinatus and teres minor externally rotate; subscapularis internally rotates.

Step 2 — Anterior dislocation: Most common direction (95%) because the inferior and anteroinferior capsule is weakest. Bankart lesion (anterior labrum detachment) and Hill-Sachs lesion (posterolateral humeral head impression) often result.

Why other options are wrong:

- Option A: Long head of biceps, coracobrachialis, deltoid, pectoralis major — these are prime movers/mobilisers, not the cuff stabilisers.
- Option B: Deltoid, teres major, latissimus dorsi, pectoralis minor — these do not form the rotator cuff and do not stabilise the glenohumeral joint primarily.
- Option D: Trapezius, serratus anterior, rhomboids, and levator scapulae stabilise the scapula, not the glenohumeral joint per se.

Final Answer: The rotator cuff (SITS) provides primary dynamic glenohumeral stability $\Rightarrow$ C

Answer: (C) Go Back to Q 10

Q11.

Solution

Concept — Blood supply of the femoral head and avascular necrosis: In adults, the blood supply to the femoral head is predominantly via the **medial circumflex femoral artery (MCFA)**, whose retinacular (ascending cervical/capsular) branches run along the posterior femoral neck beneath the synovium and pierce the head near the articular margin.

Step 1 — Retinacular vessels: The MCFA gives ascending branches that form retinacular arteries (4 groups: anterior, posterior, medial, lateral), of which the **posterior superior retinacular artery** is dominant in adults.

Step 2 — Intracapsular fracture mechanism: A fracture of the femoral neck within the capsule disrupts these ascending retinacular branches, cutting off blood supply to the femoral head and leading to avascular necrosis (AVN).

Step 3 — Role of artery in ligamentum teres: The artery of the ligamentum teres (from obturator artery) supplies a small area near the fovea capitis but is *insufficient to maintain viability* after intracapsular fracture in adults.

Why other options are wrong:

- Option A: The MCFA's obturator branch is not the correct nomenclature; the

ligamentum teres artery is minor and insufficient alone.

- Option B: The lateral circumflex femoral artery (LCFA) primarily supplies the greater trochanter and anterior femoral neck; it is a minor contributor to head supply.
- Option C: The obturator artery's contribution (via ligamentum teres) is minor in adults and insufficient to prevent AVN after femoral neck fracture.

Final Answer: MCFA retinacular branches are the dominant adult blood supply to the femoral head $\Rightarrow$ D

Answer: (D) Go Back to Q 11

Q12.

Solution

Concept — Femoral nerve (L2–L4) and quadriceps: The femoral nerve arises from the lumbar plexus (L2, L3, L4) and passes deep to the inguinal ligament (lateral to femoral artery) into the femoral triangle. It supplies: iliacus, pectineus, sartorius, and the four heads of quadriceps femoris (motor); and the anteromedial thigh and medial leg via the saphenous nerve (sensory).

Step 1 — Motor deficit: L2–L4 lesion via femoral nerve $\rightarrow$ weakness of knee extension (quadriceps) and reduced hip flexion (iliopsoas partly through lumbar plexus direct branches).

Step 2 — Sensory pattern: Anteromedial thigh (medial and intermediate cutaneous nerves of femoral) and medial leg down to the medial malleolus (saphenous nerve, the only branch of femoral nerve below the knee).

Step 3 — Reflex: Knee jerk (patellar reflex) tests L3–L4 via femoral nerve; absent in femoral neuropathy.

Why other options are wrong:

- Option B: L4–L5 via common peroneal $\rightarrow$ foot drop (ankle dorsiflexion loss); knee extension is preserved.
- Option C: L5–S1 via sciatic $\rightarrow$ hamstring weakness; knee jerk is preserved (patellar) but ankle jerk may be lost.
- Option D: Lateral cutaneous nerve of thigh (L1–L2, meralgia paraesthetica) is *purely sensory* to the lateral thigh; no motor deficit.

Final Answer: Femoral nerve (L2–L4); quadriceps weakness + medial leg sensory loss via saphenous $\Rightarrow$ A

Answer: (A) Go Back to Q 12

Q13.

Solution

Concept — Superior vs inferior gluteal nerve: The superior gluteal nerve (L4, L5, S1) exits the greater sciatic foramen *above* the piriformis and supplies gluteus medius, gluteus minimus, and tensor fasciae latae. The inferior gluteal nerve (L5, S1, S2) exits *below* the piriformis and supplies only gluteus maximus.

Step 1 — Superior gluteal nerve lesion: Loss of gluteus medius and minimus → loss of hip abduction. During walking, these muscles stabilise the pelvis, preventing it from dropping to the opposite (swinging) side. Their loss results in the **Trendelenburg gait**: the pelvis drops to the contralateral side when weight-bearing.

Step 2 — Surgical relevance: The posterior approach (Kocher-Langenbeck) to the hip risks the superior gluteal nerve as it exits above the piriformis — retractor placement must be careful.

Why other options are wrong:

- Option A: Gluteus maximus (inferior gluteal nerve) injury causes hip extension weakness but NOT Trendelenburg gait; the pelvis is stable during stance because medius/minimus are intact.
- Option C: Piriformis is supplied by direct branches from S1–S2, not the named superior/inferior gluteal nerves.
- Option D: Obturator internus is supplied by the nerve to obturator internus (L5, S1), a separate branch.

Final Answer: Superior gluteal nerve injury → gluteus medius/minimus weakness → Trendelenburg gait ⇒ B

Answer: (B) Go Back to Q 13

Q14.

Solution

Concept — Cruciate (trochanteric) anastomosis around the hip: The cruciate anastomosis is an important collateral network forming a "cross" at the level of the lesser trochanter. It is formed by four vessels: (1) descending branch of the **medial circumflex femoral** artery, (2) ascending branch of the **lateral circumflex femoral** artery (transverse branch), (3) descending branch of the **inferior gluteal** artery, and (4) ascending branch of the **first perforating** branch of the profunda femoris artery.

Step 1 — Anatomical location: The anastomosis is situated posteroinferiorly to the hip joint, around the lesser and greater trochanter region.

Step 2 — Clinical relevance: This network allows gradual occlusion of the common femoral or profunda femoris artery to be compensated by collateral flow, protecting the thigh musculature.

Why other options are wrong:

- Option A: Superior gluteal artery is NOT part of the cruciate anastomosis; it supplies the gluteal region.
- Option B: Superficial femoral artery does not contribute to the cruciate anastomosis.
- Option D: Obturator artery does not contribute to the cruciate anastomosis; it supplies the medial compartment of the thigh via its anterior and posterior branches.

Final Answer: Cruciate anastomosis: medial circumflex + lateral circumflex + inferior gluteal + first perforating artery $\Rightarrow$ C

Answer: (C) Go Back to Q 14

Q15.

Solution

Concept — Ankle joint (talocrural) anatomy and inversion sprains: The talocrural joint is a **hinge joint** (ginglymus) formed between the distal tibia, fibula (forming the mortise), and the trochlea of the talus. It permits dorsiflexion and plantar flexion. Lateral ligaments: anterior talofibular (ATFL), calcaneofibular, and posterior talofibular (PTFL).

Step 1 — Most common ligament injured: The ATFL is the **weakest and most**

commonly torn ligament in inversion sprains. In plantar flexion, the ATFL becomes nearly parallel with the fibula, leaving the lateral ankle least protected — making this the position of maximum vulnerability.

Step 2 — Why ATFL, not deltoid or PTFL: The deltoid (medial) ligament is the *strongest* ankle ligament and is rarely torn; PTFL is taut in dorsiflexion and is the least commonly injured.

Why other options are wrong:

- Option A: The talocrural joint is a hinge (not condyloid) joint; plantar flexion actually relaxes (not tightens) the lateral collateral in some references.
- Option B: Deltoid ligament rupture is uncommon (stronger + eversion mechanism required).
- Option C: PTFL is taut in *dorsiflexion* and is the least commonly injured, not in plantar flexion inversion sprains.

Final Answer: Talocrural = hinge joint; ATFL most vulnerable in plantar flexion + inversion $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 15

Q16.

Solution

Concept — Coronary arteries: RCA dominance and inferior MI: In right-dominant hearts (85% of population), the **right coronary artery (RCA)** supplies the posterior interventricular (descending) artery (PDA) and the posterior left ventricle. The inferior (diaphragmatic) surface of the left ventricle is supplied by the RCA in right-dominant systems, causing inferior ST elevation (II, III, aVF) when it is occluded.

Step 1 — RCA territory: SA node (60%), AV node (80–90%), right ventricle, inferior wall of LV, posterior septum (via PDA).

Step 2 — Left circumflex territory: Lateral wall of LV (obtuse marginal branches); in left-dominant systems it also supplies the PDA and posterior LV.

Step 3 — Lead correlation: Inferior MI (ST elevation in II, III, aVF) = RCA or dominant LCx occlusion. This case specifies right-dominant system $\rightarrow$ RCA + PDA.

Why other options are wrong:

- Option B: LCx territory is the lateral wall; would cause lateral ST changes (I,

aVL, V5–V6), not inferior.
- Option C: LAD territory is anterior wall and septum; would cause anterior ST elevation (V1–V4).
- Option D: Biventricular compromise from RCA + LCx occlusion would be extremely rare as a single angiographic finding.

Final Answer: Right-dominant RCA occlusion causes inferior wall MI via PDA territory ⇒ A

Answer: (A) Go Back to Q 16

Q17.

Solution

Concept — SA node location: The sinoatrial (SA) node is the cardiac pacemaker, located at the **junction of the superior vena cava (SVC) and the right atrium**, in the upper part of the **sulcus terminalis** (corresponding internally to the crista terminalis). It is supplied mainly by the SA nodal artery (a branch of the RCA in 60% or LCx in 40%).

Step 1 — Surgical and trauma relevance: A stab wound or surgical incision near the SVC–RA junction risks damaging the SA node, causing sick sinus syndrome or complete loss of pacemaker activity.

Step 2 — AV node location (for comparison): The AV node is in the Koch's triangle (bounded by the coronary sinus orifice, tricuspid annulus, and tendon of Todaro) in the interatrial septum, near the right atrioventricular junction.

Why other options are wrong:

- Option A: The fossa ovalis is at the interatrial septum; it is the remnant of the foramen ovale, NOT the SA node.
- Option B: The inferior RA near the IVC orifice is where the coronary sinus opens, not the SA node.
- Option D: Coronary sinus ostium is near the AV node region in Koch's triangle, not the SA node.

Final Answer: SA node is at the SVC–right atrium junction, in the sulcus terminalis ⇒ C

Answer: (C) Go Back to Q 17

Q18.

Solution

Concept — Pericardium and cardiac tamponade (Beck's triad): The pericardium has two serous layers: (1) **visceral** pericardium (epicardium, adherent to heart) and (2) **parietal** pericardium (inner lining of fibrous pericardium). The **pericardial cavity** between them normally contains 15–50 mL of fluid. In tamponade, blood accumulates here, compressing the heart.

Step 1 — Beck's triad: Hypotension (reduced cardiac output) + muffled/distant heart sounds (blood muffling sound) + elevated JVP/distended neck veins (impaired venous return).

Step 2 — Clinical threshold: As little as 150–200 mL of blood rapidly accumulating can cause tamponade; slow accumulations may allow up to 1 L due to pericardial stretching.

Why other options are wrong:

- Option A: Blood between fibrous pericardium and pleura would cause pleural effusion/haemothorax signs, not tamponade.
- Option C: Blood between myocardium and epicardium (intramyocardial) does not form a separate compressible collection; it is not a recognised entity causing tamponade.
- Option D: The transverse pericardial sinus lies posterior to the aorta and pulmonary trunk; isolated blood there would not cause the full tamponade picture.

Final Answer: Blood in the pericardial cavity (between visceral and parietal pericardium) causes tamponade $\Rightarrow$ B

Answer: (B) Go Back to Q 18

Q19.

Solution

Concept — Rib classification and sternal angle: True ribs (1–7): each articulates directly with the sternum via its own costal cartilage. **False ribs (8–10)**: their costal cartilages join the cartilage of rib 7, attaching indirectly. **Floating ribs (11–12)**: no anterior attachment at all. The **sternal angle** (angle of Louis) marks the articulation between the manubrium and body of the sternum, corresponds to the level of the **T4/T5 intervertebral disc**, and is where the costal cartilage of **rib 2** articulates.

Step 1 — Clinical use: Palpating rib 2 at the sternal angle allows counting down to rib 5 for intercostal or thoracocentesis procedures.

Step 2 — Other landmarks at T4/T5: Bifurcation of the trachea (carina), aortic arch beginning and ending, cardiac notch.

Why other options are wrong:

- Option A: Ribs 8–10 are false ribs (not floating); ribs 11–12 are floating.
- Option B: Sternal angle articulates with rib 2 cartilage (not rib 3) and marks T4/T5 (not T3/T4).
- Option C: True ribs each have *individual* costal cartilages going to the sternum; it is the false ribs (8–10) that share a common costal cartilage. Also, floating ribs are 11–12, not 8–10.

Final Answer: True ribs 1–7 (individual cartilages); floating ribs 11–12 (no anterior attachment); sternal angle = T4/T5 + rib 2 $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 19

Q20.

Solution

Concept — Breast lymphatic drainage: Approximately **60–75%** of breast lymph drains to the **axillary lymph nodes**, predominantly the anterior (pectoral) group, which is Level I. The internal mammary (parasternal) nodes receive most of the rest (mainly from medial quadrants). Axillary nodes are grouped as Level I (lateral to pectoralis minor), Level II (behind), and Level III (medial/infraclavicular apical).

Step 1 — Route from upper outer quadrant (UOQ): UOQ lymphatics pass through the axillary tail of Spence (tail of the breast) to reach Level I axillary nodes first.

Step 2 — Sentinel node biopsy: The sentinel node is the first lymph node to receive drainage from the tumour. For UOQ tumours this is almost always an axillary Level I node.

Why other options are wrong:

- Option B: Internal mammary nodes receive mainly *medial* quadrant drainage, not the majority overall.
- Option C: Level III (infraclavicular/apical) is the last-draining axillary level; drainage does not bypass Levels I and II.

- Option D: Supraclavicular nodes are the *tertiary* drainage only (after axillary overflow); primary drainage is NOT supraclavicular.

Final Answer: 60–75% to axillary nodes (Level I predominantly); UOQ drains via axillary tail $\Rightarrow$ A

Answer: (A) Go Back to Q 20

Q21.

Solution

Concept — Splenic ligaments: The spleen is attached by two main peritoneal ligaments: (1) **Gastrosplenic ligament** (from greater curvature of stomach to splenic hilum) — contains the short gastric arteries and left gastroomental vessels. (2) **Splenorenal (lienorenal) ligament** (from left kidney to splenic hilum) — contains the tail of the pancreas and splenic vessels.

Step 1 — Gastrosplenic contents: Short gastric arteries (from splenic artery) and left gastro-omental (gastroepiploic) artery are contained within the gastrosplenic ligament.

Step 2 — Surgical hazard: Careless clamping of the gastrosplenic ligament can devascularise the fundus of the stomach by cutting the short gastric arteries.

Why other options are wrong:

- Option A: The tail of pancreas and splenic vessels are in the *splenorenal* ligament, not the gastrosplenic.
- Option B: The inferior mesenteric vein runs along the posterior abdominal wall medial to the spleen, not in the gastrosplenic ligament.
- Option D: The portal vein and hepatic artery proper are in the *hepatoduodenal ligament* (free edge of lesser omentum), not related to the spleen.

Final Answer: Gastrosplenic ligament contains short gastric arteries and left gastro-omental vessels $\Rightarrow$ C

Answer: (C) Go Back to Q 21

Q22.

Solution

Concept — Gastric blood supply: The stomach has a rich blood supply from all branches of the coeliac trunk. **Lesser curvature**: supplied by the **left gastric artery** (directly from coeliac trunk) and the **right gastric artery** (from the proper hepatic artery), both running in the lesser omentum. **Greater curvature**: right and left gastro-omental (gastroepiploic) arteries + short gastric arteries.

Step 1 — Lesser omentum contents: The hepatogastric portion of the lesser omentum contains the right and left gastric arteries along the lesser curvature, and (at its free edge) the portal vein, hepatic artery proper, and bile duct (the portal triad).

Step 2 — Right gastric origin: Right gastric artery branches from the proper hepatic artery (or sometimes from the left or right hepatic artery); it runs left along the lesser curvature to anastomose with the left gastric.

Why other options are wrong:

- Option A: Left gastro-omental artery is a branch of the splenic artery and runs along the *greater* curvature, not the lesser.
- Option C: Right gastro-omental artery (from gastroduodenal artery) also runs along the *greater* curvature.
- Option D: Short gastric arteries are branches of the splenic artery supplying the *fundus*, not the lesser curvature.

Final Answer: Left gastric (coeliac trunk) + right gastric (proper hepatic) supply the lesser curvature $\Rightarrow$ B

Answer: (B) Go Back to Q 22

Q23.

Solution

Concept — Duodenum parts and major duodenal papilla: The duodenum has four parts: (1) Superior (first part, mobile, intraperitoneal); (2) **Descending** (second part, retroperitoneal, C-shaped around pancreatic head) — the major duodenal papilla (ampulla of Vater) opens on its **posteromedial wall**; (3) Horizontal/inferior (third part, crosses vertebral column); (4) Ascending (fourth part, ends at duodenojejunal flexure/ligament of Treitz).

Step 1 — Second part relations: The second (descending) part lies to the **right**

of the head of the pancreas. The common bile duct and main pancreatic duct join to form the hepatopancreatic ampulla, which opens at the major duodenal papilla on the posteromedial wall of the second part.

Step 2 — ERCP relevance: The endoscopist must navigate through the first and into the second part to find and cannulate the papilla.

Why other options are wrong:

- Option A: The first (superior) part (duodenal cap) is related anteriorly to the gallbladder, not the site of the major papilla.
- Option B: Third part crosses the vertebral column at L3 level (not L2–L3), anterior to the aorta and IVC.
- Option C: Fourth part ends at the duodenojejunal flexure suspended by the ligament of Treitz (suspensory muscle of duodenum) at L2 level.

Final Answer: Major duodenal papilla opens on the posteromedial wall of the 2nd (descending) part of duodenum $\Rightarrow$ D

Answer: (D) Go Back to Q 23

Q24.

Solution

Concept — Appendix position and McBurney's point: The base of the appendix is consistently located at the convergence of the three taeniae coli at the posteromedial wall of the caecum. The tip position varies: **retrocaecal** is most common (~65%), followed by pelvic/subcaecal (~30%), and less common positions (preileal, postileal). **McBurney's point** is at the junction of the lateral one-third and medial two-thirds of the line from the **right anterior superior iliac spine (ASIS) to the umbilicus**.

Step 1 — McBurney's point definition: One-third of the distance from ASIS to umbilicus along that line (or 2/3 of the way from the umbilicus to the ASIS).

Step 2 — Retrocaecal appendix and atypical presentation: Because the retrocaecal appendix is behind the caecum, classic McBurney's point tenderness may be attenuated, causing delayed diagnosis.

Why other options are wrong:

- Option B: Pelvic is the second most common position (~30%), not the most common; McBurney's point is not midpoint between ASIS and pubic symphysis.

- Option C: Subcaecal is uncommon; McBurney's point is not the midpoint of ASIS-umbilicus line.
- Option D: Preileal position is rare (<1%); McBurney's tenderness is not specific for pelvic appendix.

Final Answer: Retrocaecal most common (~65%); McBurney's = lateral 1/3 of ASIS-to-umbilicus line ⇒ A

Answer: (A) Go Back to Q 24

Q25.

Solution

Concept — Kidney relations (anterior): Both kidneys are retroperitoneal. Their anterior relations differ because of the asymmetry of abdominal organs.

Right kidney anterior relations (from superior to inferior):

- Suprarenal gland (superomedial)
- Liver / right lobe hepatic impression (superolateral)
- Second part of duodenum (medially)
- Right colic (hepatic) flexure (inferolaterally)

Left kidney anterior relations:

- Suprarenal gland (superomedial)
- Stomach (superolateral)
- Spleen (lateral)
- Tail of pancreas (splenic vessels cross its hilum)
- Left colic (splenic) flexure + descending colon (inferolateral)

Why other options are wrong:

- Option A: Spleen is a LEFT kidney relation, not right; descending colon is a left kidney relation.
- Option B: Incomplete list for left kidney (misses stomach and suprarenal).
- Option D: The two kidneys have clearly different anterior relations because of the liver/spleen asymmetry.

Final Answer: Right = suprarenal + liver + duodenum + right colic flexure; Left = suprarenal + stomach + spleen + pancreatic tail + left colic flexure ⇒ C

Answer: (C) Go Back to Q 25

Q26.

Solution

Concept — Optic canal vs superior orbital fissure contents:

Optic canal (in the lesser wing of sphenoid):

- CN II (optic nerve) + its meningeal sheaths
- Ophthalmic artery (first branch of internal carotid)

Superior orbital fissure (between greater and lesser wings of sphenoid):

- CN III (oculomotor), IV (trochlear), V1 (ophthalmic — nasociliary, frontal, lacrimal branches), VI (abducens)
- Superior and inferior ophthalmic veins
- Sympathetic fibres

Step 1 — Orbital apex syndrome: Compression at the apex affects all structures passing through both the optic canal and the superior orbital fissure, causing CN II–VI palsies + visual loss.

Why other options are wrong:

- Option A: CN V2 (maxillary) passes through the foramen rotundum, NOT the superior orbital fissure.
- Option B: Ophthalmic artery passes through the optic canal, NOT the superior orbital fissure.
- Option C: Ophthalmic vein passes through the superior orbital fissure, NOT the optic canal.

Final Answer: Optic canal = CN II + ophthalmic artery; SOF = CN III, IV, V1, VI, superior ophthalmic vein $\Rightarrow$ D

Answer: (D) Go Back to Q 26

Q27.

Solution

Concept — Facial nerve (CN VII) in the mastoid: After exiting the internal auditory meatus, CN VII runs through the petrous temporal bone in three segments: labyrinthine, tympanic (horizontal, in the medial wall of the middle ear), and **mastoid** (vertical, running downward in the posterior wall of the facial canal to exit at the **stylomastoid foramen**).

Step 1 — Risk during mastoidectomy: The mastoid segment of the facial nerve lies directly in the surgical field. The nerve is identified by careful bone removal and intraoperative nerve monitoring. The "drill-off" technique preserves a thin shell of bone over the nerve.

Step 2 — Chorda tympani: A branch of CN VII given off in the mastoid segment; it enters the middle ear — at risk during tympanoplasty/myringotomy, not mastoidectomy per se.

Why other options are wrong:

- Option A: The sigmoid sinus is posterior to the mastoid and can be injured, but the facial nerve is the *most critical* structure specific to mastoidectomy in terms of functional consequence.
- Option C: Chorda tympani is at risk during middle ear surgery, less so during mastoidectomy itself.
- Option D: The internal carotid artery passes through the carotid canal in the petrous bone; it is not directly in the mastoidectomy field.

Final Answer: CN VII (mastoid segment, in its vertical course) is the most critical structure at risk during mastoidectomy $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q 27

Q28.

Solution

Concept — Great auricular nerve and the tail of the parotid: The great auricular nerve (C2–C3) is the largest ascending branch of the cervical plexus. It wraps around the posterior border of the sternocleidomastoid (SCM) at Erb's point (~midpoint of posterior border of SCM), then runs superiorly on the surface of SCM to supply the skin over the parotid, the lower part of the auricle (both surfaces), and the mastoid process.

Step 1 — Surgical relevance: During superficial parotidectomy, the inferior pole (tail) overlies the great auricular nerve. Preserving it avoids post-operative numbness of the earlobe and overlying skin.

Step 2 — Auriculotemporal nerve distinction: The auriculotemporal nerve (V3) carries the secretomotor fibres from the otic ganglion to the parotid and provides sensory supply to the temporal scalp/tragus — but it runs with the vessels at the superior pole of the parotid and near the temporomandibular joint, NOT in the tail.

Why other options are wrong:

- Option B: Lesser occipital nerve (C2) supplies the posterior scalp behind the ear, not the parotid region skin.
- Option C: Auriculotemporal nerve is at the superior pole of the parotid, not the tail; it is also purely sensory to the skin in that region plus carries postganglionic secretomotor fibres.
- Option D: Transverse cervical nerve (C2–C3) crosses the neck anteriorly; it does not supply the parotid region.

Final Answer: Great auricular nerve (C2–C3) is encountered at the tail of the parotid during parotidectomy $\Rightarrow$ A

Answer: (A) Go Back to Q 28

Q29.

Solution

Concept — SCALP mnemonic and dangerous area: The scalp has five layers (SCALP):

(a) **S**kin (highly vascular — bleeds profusely when cut)
(b) Dense **C**onnective tissue (vessels and nerves run here; arteries do not retract when cut due to fibrous anchoring)
(c) **A**poneurosis (epicranial aponeurosis / galea aponeurotica)
(d) **L**oose areolar tissue (**dangerous layer**)
(e) **P**ericranium (periosteum of skull)

Step 1 — Why layer 4 is dangerous: The loose areolar layer has *no septa or barriers* across the calvaria (between orbital margins anteriorly and nuchal lines posteriorly, and from temporal fascia to temporal fascia laterally). Pus, blood, or oedema can spread freely in this plane — forming a "surgical space". Crucially,

emissary veins passing through the skull connect this layer to the intracranial dural venous sinuses, allowing spread of infection intracranially (cavernous sinus thrombosis, meningitis, cerebral abscess).

Why other options are wrong:

- Option A: Layer 1 (skin) bleeding is heavy but self-contained (vessels anchored in layer 2 fibrous tissue); "dangerous" refers to infection spread, not external bleeding.
- Option B: Emissary veins traverse layer 4, not layer 2; layer 2 contains the named scalp vessels.
- Option D: Pericranium is vascular but firmly adhered to the outer table; infection here creates a subperiosteal abscess, which is localised (not the "dangerous" layer for intracranial spread).

Final Answer: Layer 4 (loose areolar tissue) = dangerous layer; free infection spread + emissary vein connection to dural sinuses $\Rightarrow$ C

Answer: (C) Go Back to Q 29

Q30.

Solution

Concept — Kiesselbach's plexus (Little's area): The anteroinferior part of the nasal septum (just above the vestibule) is the most common site of epistaxis in children. Here, five arteries anastomose to form **Kiesselbach's plexus** (also called **Little's area**):

(a) Anterior ethmoidal artery (from ophthalmic artery $\rightarrow$ ICA)
(b) Posterior ethmoidal artery (from ophthalmic artery $\rightarrow$ ICA)
(c) Sphenopalatine artery (from maxillary artery $\rightarrow$ ECA) — largest contributor
(d) Superior labial artery (from facial artery $\rightarrow$ ECA)
(e) Greater palatine artery (from maxillary artery $\rightarrow$ ECA)

Step 1 — Location: Anteroinferior nasal septum (Cottle area 2–3), visible on anterior rhinoscopy.

Step 2 — Woodruff's area distinction: Woodruff's area is in the posterior nasal cavity (posterior end of inferior meatus) and is the site of *posterior* epistaxis, predominantly due to the sphenopalatine artery and posterior nasal vessels — common in elderly/hypertensive patients.

Why other options are wrong:

- Option A: Woodruff's area is *posterior* (not anterior); the listed vessels are partial.
- Option B: Woodruff's area involves more vessels than just superior labial and greater palatine.
- Option C: Only the anterior ethmoidal artery alone cannot be called Kiesselbach's plexus; it is a multi-vessel anastomosis.

Final Answer: Kiesselbach's plexus (Little's area) on the anteroinferior septum: five-vessel anastomosis including anterior/posterior ethmoidal + sphenopalatine + superior labial arteries $\Rightarrow$ D

Answer: (D) Go Back to Q 30

Q31.

Solution

Concept — Cerebellar lobes and peduncles: The cerebellum is divided by fissures into three lobes:

- **Anterior lobe** (paleocerebellum / spinocerebellum): anterior to primary fissure; receives proprioceptive input from the spinal cord; coordinates axial and proximal limb muscles; disease $\rightarrow$ truncal and gait ataxia.
- **Posterior lobe** (neocerebellum / cerebrocerebellum): largest lobe, between primary and posterolateral fissures; coordinates voluntary skilled limb movement.
- **Flocculonodular lobe** (archicerebellum / vestibulocerebellum): posterior to posterolateral fissure; coordinates eye movements and balance.

Three peduncles: Superior (SCP / brachium conjunctivum) — main OUTPUT to thalamus and then cortex; Middle (MCP / brachium pontis) — INPUT from cortex via pontine nuclei; Inferior (ICP / restiform body) — INPUT from spinal cord and vestibular nuclei.

Step 1 — Case analysis: Broad-based gait + truncal ataxia + nystagmus = anterior lobe (spinocerebellum) disease, consistent with alcoholic cerebellar degeneration affecting the anterior/superior vermis selectively.

Step 2 — Cortex-to-cortex loop: Cerebral cortex $\rightarrow$ pontine nuclei $\rightarrow$ MCP $\rightarrow$ cerebellar cortex $\rightarrow$ deep nuclei $\rightarrow$ SCP $\rightarrow$ thalamus $\rightarrow$ cerebral cortex (dentato-rubro-thalamo-cortical pathway, uses SCP as output).

Why other options are wrong:

- Option A: Flocculonodular lobe disease causes pure vestibular ataxia (nystagmus, vertigo, truncal unsteadiness) without limb ataxia; its peduncle is the ICP.
- Option C: Posterior lobe (cerebrocerebellum) disease causes ipsilateral limb dysmetria and dysdiadochokinesia; it communicates via MCP (input) and SCP (output) but is NOT primarily affected here.
- Option D: ICP carries proprioceptive INPUT (spinocerebellar tracts) to the anterior lobe; the cortex-to-cortex OUTPUT uses the SCP.

Final Answer: Anterior lobe (spinocerebellum) affected; cortex–cerebellar loop uses the superior cerebellar peduncle $\Rightarrow$ B

Answer: (B) Go Back to Q 31

Q32.

Solution

Concept — Midbrain tegmentum structures: The midbrain is divided into three regions: tectum (corpora quadrigemina: superior and inferior colliculi), tegmentum (between aqueduct and substantia nigra), and base/crura (cerebral peduncles). Key tegmental structures: **red nucleus** (rubrospinal tract), oculomotor nuclei (CN III in superior colliculus level), trochlear nucleus (CN IV at inferior colliculus level), periaqueductal grey, medial longitudinal fasciculus.

Step 1 — Red nucleus location: Paired, oval-shaped, reddish (due to iron-containing neuromelanin and vascularity) nuclei in the tegmentum at the level of the superior colliculus. It receives input from the dentate nucleus (via SCP) and motor cortex, and projects to the contralateral spinal cord via the rubrospinal tract.

Step 2 — Midbrain (Weber's) syndrome: CN III palsy + contralateral hemiplegia suggests a lesion at the base/peduncle level (Weber's); red nucleus involvement adds contralateral tremor/ataxia (Benedikt's syndrome).

Why other options are wrong:

- Option B: Substantia gelatinosa is in the spinal cord dorsal horn (Rexed lamina II), not the brainstem.
- Option C: Inferior olive is in the *medulla*, not the midbrain; it relays to cerebellum via climbing fibres.
- Option D: Nucleus ambiguus (motor neurons for CN IX, X) is in the *medulla*.

Final Answer: Red nucleus is the key midbrain tegmental structure involved in

coordination (rubrospinal tract) $\Rightarrow$ A

Answer: (A) Go Back to Q 32

Q33.

Solution

Concept — Facial nerve UMN vs LMN lesion: The facial nerve (CN VII) nucleus in the pons has two divisions: the **upper** part (supplying frontalis/orbicularis oculi) receives **bilateral** upper motor neuron (UMN) input from both motor cortices. The **lower** part (supplying orbicularis oris, buccinator, platysma) receives **only contralateral** UMN input.

Step 1 — UMN lesion (cortical/subcortical/capsular): Only the lower facial muscles on the contralateral side are weak; the frontalis (forehead) is spared because the upper facial nucleus has *bilateral* cortical input and is protected.

Step 2 — LMN lesion (nuclear or nerve): ALL ipsilateral facial muscles are weak, including the forehead (Bell's palsy pattern).

Step 3 — This case: Right hemisphere stroke $\rightarrow$ left lower facial weakness + preserved bilateral forehead wrinkling = **right-sided UMN lesion**.

Why other options are wrong:

- Option A: LMN lesion of left facial nerve $\rightarrow$ ALL left facial muscles weak (including forehead). Not seen here.
- Option B: LMN lesion of right facial nerve $\rightarrow$ right-sided total facial palsy. Not described.
- Option D: A UMN lesion of the *left* facial nucleus would cause right lower facial weakness, not left.

Final Answer: Right hemisphere UMN lesion $\rightarrow$ left lower facial weakness; upper face spared by bilateral cortical input $\Rightarrow$ C

Answer: (C) Go Back to Q 33

Q34.

Solution

Concept — Circle of Willis aneurysm sites: Berry (saccular) aneurysms form at arterial bifurcations in the Circle of Willis where haemodynamic stress is greatest. Distribution of intracranial aneurysms:

- **Anterior communicating artery (AComA): ~30–35%** — most common single site
- ICA–posterior communicating (PComA): ~25–30%
- MCA bifurcation: ~20%
- Basilar tip: ~5–10%

Step 1 — AComA aneurysm presentation: Rupture → subarachnoid haemorrhage (thunderclap headache, meningism, photophobia), often with blood in the interhemispheric fissure on CT.

Step 2 — PComA aneurysm distinction: PComA aneurysm classically presents with an isolated, painful CN III palsy (ipsilateral ptosis, dilated non-reactive pupil, "down and out" eye) before rupture — the expanding aneurysm compresses the superior aspect of CN III (pupillomotor fibres run on the outside). Not the presentation described here.

Why other options are wrong:

- Option A: Basilar tip aneurysm is less common (~5–10%) and often presents with bilateral CN III palsies or locked-in syndrome.
- Option B: ICA–PComA is the second most common but not the single most common; it presents with CN III palsy + SAH.
- Option C: Ophthalmic artery aneurysm is uncommon and causes visual field defects (compresses optic nerve/chiasm), not the typical SAH picture described.

Final Answer: Anterior communicating artery is the most common site for intracranial berry aneurysms (~30–35%) ⇒ D

Answer: (D) Go Back to Q 34

Q35.

Solution

Concept — Neural tube defect classification: Neural tube defects (NTDs) arise from failure of neural tube closure (weeks 3–4). Spectrum:

(a) **Spina bifida occulta**: incomplete fusion of vertebral arch *only*; skin intact; no herniation; may have dimple, hypertrichosis, lipoma. Neurologically normal.
(b) **Meningocele**: meninges (dura + arachnoid) herniate through bony defect; skin covered; cord is in normal position; mild or no neurological deficit.
(c) **Myelomeningocele**: herniation of cord + nerve roots + meninges; exposed neural placode; significant motor/sensory deficit, bladder/bowel dysfunction, associated with Chiari II malformation; may be open (leaking CSF) or covered.
(d) **Anencephaly**: failure of cranial neuropore to close; absence of skull vault and cerebral hemispheres; incompatible with sustained life.

Step 1 — Case identification: Dimple + hair tuft + incomplete vertebral arch fusion + normal neurological examination = spina bifida occulta.

Step 2 — Prevention: Periconceptional folic acid (400 μg/day for general population; 4 mg/day if previous NTD) reduces NTD risk by up to 70%.

Why other options are wrong:

- Option B: Meningocele causes a visible posterior midline mass (herniated meninges); neurological function is usually intact but the mass is palpable.
- Option C: Myelomeningocele presents with an open neural defect or sac containing neural tissue, with significant neurological deficits.
- Option D: Anencephaly is a cranial NTD with absence of brain/skull vault, incompatible with life.

Final Answer: Spina bifida occulta = posterior arch defect only; skin intact; neurologically normal $\Rightarrow$ A

Answer: (A) Go Back to Q 35

Q36.

Solution

Concept — Midgut rotation and gut malrotation: During weeks 6–10, the midgut herniates into the umbilical cord and undergoes **270° counterclockwise rotation** around the superior mesenteric artery (SMA) axis before returning to the abdominal cavity. Failure of this rotation (malrotation) results in:

- Duodenojejunal junction (DJ flexure) on the **right** side (normally left of midline at L2)
- Caecum near the **epigastrium** (normally right iliac fossa)
- **Ladd's bands**: peritoneal bands crossing the duodenum from the malpositioned caecum → duodenal obstruction (extrinsic compression)
- Narrow SMA pedicle → risk of **midgut volvulus** (twisting of entire midgut around SMA)

Step 1 — Emergency: Midgut volvulus is a surgical emergency; its classic presentation is bilious vomiting in a neonate with a "coffee-ground" or bloody stool and peritonitis.

Step 2 — Ladd's procedure: Untwisting the volvulus + division of Ladd's bands + appendectomy + fixation.

Why other options are wrong:

- Option A: Short-bowel syndrome results from massive bowel resection, not malrotation per se.
- Option B: Failure of vitelline duct obliteration causes Meckel's diverticulum (not malrotation).
- Option D: Failure of lateral folding causes gastroschisis (anterior abdominal wall defect, right of umbilicus); not malrotation.

Final Answer: Failure of 270° midgut rotation → Ladd's bands + midgut volvulus risk ⇒ C

Answer: (C) Go Back to Q 36

Q37.

Solution

Concept — Diaphragm development: The diaphragm develops from four components:

(a) **Septum transversum** (forms the **central tendon**)
(b) Two **pleuroperitoneal membranes** (close the pericardioperitoneal canals; failure on the left → congenital diaphragmatic hernia, Bochdalek type)
(c) **Dorsal oesophageal mesentery** (dorsal mesentery of oesophagus, forms the crura)
(d) **Peripheral muscular ingrowth from the thoracic wall** (body wall mesoderm; innervated by intercostals for the costal part, and phrenic nerve C3–C5 for the remainder due to cervical myotome migration)

Step 1 — Phrenic nerve origin: C3, C4, C5 ("C3,4,5 keep the diaphragm alive") — the cervical myotomes that migrate into the developing diaphragm carry their phrenic nerve with them.

Step 2 — Bochdalek hernia: Failure of the left pleuroperitoneal membrane to close → herniation of bowel into the left hemithorax, compressing the developing left lung.

Why other options are wrong:

- Option A: Septum transversum forms the central tendon (not the entire diaphragm); pleuroperitoneal membranes are correctly included but the dorsal mesentery/muscular ingrowth are missing.
- Option C: Pleuropericardial membranes are separate structures that close the pericardioperitoneal canal on the *cardiac* side — they do not contribute to the diaphragm.
- Option D: Lumbar myotomes do not contribute; the muscular portion derives from cervical myotomes (C3–C5) growing into the diaphragm as it descends.

Final Answer: Diaphragm = septum transversum + pleuroperitoneal membranes + dorsal mesentery + C3–C5 myotome ingrowth ⇒ B

Answer: (B) Go Back to Q 37

Q38.

Solution

Concept — Epidermis layers and Langerhans cells: The epidermis (from deep to surface):

(a) **Stratum basale**: single layer of columnar stem cells + melanocytes + Merkel cells
(b) **Stratum spinosum**: "prickle cell" layer; polygonal keratinocytes with prominent desmosomal spines; **Langerhans cells** are found here
(c) **Stratum granulosum**: 2–5 layers; basophilic keratohyalin granules; lamellar bodies release lipid
(d) **Stratum lucidum**: thin, clear layer; only in thick skin (palms, soles)
(e) **Stratum corneum**: dead, anucleate corneocytes; keratin-filled; the outer barrier

Step 1 — Langerhans cells: Bone marrow-derived dendritic cells, express MHC class II (HLA-DR) and CD1a; located in the stratum spinosum; function as antigen-presenting cells (APCs) for T-cell activation; damaged by UVB radiation. **Birbeck granules** are their pathognomonic organelle (tennis racket-shaped on EM).

Step 2 — Thick skin on palm: The palm has all five epidermal layers including the stratum lucidum; thin skin elsewhere lacks stratum lucidum.

Why other options are wrong:

- Option A: Melanocytes are in the stratum basale and perform pigment synthesis (MHC I expression for cytotoxic T-cell recognition) — they are NOT antigen-presenting cells for adaptive immunity.
- Option B: Merkel cells are in the stratum basale; they are slow-adapting mechanoreceptors (Type I), not immune cells.
- Option D: Keratinocytes release cytokines (IL-1, TNF-α) for innate immunity but are NOT professional APCs.

Final Answer: Langerhans cells (MHC II dendritic cells, bone marrow-derived) reside in stratum spinosum $\Rightarrow$ C

Answer: (C) Go Back to Q 38

Q39.

Solution

Concept — Lymph node histology zones: A lymph node has:

- **Outer cortex**: primary follicles (dense, resting B cells) and secondary follicles with germinal centres (activated B cells, follicular dendritic cells, tingible-body macrophages) — **B-cell zone**
- **Paracortex (deep cortex)**: **T-cell zone**; contains post-capillary **high endothelial venules (HEVs)** through which naïve lymphocytes home; expands in cell-mediated immunity, viral infections, delayed hypersensitivity
- **Medulla**: medullary cords (plasma cells, macrophages) + medullary sinuses (lymph percolates here)

Step 1 — Infectious mononucleosis (EBV): EBV infects B cells but the predominant reactive change is paracortical expansion by activated CD8+ T cells (atypical lymphocytes / Downey cells) targeting EBV-infected B cells $\rightarrow$ paracortex expansion on histology.

Step 2 — HEVs significance: HEVs express addressins (PNAd, MadCAM-1) that interact with L-selectin on naïve T cells. Their presence in the paracortex enables lymphocyte homing from blood into lymph nodes.

Why other options are wrong:

- Option B: B cells reside in the outer cortex (follicles), NOT the paracortex; the statement reverses the zones.
- Option C: Medullary cords contain plasma cells and macrophages but are NOT the site of B-cell activation (that occurs in the germinal centre of secondary follicles).
- Option D: The subcapsular sinus is lined by sinus-lining (lymphoid reticular) cells and macrophages; it is NOT the site of T-cell–antigen interaction (that occurs in the paracortex).

Final Answer: Paracortex = T-cell zone with HEVs; expands in viral infections and delayed hypersensitivity $\Rightarrow$ A

Answer: (A) Go Back to Q 39

Q40.

Solution

Concept — Spleen histology (white pulp, red pulp, marginal zone): The spleen lacks lymph node cortex/medulla/sinuses architecture; instead:

White pulp (lymphoid tissue):

- **Periarterial lymphatic sheath (PALS)**: **T-cell zone** surrounding the **central (splenic) artery**
- **Malpighian corpuscles** (lymphoid follicles): B-cell follicles, primary or secondary (with germinal centres), attached to or bulging from the PALS

Marginal zone: transition zone between white and red pulp; contains marginal zone B cells (innate-like B cells) and macrophages; captures blood-borne antigens.

Red pulp: splenic sinusoids (fenestrated endothelium) + splenic cords (Billroth's cords) — site of red blood cell filtration, destruction of old/damaged RBCs, and reservoirs of blood.

Step 1 — PALS function: The PALS is analogous to the paracortex of a lymph node (T-cell zone). Activated T cells proliferate here in response to blood-borne antigens.

Step 2 — Clinical relevance: Post-splenectomy patients lose marginal zone B cells $\rightarrow$ susceptible to encapsulated organisms (Streptococcus pneumoniae, Haemophilus influenzae, Neisseria meningitidis).

Why other options are wrong:

- Option A: White pulp has BOTH T-cell zones (PALS) and B-cell zones (follicles) — NOT exclusively B cells.
- Option B: PALS is the T-cell zone, NOT the B-cell zone; B-cell follicles are adjacent to the PALS.
- Option C: The marginal zone lies *outside* the PALS (between white and red pulp), not inside it.

Final Answer: PALS = T-cell zone around central artery; B-cell follicles adjacent; marginal zone between white and red pulp $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 40

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	D	2	B	3	A	4	C	5	D
6	C	7	D	8	A	9	B	10	C
11	D	12	A	13	B	14	C	15	D
16	A	17	C	18	B	19	D	20	A
21	C	22	B	23	D	24	A	25	C
26	D	27	B	28	A	29	C	30	D
31	B	32	A	33	C	34	D	35	A
36	C	37	B	38	C	39	A	40	D