FMGE Anatomy Sample Paper – 2

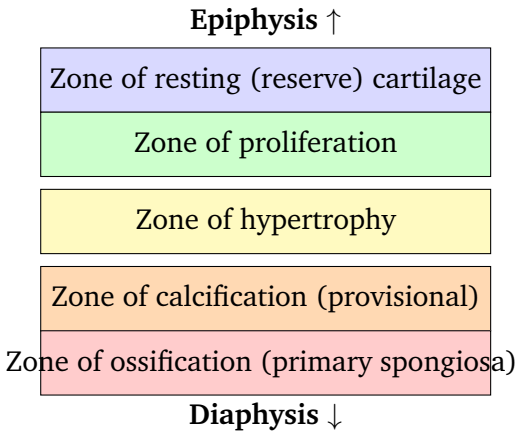
Duration: 60 Minutes **Maximum Marks: 40**

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 12-year-old boy is brought with pain and tenderness at the lower end of the femur after a fall. X-ray shows injury at the growth plate. Regarding the zones of the epiphyseal (growth) plate from epiphysis to diaphysis, which of the following correctly describes the zone where calcification occurs?



(A) Zone of proliferation — chondrocytes divide and calcium is deposited here

(B) Zone of provisional calcification — matrix calcifies to allow vascular invasion and bone deposition

(C) Zone of resting cartilage — metabolically active zone responsible for enchondral ossification

(D) Zone of hypertrophy — chondrocytes shrink and calcification begins at this level

Q2. During neurophysiology revision, a student is asked to classify nerve fibers based on conduction velocity. Which of the following statements correctly describes the classification of nerve fibers according to Erlanger and Gasser?

(A) Aα fibers are unmyelinated and carry pain sensation with the slowest conduction velocity

(B) B fibers are somatic motor fibers with the largest diameter and fastest conduction velocity

(C) C fibers are lightly myelinated preganglionic autonomic fibers conducting at 3–15 m/s

(D) C fibers are unmyelinated, carry pain and temperature, and have the slowest conduction velocity ($<$2 m/s)

Q3. A 55-year-old carpet layer presents with pain and swelling over the anterior aspect of the knee. Examination reveals a fluctuant swelling superficial to the patella. This is an example of bursitis. Which of the following best defines a bursa and its primary function?

(A) A bursa is a blind-ending diverticulum of the synovial joint cavity lined by fibrocartilage

(B) A bursa is a fibrous sac located between tendons only, containing mucoid material

(C) A bursa is a closed sac lined by synovial membrane containing a small amount of synovial fluid, reducing friction between moving structures

(D) A bursa is an outpouching of the periosteum found only at bony prominences, secreting serous fluid

Q4. A 48-year-old woman presents with locking of her right index finger in a flexed position with a painful snap on extension. This is diagnosed as trigger finger (stenosing tenosynovitis). The pathology involves the tendon sheath. Which of the following correctly describes the structure of a tendon sheath?

(A) A tendon sheath is a double-layered synovial sleeve enclosing the tendon; the visceral layer (epitenon) adheres to the tendon and the parietal layer lines the fibrous sheath, with synovial fluid in between

(B) A tendon sheath is a single-layered fibrous tube binding the tendon tightly to adjacent bone

(C) A tendon sheath is lined by fibrocartilage and functions primarily to anchor the tendon to the periosteum

(D) A tendon sheath is a loose connective tissue envelope found only around tendons crossing the wrist

Q5. A 60-year-old man presents with varicose veins of the lower limb. He is told that failure of venous valves is responsible. Which of the following best explains why veins of the lower limb have more valves compared to upper limb veins?

(A) Lower limb veins are larger in diameter and require more valves to prevent turbulent flow

(B) Valves are more numerous in the lower limb because the arterial pressure is higher there

(C) Valves in lower limb veins counteract the greater hydrostatic pressure due to the longer column of blood that must be propelled against gravity back to the heart

(D) Lower limb veins are superficial and require valves to resist external compression by muscles

Q6. A 40-year-old computer programmer presents with tingling and numbness in the thumb, index finger, middle finger, and lateral half of the

ring finger, worse at night. Nerve conduction studies confirm carpal tunnel syndrome. Regarding the median nerve in the forearm and carpal tunnel, which statement is correct?

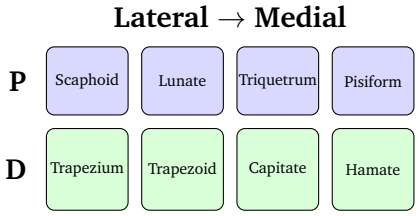
(A) The median nerve enters the forearm between the two heads of pronator teres and passes superficial to the flexor digitorum superficialis

(B) The median nerve passes through the carpal tunnel superficial to the flexor retinaculum and lateral to the palmaris longus tendon

(C) The palmar cutaneous branch of the median nerve passes through the carpal tunnel and is affected in carpal tunnel syndrome

(D) The median nerve enters the forearm between the two heads of pronator teres, passes deep to flexor digitorum superficialis, and enters the carpal tunnel deep to the flexor retinaculum; the palmar cutaneous branch arises proximal to the tunnel and is spared

Q7. A 25-year-old footballer falls on his outstretched hand. X-ray and MRI reveal a fractured scaphoid. A student is asked to name the carpal bones in sequence. Referring to the diagram below, which of the following correctly lists the proximal row of carpal bones from lateral to medial?



(A) Scaphoid, Lunate, Triquetrum, Pisiform (mnemonic: She Looks Too Pretty)

(B) Trapezium, Trapezoid, Capitate, Hamate

(C) Scaphoid, Lunate, Capitate, Hamate

(D) Pisiform, Triquetrum, Lunate, Scaphoid (medial to lateral)

Q8. During an anatomy viva, a student is asked about the wrist joint. Which of the following correctly describes the articulating surfaces and primary movements of the radiocarpal (wrist) joint?

(A) The wrist joint is formed between the distal radius, ulna, and all eight carpal bones, allowing flexion and extension only

(B) The radiocarpal joint is formed between the distal radius (and articular disc) proximally and the scaphoid, lunate, and triquetrum distally, allowing flexion, extension, abduction, and adduction

(C) The wrist joint is a pivot joint formed between the distal radioulnar joint and the proximal carpal row

(D) The radiocarpal joint is formed between the radius and the trapezium, trapezoid, and capitate, allowing circumduction but not true rotation

Q9. A 22-year-old skateboarder falls on an outstretched hand and presents with pain in the anatomical snuffbox. Which of the following correctly identifies the boundaries and important contents of the anatomical snuffbox?

(A) The anatomical snuffbox is bounded medially by extensor pollicis longus and laterally by extensor digitorum; the ulnar artery passes through it

(B) The anatomical snuffbox is bounded laterally by extensor pollicis brevis and medially by extensor pollicis longus; the cephalic vein and superficial branch of the ulnar nerve cross its roof

(C) The anatomical snuffbox is bounded laterally by abductor pollicis longus and extensor pollicis brevis, medially by extensor pollicis longus; it contains the radial artery and the scaphoid lies on its floor

(D) The anatomical snuffbox is bounded by the two heads of the first dorsal interosseous muscle; the radial nerve (deep branch) passes through its floor

Q10. A 65-year-old man presents with sudden pain in the anterior shoulder followed by a "Popeye" deformity — a bulge in the lower arm with a palpable gap near the shoulder. This is a proximal long head of biceps rupture. Which of the following correctly describes the attachment and clinical significance of the long head of biceps brachii?

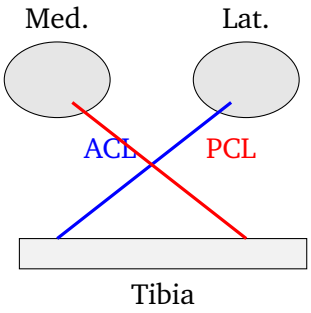
(A) The long head of biceps arises from the coracoid process, passes through the glenohumeral joint, and ruptures distally at the radial tuberosity

(B) The long head of biceps arises from the lesser tubercle of humerus, passes extracapsularly, and is commonly injured in the elderly

(C) The long head of biceps arises from the coracoid process alongside the short head and its rupture produces the “Popeye” sign distally

(D) The long head of biceps arises from the supraglenoid tubercle of the scapula, passes intracapsularly (but extrasynovially) through the glenohumeral joint, and travels in the intertubercular groove; proximal rupture produces the characteristic “Popeye” bulge in the lower arm

Q11. A 28-year-old footballer is tackled from the side; he hears a “pop” and cannot bear weight. Lachman’s test is positive. MRI confirms an anterior cruciate ligament (ACL) tear. Referring to the diagram below, which statement correctly describes the function of the cruciate ligaments?



(A) The ACL (anterior cruciate ligament) prevents anterior translation of the tibia on the femur and is tested by the anterior drawer test and Lachman’s test; the PCL prevents posterior translation

(B) The ACL prevents posterior translation of the tibia and is attached to the posterior intercondylar area of the tibia

(C) The PCL is intracapsular and extrasynovial; it prevents anterior translation of the tibia

(D) Both cruciate ligaments arise from the lateral femoral condyle and cross each other within the joint cavity

Q12. A 45-year-old man presents with a pulsatile swelling behind the knee joint. Ultrasound reveals a popliteal artery aneurysm. Regarding the popliteal fossa and its contents, which of the following is correct?

(A) The popliteal fossa is bounded superolaterally by semitendinosus and semimembranosus; the common peroneal nerve is the deepest structure

(B) The popliteal fossa is bounded superolaterally by biceps femoris and superomedially by semitendinosus and semimembranosus; from superficial to deep: tibial nerve, popliteal vein, popliteal artery

(C) The popliteal artery is the most superficial structure in the popliteal fossa, making it easily palpable

(D) The common peroneal nerve passes through the centre of the popliteal fossa and winds around the medial aspect of the fibular neck

Q13. A 35-year-old woman presents with an infected toe wound and painful swollen groin lymph nodes. Knowledge of inguinal lymph node drainage is essential. Which of the following correctly describes the arrangement of superficial inguinal lymph nodes?

(A) Superficial inguinal nodes lie deep to the deep fascia and drain the testes and ovaries

(B) Superficial inguinal nodes form a vertical group only, draining the lower limb exclusively

(C) Superficial inguinal nodes are divided into deep and superficial groups; deep nodes drain the glans penis/clitoris

(D) Superficial inguinal nodes form a horizontal group (along the inguinal ligament — draining perineum, scrotum/labia, lower anal canal, and uterus via round ligament) and a vertical group (along the great saphenous vein — draining the lower limb); deep inguinal nodes lie medial to the femoral vein

Q14. A 32-year-old man sustains a fracture of the neck of fibula in a road traffic accident. He develops a “foot drop.” Which of the following correctly

explains the nerve injury and resulting deficit?

(A) The tibial nerve winds around the neck of fibula and its injury causes foot drop

(B) Injury to the common fibular nerve at the fibular neck causes loss of plantar flexion and inversion (inverted foot)

(C) The common fibular (peroneal) nerve winds around the neck of fibula, making it vulnerable to injury here; injury causes foot drop (loss of dorsiflexion — deep fibular nerve) and loss of eversion (superficial fibular nerve), with sensory loss over the dorsum of the foot

(D) Common fibular nerve injury at the fibular neck causes loss of knee extension due to denervation of the quadriceps

Q15. During a femoral artery angiogram, the radiologist notes the vessel passing through the adductor canal (Hunter's canal) in the thigh. Which of the following correctly describes the contents and boundaries of the adductor canal?

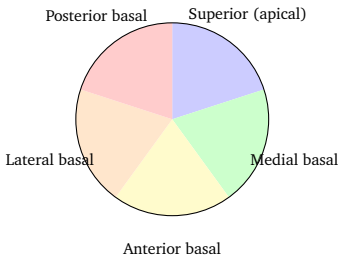
(A) The adductor canal contains the femoral artery, femoral vein, femoral nerve, and saphenous nerve; it is bounded laterally by sartorius

(B) The adductor canal contains the femoral artery, femoral vein, and saphenous nerve (not the femoral nerve itself, which ends proximal); it is bounded anteriorly by sartorius, laterally by vastus medialis, and posteriorly by adductor longus and magnus

(C) The adductor canal is the same structure as the femoral triangle and contains the femoral nerve throughout its length

(D) The adductor canal transmits the profunda femoris artery as its main arterial content

Q16. A 60-year-old bedridden patient develops aspiration pneumonia. The chest X-ray shows consolidation in the posterobasal segment of the right lower lobe. Which of the following diagrams correctly represents the bronchopulmonary segments of the right lower lobe?



Right Lower Lobe (5 segments)

(A) The right lower lobe has 5 bronchopulmonary segments: Superior (apical), Medial basal, Anterior basal, Lateral basal, and Posterior basal

(B) The right lower lobe has 3 segments: Apical, Middle, and Basal — corresponding to upper, middle, and lower divisions

(C) The right lower lobe has the same segment pattern as the left lower lobe, with 4 segments only

(D) The right lower lobe contains the cardiac notch and has 6 segments including the lingula

Q17. A neonate presents with stridor and difficulty swallowing. CT angiography reveals a vascular ring compressing the trachea and esophagus. This is most likely due to a double aortic arch. Which of the following best explains the developmental basis of this anomaly?

(A) Double aortic arch results from persistence of the right 4th aortic arch combined with an absent left 4th arch

(B) Double aortic arch is caused by abnormal regression of the right ductus arteriosus

(C) Double aortic arch results from persistence of both right and left 4th aortic arches, forming a complete vascular ring around the trachea and esophagus

(D) Double aortic arch develops due to failure of regression of the 6th aortic arch bilaterally

Q18. A 55-year-old man is undergoing upper GI endoscopy. The endoscopist notes resistance at three specific points during passage of the scope.

These correspond to the normal anatomical constrictions of the esophagus. Which of the following correctly identifies all three constrictions and their clinical significance?

(A) Constrictions occur at the cricopharyngeus, the bifurcation of the trachea, and the pylorus; they are common sites for foreign body impaction

(B) Constrictions occur at the pharyngo-esophageal junction, at the level of the left main bronchus, and at the diaphragmatic hiatus; they represent areas of maximum distensibility

(C) Constrictions occur at the junction of the pharynx and larynx, at the aortic arch level, and at the gastroesophageal junction; they are sites where carcinoma never occurs

(D) The three constrictions are: (1) pharyngo-esophageal junction (cricopharyngeus — 15 cm from incisors), (2) aortic/bronchial constriction (22–25 cm), and (3) diaphragmatic/cardiac constriction (40 cm); these are the common sites of carcinoma and foreign body impaction

Q19. During a left neck dissection for thyroid cancer, a surgeon inadvertently injures the thoracic duct, resulting in a chylous fistula. Which of the following correctly describes the course and termination of the thoracic duct?

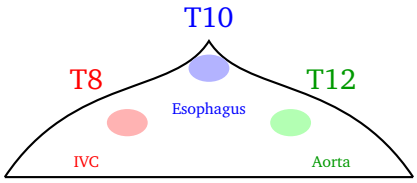
(A) The thoracic duct begins at the right kidney, ascends on the right of the aorta, and drains into the right subclavian vein

(B) The thoracic duct begins at the cisterna chyli (L1–L2), ascends through the aortic hiatus on the right of the thoracic aorta, crosses to the left at T4–T5, and terminates at the junction of the left internal jugular and left subclavian veins (left venous angle)

(C) The thoracic duct drains only the lower half of the body and terminates in the left axillary vein

(D) The thoracic duct carries lymph from both lower limbs and the right upper limb, terminating in the right venous angle

Q20. During a clinical anatomy session, students are asked about the openings in the diaphragm. Which of the following diagrams and descriptions correctly identifies the three main openings and the vertebral levels at which structures pass through?



Diaphragm (inferior view)

(A) T8 — IVC (and right phrenic nerve); T10 — Esophagus (and vagus nerves); T12 — Aorta, thoracic duct, and azygos vein

(B) T8 — Aorta; T10 — IVC; T12 — Esophagus and vagal trunks

(C) T8 — Esophagus; T10 — Aorta; T12 — IVC and thoracic duct

(D) T8 — Thoracic duct; T10 — Aorta; T12 — Esophagus and IVC

Q21. A 55-year-old man with hepatocellular carcinoma is being evaluated for surgical resection. The hepatobiliary surgeon describes the lesion as being in segment VI of the liver (Couinaud classification). Which of the following correctly describes the basis of Couinaud's hepatic segmentation?

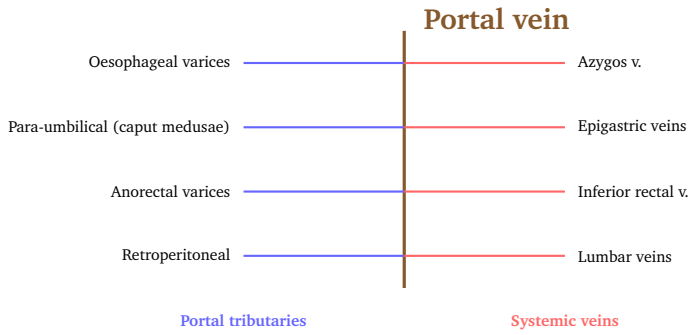
(A) Couinaud segments are based on hepatic artery branches only; the liver has 5 segments

(B) Couinaud segments are based on bile duct anatomy; the caudate lobe has no separate segment

(C) Couinaud's classification divides the liver into 8 functionally independent segments based on portal vein, hepatic artery, and bile duct (portal pedicles) distribution; the caudate lobe is segment I and has independent venous drainage directly to the IVC

(D) Couinaud segments are numbered I–VIII from right to left; the left lobe contains segments V–VIII

Q22. A 50-year-old alcoholic man with liver cirrhosis develops hematemesis. Endoscopy reveals oesophageal varices. These are a consequence of portal hypertension and portosystemic shunting. Which of the following diagrams and descriptions correctly identifies the main sites of portosystemic anastomosis?



(A) Portosystemic anastomoses occur only at the oesophagus and rectum

(B) Portosystemic anastomoses are clinically irrelevant in portal hypertension

(C) Portosystemic anastomoses occur at the oesophagus, rectum, and retroperitoneum only; umbilical veins are not involved in adults

(D) Portosystemic anastomoses occur at four main sites: (1) lower oesophagus (left gastric–azygos), (2) paraumbilical (para-umbilical veins–epigas (3) anorectal junction (superior rectal–inferior/middle rectal), and (4) retroperitoneal (mesenteric–lumbar/renal); oesophageal varices are the most dangerous

Q23. A 45-year-old man undergoes CT for abdominal pain and is found to have a tumour in the uncinate process of the pancreas compressing the superior mesenteric vessels. Which of the following correctly describes the relationship of the pancreatic head and uncinate process to the superior mesenteric vessels?

(A) The uncinate process lies posterior to the superior mesenteric artery and anterior to the aorta; the superior mesenteric vein passes posterior to the neck of pancreas

(B) The uncinate process of the pancreas is a projection from the lower part of the head and hooks behind the superior mesenteric vessels

(SMA and SMV); the neck of the pancreas lies anterior to the SMA and portal vein confluence

(C) The uncinate process wraps around the right side of the inferior mesenteric artery; the body of pancreas overlies the SMA

(D) The superior mesenteric artery passes anterior to the pancreatic neck, making the uncinate process accessible for surgical resection

Q24. A 22-year-old student is involved in a road traffic accident and presents with left-sided abdominal pain and hypotension. CT reveals a ruptured spleen. Which of the following correctly describes the anatomical relations and blood supply of the spleen?

(A) The spleen lies in the left hypochondrium between ribs 9–11 (posterolaterally), with its notch on the superior border; it is related to the stomach (gastrosplenic ligament), left kidney, and left colic flexure; blood supply is the splenic artery (from the coeliac trunk), which courses along the superior border of the pancreas

(B) The spleen is supplied by the left gastric artery and lies in the left iliac fossa

(C) The spleen is a retroperitoneal organ lying posterior to the left kidney with blood supply from the superior mesenteric artery

(D) The splenic notch is on the inferior border; the organ lies between ribs 7–9 and is related to the right kidney medially

Q25. During a laparotomy, the surgeon notes that the greater omentum has migrated to wall off a perforated appendix. A student is asked about the layers and blood supply of the greater omentum. Which of the following is correct?

(A) The greater omentum consists of two layers of peritoneum and is supplied by branches of the superior mesenteric artery only

(B) The greater omentum hangs from the greater curvature of the stomach and is avascular in healthy adults

(C) The greater omentum is derived from the dorsal mesentery and is supplied exclusively by the left gastroepiploic artery

(D) The greater omentum consists of four layers of peritoneum (descending and ascending leaves), hangs from the greater curvature of the stomach, and is supplied by the right and left gastroepiploic (gastroomental) arteries — branches of the gastroduodenal and splenic arteries respectively

Q26. A 35-year-old woman presents with periorbital cellulitis complicated by septic thrombosis of the cavernous sinus. She develops ophthalmoplegia and sensory loss over the face. Which of the following correctly lists the contents of the cavernous sinus?

(A) The cavernous sinus contains only the internal carotid artery and the abducens nerve (VI) within the sinus itself

(B) The cavernous sinus contains, within its lumen: the internal carotid artery (with sympathetic plexus) and CN VI (abducens); in its lateral wall (from superior to inferior): CN III (oculomotor), CN IV (trochlear), V1 (ophthalmic), and V2 (maxillary divisions of trigeminal)

(C) The cavernous sinus contains the middle meningeal artery and CN V1, V2, V3 in its lateral wall

(D) The cavernous sinus contains CN II (optic nerve) traversing its lateral wall, making it vulnerable in pituitary tumours

Q27. A patient requires a maxillary nerve block for dental surgery. The anaesthetist accesses the pterygopalatine fossa. Which of the following correctly describes the communications of the pterygopalatine fossa?

(A) The pterygopalatine fossa communicates with only the orbit above and the nasal cavity medially

(B) The pterygopalatine fossa is a closed space with no direct communications outside the skull

(C) The pterygopalatine fossa communicates with the orbit (via inferior orbital fissure), middle cranial fossa (via foramen rotundum — carrying V2/maxillary nerve), infratemporal fossa (via pterygomaxillary fissure), nasal cavity (via sphenopalatine foramen), oral cavity (via greater and lesser palatine canals), and nasopharynx (via palatovaginal canal)

(D) The pterygopalatine fossa communicates with the infratemporal fossa via the foramen ovale and contains the mandibular nerve

Q28. A 60-year-old man presents with deviation of the tongue to the right on protrusion after a stroke affecting the right hypoglossal nucleus. Which of the following correctly describes the motor and sensory nerve supply of the tongue?

(A) All intrinsic and extrinsic muscles of the tongue (except palatoglossus) are supplied by the hypoglossal nerve (CN XII); general sensation from the anterior 2/3 is via the lingual nerve (V3), taste via chorda tympani (VII); posterior 1/3 sensation and taste via glossopharyngeal nerve (CN IX)

(B) All tongue muscles are supplied by CN XI (accessory nerve); taste from anterior 2/3 is via the glossopharyngeal nerve

(C) The hypoglossal nerve supplies only the intrinsic muscles; the lingual nerve supplies both intrinsic and extrinsic muscles

(D) Palatoglossus is supplied by CN XII; the lingual nerve carries both taste and general sensation from the whole tongue

Q29. A patient presents with pain in the lower jaw, trismus, and loss of sensation over the mandibular teeth following a complication of dental extraction. The dentist suspects injury to branches in the infratemporal fossa. Which of the following correctly describes the contents of the infratemporal fossa?

(A) The infratemporal fossa contains the ophthalmic division of the trigeminal nerve and the facial nerve

(B) The infratemporal fossa is a closed space containing only the masseter muscle and its nerve

(C) The infratemporal fossa contains the maxillary artery and the maxillary nerve (V2) as its main vascular and neural contents

(D) The infratemporal fossa contains the lower part of the temporalis, medial and lateral pterygoid muscles; the mandibular nerve (V3) and its branches (inferior alveolar, lingual, buccal nerves); the chorda tympani joining the lingual nerve; and the maxillary artery (2nd part) and pterygoid venous plexus

Q30. A 55-year-old man undergoes parotidectomy for a pleomorphic adenoma. The surgeon must preserve the facial nerve within the gland. Which of the following correctly describes the facial nerve's relationship to the parotid gland and the course of the parotid duct?

(A) The facial nerve passes deep to the parotid gland and enters the gland from its medial surface; the parotid duct opens into the vestibule opposite the lower second molar

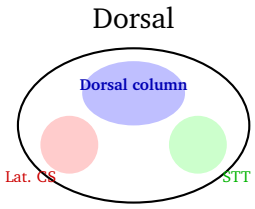
(B) The facial nerve enters the gland from the anterior surface and passes superficial to the retromandibular vein; the parotid duct (Stensen's duct) runs vertically downward from the gland

(C) The facial nerve exits the stylomastoid foramen, enters the parotid gland from its posteromedial surface, and divides within the gland into temporofacial and cervicofacial divisions; the parotid duct (Stensen's duct) passes over masseter, pierces buccinator, and opens opposite the upper second molar tooth

(D) The facial nerve passes inferior to the parotid gland without entering it; the parotid duct pierces the buccinator and opens at the upper first premolar

Q31. A 30-year-old woman presents with loss of fine touch, vibration sense, and proprioception below the T10 level on the right side following a spinal cord injury. The dorsal column–medial lemniscal pathway is in-

volved. Referring to the diagram, which of the following correctly describes this pathway?



Spinal cord cross-section

(A) First-order neurons enter the ipsilateral dorsal column (fasciculus gracilis below T6, fasciculus cuneatus above T6), ascend to the medulla (nucleus gracilis/cuneatus), second-order neurons cross in the medial lemniscus to reach the contralateral VPL thalamus, and third-order neurons project to the primary somatosensory cortex (areas 3, 1, 2)

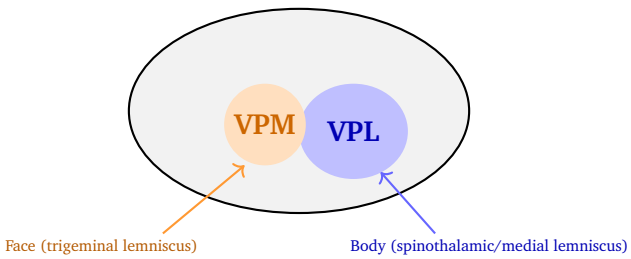
(B) The dorsal column carries pain and temperature fibres that cross at the level of entry in the spinal cord

(C) First-order neurons of the dorsal column cross immediately in the spinal cord anterior white commissure and ascend contralaterally

(D) The dorsal column pathway relays in the posterior horn of the spinal cord before ascending

Q32. A 65-year-old man presents with loss of all sensation on the right side of his body and face following a left thalamic stroke. Which of the following diagrams and descriptions correctly distinguishes between the VPL and VPM thalamic nuclei?

Thalamus (left, coronal view)



(A) VPL (ventral posterolateral) nucleus receives inputs from the face via the trigeminal pathways; VPM receives body sensation

(B) VPL and VPM both relay motor information to the precentral gyrus; they do not process sensory inputs

(C) VPL (ventral posterolateral) nucleus receives sensory impulses from the contralateral body (via medial lemniscus and spinothalamic tract); VPM (ventral posteromedial) receives sensation from the contralateral face (via trigeminal lemniscus/trigeminothalamic tract); both project to the primary somatosensory cortex

(D) VPL and VPM are identical in function; both relay pain from the body and face to the cingulate cortex

Q33. A 40-year-old woman with a craniopharyngioma compressing the hypothalamus develops diabetes insipidus (polyuria and polydipsia). She passes 8 litres of dilute urine per day. This is due to loss of ADH secretion. Which of the following correctly identifies the hypothalamic nucleus responsible for ADH (vasopressin) synthesis?

(A) Ventromedial nucleus — satiety centre; its destruction leads to diabetes insipidus

(B) Posterior hypothalamic nucleus synthesises ADH, which is stored in the anterior pituitary

(C) Arcuate nucleus — synthesises ADH and releases it via the median eminence into the portal system

(D) Supraoptic nucleus (and paraventricular nucleus) synthesises ADH (vasopressin), which is transported along axons to the posterior pituitary (neurohypophysis) for release into the bloodstream

Q34. A 68-year-old right-handed man presents with non-fluent speech but intact comprehension following a left MCA territory infarct. He can understand commands but cannot speak fluently (Broca's aphasia). Which of the following correctly localises Broca's and Wernicke's speech areas?

(A) Broca's area is Brodmann areas 41 and 42 in the superior temporal gyrus; Wernicke's area is in the inferior frontal gyrus

(B) Broca's area is Brodmann areas 44 and 45 (pars opercularis and pars triangularis) in the inferior frontal gyrus of the dominant hemisphere; Wernicke's area is Brodmann area 22 in the posterior part of the superior temporal gyrus; both are connected by the arcuate fasciculus

(C) Broca's area is located in the parietal lobe; Wernicke's area is in the frontal lobe

(D) Broca's area and Wernicke's area are both located in the right hemisphere in right-handed individuals

Q35. A newborn is found to have bilateral renal agenesis (Potter sequence) with characteristic facial features, pulmonary hypoplasia, and limb deformities due to oligohydramnios. The condition results from failure of normal kidney development. Which of the following correctly describes the critical embryological interaction in kidney (metanephros) development?

(A) The metanephros develops from the pronephros directly, independent of any ureteric bud

(B) Kidney development requires the mesonephric tubules to invade the metanephric blastema and induce nephrogenesis

(C) The ureteric bud (a dorsal outgrowth of the mesonephric/Wolffian duct) induces the metanephric blastema to differentiate into nephrons; in turn, the metanephric blastema induces the ureteric bud to branch into the collecting system (ureter, pelvis, calyces, collecting ducts); failure of this induction causes renal agenesis

(D) The metanephric blastema develops into the collecting ducts while the ureteric bud forms the nephrons (glomerulus to distal tubule)

Q36. A 25-year-old woman with primary amenorrhea is found to have a blind-ending vagina and absent uterus on MRI, but normal ovaries and a 46,XX karyotype. She is diagnosed with Mullerian agenesis (MRKH syndrome). Which of the following correctly lists the normal derivatives of the Mullerian (paramesonephric) duct in a female?

(A) Mullerian ducts form the ovaries, uterine tubes, and the vaginal epithelium entirely

(B) Mullerian ducts form the uterus and upper vagina; the lower vagina and ovaries are derived from the mesonephric duct

(C) Mullerian duct derivatives include the epididymis, vas deferens, and seminal vesicles in the male

(D) Mullerian (paramesonephric) duct derivatives in the female are: uterine (Fallopian) tubes, uterus (body and cervix), and the upper portion of the vagina (upper 1/3); the ovaries are derived from the genital ridge (gonadal mesoderm and primordial germ cells), not the Mullerian duct

Q37. A neonate presents on day 2 of life with bilious vomiting and a distended abdomen. Upper GI contrast study shows the duodeno-jejunal flexure (ligament of Treitz) on the right side. This is intestinal malrotation. Which of the following correctly describes normal intestinal rotation?

(A) Normal midgut rotation involves a total of 270° counterclockwise rotation (as viewed from the front) around the superior mesenteric artery; the duodenojejunal junction comes to lie to the left of the midline (ligament of Treitz), and the cecum migrates to the right iliac fossa; malrotation predisposes to volvulus

(B) Normal intestinal rotation is 90° clockwise, bringing the cecum to the left iliac fossa

(C) The hindgut (not midgut) rotates 270°; the foregut does not rotate during development

(D) Intestinal rotation occurs around the inferior mesenteric artery as the axis; total rotation is 180° anticlockwise

Q38. A histology student is examining a liver section under the microscope. She identifies a hepatic lobule with a central vein in the centre and portal triads at the periphery. Which of the following correctly describes the key histological features of the hepatic lobule?

(A) The hepatic lobule contains bile canaliculi flowing towards the central vein; Kupffer cells line the hepatic veins

(B) The portal triad contains the portal vein, hepatic artery, and central vein; blood flows from the periphery to the central vein

(C) The hepatic sinusoids are lined by continuous endothelium with a basement membrane; hepatocytes secrete bile directly into the sinusoids

(D) The hepatic lobule is a hexagonal unit with a central vein at its centre; the portal triad (at corners) contains a portal vein radicle, hepatic artery branch, and bile ductule; blood flows from the portal triad through sinusoids to the central vein; Kupffer cells (macrophages) line the sinusoids; bile flows in opposite direction to blood — from centre to portal triad via canaliculi

Q39. A 28-year-old man presents with nephrotic syndrome (heavy proteinuria, hypoalbuminaemia, oedema). Renal biopsy under electron microscopy shows fusion of podocyte foot processes. Which of the following correctly describes the structure of the glomerular filtration barrier?

(A) The glomerular filtration barrier consists of three layers: fenestrated endothelium (with pores of 70–100 nm), the glomerular basement membrane (GBM — type IV collagen), and podocytes with interdigitating foot processes (pedicels) bridged by a slit diaphragm; charge selectivity is provided by heparan sulfate proteoglycans in the GBM; podocyte foot process fusion obliterates the slit diaphragm causing proteinuria

(B) The filtration barrier consists only of the GBM and the Bowman's capsule parietal layer; podocytes are found in the efferent arteriole

(C) The glomerular capillaries are non-fenestrated, relying on transcytosis for filtration; the GBM is made of type II collagen

(D) Podocytes are mesangial cells that support the GBM; they do not directly participate in filtration

Q40. A 45-year-old woman undergoes total thyroidectomy. The pathologist examining the specimen identifies follicular cells, colloid-filled follicles, and parafollicular cells. Which of the following correctly describes the histology and function of the thyroid gland?

(A) Parafollicular (C) cells are the majority cell type in the thyroid, producing T3 and T4 stored as colloid in follicles

(B) Follicular cells produce calcitonin; parafollicular cells produce thyroid hormone (T3 and T4)

(C) Follicular cells (principal cells) line the colloid-filled follicles and produce thyroglobulin, which is processed to T3 and T4; parafollicular (C) cells lie between follicles, are neural crest derived, and produce calcitonin (lowering serum calcium); C cells are the origin of medullary thyroid carcinoma

(D) All thyroid cells originate from neural crest; follicular cells produce parathyroid hormone (PTH) and C cells produce T4

Detailed Solutions

Q1.

Solution

Concept — Epiphyseal plate zones: The growth plate (physis) is organised into zones from epiphysis to diaphysis. Each zone has a distinct function in endochondral ossification.

Step 1 — Zones in order (epiphysis → diaphysis):

(a) **Resting (reserve) zone** — chondrocytes are small, quiescent, act as stem cells.
(b) **Proliferative zone** — chondrocytes actively divide forming columns; site of longitudinal growth.
(c) **Hypertrophic zone** — chondrocytes enlarge, matrix volume increases; type X collagen produced.
(d) **Zone of provisional calcification** — matrix calcifies; calcium deposited allowing vascular invasion.
(e) **Zone of ossification (primary spongiosa)** — osteoblasts deposit bone on calcified cartilage scaffold.

Why other options are wrong:

- Option A: Zone of proliferation is the site of cell division, not calcification.
- Option C: Reserve zone is quiescent, not the active site of enchondral ossification.
- Option D: Hypertrophic zone shows cell swelling, not primary calcification; that occurs in the next zone.

Final Answer: Zone of provisional calcification is where matrix calcification occurs to allow vascular invasion and bone deposition $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q 1

Q2.

Solution

Concept — Erlanger-Gasser nerve fiber classification: Nerve fibers are classified by diameter, myelination, and conduction velocity (Aα fastest $\rightarrow$ C slowest).

Step 1 — Classification summary:

- **A fibers** (myelinated): Aα = proprioception/motor (70–120 m/s); Aβ = touch/pressure; Aγ = muscle spindle efferents; Aδ = sharp pain/temperature (5–30 m/s).
- **B fibers** (lightly myelinated): Preganglionic autonomic (3–15 m/s).
- **C fibers** (unmyelinated): Postganglionic autonomic, slow pain, temperature ($<$2 m/s).

Why other options are wrong:

- Option A: Aα are the largest, fastest, myelinated fibers — not unmyelinated pain fibers.
- Option B: B fibers are preganglionic autonomic, not somatic motor.
- Option C: B fibers are lightly myelinated preganglionic autonomic — this is correct for B, not C.

Final Answer: C fibers are unmyelinated, carry slow pain and temperature, conduction velocity $<$2 m/s $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 2

Q3.

Solution

Concept — Bursa: A bursa is a potential space lined by synovial membrane that reduces friction between moving structures. Pre-patellar bursitis ("housemaid's knee") is a classic clinical example.

Step 1 — Clinically important bursae:

- Pre-patellar bursa: between patella and skin — "housemaid's knee."
- Infrapatellar bursa: between tibial tuberosity and skin — "clergyman's knee."
- Olecranon bursa: posterior to olecranon — "student's elbow."
- Subacromial bursa: largest clinically significant bursa.

Why other options are wrong:

- Option A: Bursae are lined by synovial membrane, not fibrocartilage; they are not joint diverticula.
- Option B: Bursae are found in many locations, not only between tendons.
- Option D: Bursae are not periosteal outpouchings; they can be found in many soft tissue locations.

Final Answer: A bursa is a closed synovial-lined sac containing synovial fluid, reducing friction $\Rightarrow$ C

Answer: (C) Go Back to Q 3

Q4.

Solution

Concept — Tendon sheath and trigger finger: A tendon sheath is a double-layered synovial structure allowing frictionless gliding. In trigger finger (stenosing tenosynovitis), the fibrous sheath becomes thickened at the A1 pulley, catching the flexor tendon nodule.

Step 1 — Structure of a tendon sheath:

- **Outer fibrous sheath**: maintains tendon in position within an osteofibrous tunnel.
- **Inner synovial sheath**: double-layered — visceral layer (epitenon, adheres to tendon) and parietal layer (lines the fibrous sheath).
- **Synovial fluid** (small amount) fills the potential space between the two layers, allowing frictionless gliding.
- A **mesotenon/vincula** carries blood vessels to the tendon within the sheath.

Why other options are wrong:

- Option B: The sheath is not single-layered fibrous; it has a synovial inner lining.
- Option C: Tendon sheaths are lined by synovium, not fibrocartilage.
- Option D: Tendon sheaths are found wherever tendons pass through confined spaces, not only at the wrist.

Final Answer: Tendon sheath = double-layered synovial sleeve (visceral + parietal layers) with synovial fluid enabling frictionless movement $\Rightarrow$ A

Answer: (A) Go Back to Q 4

Q5.

Solution

Concept — Venous valves and varicose veins: Valves in veins are bicuspid, semilunar, and prevent retrograde flow. They are most numerous where hydrostatic pressure is greatest — the lower limb.

Step 1 — Hydrostatic pressure principle: In the upright position, the column of blood in a lower limb vein is approximately 120–130 cm. This creates enormous hydrostatic pressure that must be overcome to return blood to the heart. More valves are needed at shorter intervals to break up this pressure column and prevent reflux.

Step 2 — Valve-free veins: Valves are absent in: cerebral veins, venae cavae, portal vein, pulmonary veins, and most visceral veins (where pressure gradients are low or flow is continuous).

Why other options are wrong:

- Option A: Diameter alone does not determine valve number; it is the hydrostatic pressure column.
- Option B: Arterial pressure does not directly determine venous valve number.
- Option D: Valves are in deep veins as much as superficial veins; the key driver is hydrostatic pressure.

Final Answer: Lower limb veins have more valves to counteract greater hydrostatic pressure from the taller blood column $\Rightarrow$ C

Answer: (C) Go Back to Q 5

Q6.

Solution

Concept — Median nerve course and carpal tunnel syndrome: The median nerve enters the forearm between the two heads of pronator teres and travels deep to flexor digitorum superficialis. At the wrist, it passes through the carpal tunnel. A key clinical point is that the palmar cutaneous branch (supplying the thenar eminence skin) arises proximal to the carpal tunnel and is spared in carpal tunnel syndrome.

Step 1 — Course in forearm:

- Enters forearm between two heads of pronator teres (at risk in pronator teres syndrome).

- Gives off anterior interosseous nerve (AIN) — supplies FPL, FDP (radial half), pronator quadratus.
- Passes **deep to FDS**, then emerges lateral to FDS tendon at the wrist.
- Palmar cutaneous branch arises 5 cm proximal to the flexor retinaculum.

Step 2 — Carpal tunnel contents: 9 tendons (FDS $\times 4$, FDP $\times 4$, FPL $\times 1$) + median nerve; flexor retinaculum is the roof.

Why other options are wrong:

- Option A: The nerve passes *deep to* FDS, not superficial.
- Option B: The median nerve passes *deep to* (not superficial to) the flexor retinaculum.
- Option C: The palmar cutaneous branch does NOT pass through the carpal tunnel and is spared in CTS.

Final Answer: Median nerve enters between pronator teres heads, passes deep to FDS, enters carpal tunnel deep to flexor retinaculum; palmar cutaneous branch spared in CTS $\Rightarrow$ D

Answer: (D) Go Back to Q 6

Q7.

Solution

Concept — Carpal bones: 8 carpal bones arranged in two rows (proximal and distal). Scaphoid fracture is the most common carpal fracture (falls on outstretched hand), and avascular necrosis of the proximal fragment is a complication.

Step 1 — Mnemonic (lateral to medial):

- **Proximal row**: **S**he **L**ooks **T**oo **P**retty = **S**caphoid, **L**unate, **T**riquetrum, **P**isiform.
- **Distal row**: **T**here **T**o **C**atch **H**er = **T**rapezium, **T**rapezoid, **C**apitate, **H**amate.

Step 2 — Clinical notes:

- Scaphoid: most common carpal fracture; avascular necrosis risk.
- Lunate: most commonly dislocated carpal bone.
- Pisiform: sesamoid bone in tendon of flexor carpi ulnaris.
- Hamate: hook fracture in racket sports; ulnar nerve at risk.

Why other options are wrong:

- Option B: These are the distal row, not the proximal row.
- Option C: Capitate and Hamate are distal row bones, not in the proximal row.
- Option D: Option D lists them medial to lateral (reverse), which is incorrect for standard anatomical description.

Final Answer: Proximal row lateral to medial: Scaphoid, Lunate, Triquetrum, Pisiform (She Looks Too Pretty) $\Rightarrow$ A

Answer: (A) Go Back to Q 7

Q8.

Solution

Concept — Radiocarpal (wrist) joint: An ellipsoid (condyloid) synovial joint between the distal radius + articular disc and the proximal row of carpals (scaphoid, lunate, triquetrum). The ulna does NOT directly articulate.

Step 1 — Key facts:

- Type: Ellipsoid/condyloid.
- Proximal surface: Distal radius + triangular articular disc (TFCC).
- Distal surface: Scaphoid, lunate, triquetrum (pisiform excluded).
- Movements: Flexion, extension, abduction (radial deviation), adduction (ulnar deviation), circumduction.
- No rotation at the radiocarpal joint (rotation = distal radioulnar joint).

Why other options are wrong:

- Option A: Ulna does not directly articulate; all 8 carpals are not involved; rotation does not occur.
- Option C: The wrist joint is ellipsoid not pivot; pivot = radioulnar.
- Option D: Trapezium, trapezoid, capitate are distal row — they articulate at the midcarpal joint, not the radiocarpal joint.

Final Answer: Radiocarpal joint = distal radius + articular disc vs scaphoid, lunate, triquetrum; allows flexion, extension, abduction, adduction $\Rightarrow$ B

Answer: (B) Go Back to Q 8

Q9.

Solution

Concept — Anatomical snuffbox: A triangular depression on the lateral (radial) aspect of the wrist, visible when the thumb is extended. Tenderness here after a wrist injury suggests scaphoid fracture until proven otherwise (even with normal X-ray).

Step 1 — Boundaries:

- **Laterally (anterior boundary)**: Abductor pollicis longus (APL) + Extensor pollicis brevis (EPB).
- **Medially (posterior boundary)**: Extensor pollicis longus (EPL).
- **Proximal**: Radial styloid.
- **Roof**: Skin + cephalic vein + superficial branch of radial nerve.
- **Floor**: Scaphoid and trapezium.
- **Contents**: Radial artery (passing deep to APL and EPB tendons), branches of radial nerve.

Why other options are wrong:

- Option A: Extensor digitorum is not a boundary; the ulnar artery does not pass through.
- Option B: Only partially correct — cephalic vein and superficial radial nerve are in the roof, but it misidentifies the lateral boundary (EPB alone is not the only boundary; APL is also lateral).
- Option D: Dorsal interosseous muscles are not boundaries; the deep branch of the radial nerve (posterior interosseous) does not pass through the snuffbox.

Final Answer: Anatomical snuffbox — lateral: APL + EPB; medial: EPL; floor: scaphoid; content: radial artery $\Rightarrow$ C

Answer: (C) Go Back to Q 9

Q10.

Solution

Concept — Long head of biceps and "Popeye" sign: The long head of biceps arises from the supraglenoid tubercle of the scapula, passes *intracapsularly but extrasynovially* through the glenohumeral joint, and descends in the intertubercular (bicipital) groove. Rupture of this proximal tendon leads to the characteristic "Popeye" muscle bulge in the lower arm as the muscle belly falls distally.

Step 1 — Attachments:

- **Long head**: supraglenoid tubercle of scapula (proximal).
- **Short head**: coracoid process (with coracobrachialis).
- **Distal**: radial tuberosity and bicipital aponeurosis.

Step 2 — Clinical significance:

- Proximal long head rupture (90% of biceps ruptures) $\rightarrow$ "Popeye" sign — bulge in distal arm.
- Common in elderly/overhead athletes; associated with rotator cuff tears.
- Distal rupture (10%) $\rightarrow$ loss of supination strength.

Why other options are wrong:

- Option A: Long head arises from supraglenoid tubercle, NOT coracoid; distal rupture is rare.
- Option B: It arises from supraglenoid tubercle, not lesser tubercle; it is intracapsular.
- Option C: Only the short head arises from coracoid process.

Final Answer: Long head of biceps arises from supraglenoid tubercle, passes intracapsularly (extrasynovially); proximal rupture = Popeye sign $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 10

Q11.

Solution

Concept — Cruciate ligaments of the knee: Both cruciate ligaments are intracapsular but extrasynovial. They cross each other forming an "X" (cruciate = cross). They are the primary stabilisers against anteroposterior tibial translation.

Step 1 — ACL:

- **Attachment**: Anterior intercondylar area of tibia → posterior part of the lateral femoral condyle (intercondylar notch).
- **Function**: Prevents *anterior* translation of tibia on femur; taut in extension.
- **Tests**: Anterior drawer test, Lachman's test (more sensitive), pivot shift test.

Step 2 — PCL:

- **Attachment**: Posterior intercondylar area of tibia → anterior part of the medial femoral condyle.
- **Function**: Prevents *posterior* translation of tibia on femur; taut in flexion.
- **Test**: Posterior drawer test, "sag sign."

Why other options are wrong:

- Option B: ACL prevents *anterior* translation (not posterior); it is attached to the *anterior* intercondylar area.
- Option C: PCL prevents *posterior* (not anterior) translation; PCL is extrasynovial.
- Option D: ACL arises from lateral femoral condyle; PCL from medial femoral condyle — they do NOT both arise from the lateral condyle.

Final Answer: ACL prevents anterior tibial translation (Lachman's positive); PCL prevents posterior translation ⇒ A

Answer: (A) Go Back to Q 11

Q12.

Solution

Concept — Popliteal fossa contents and depth order: The popliteal fossa is a diamond-shaped space behind the knee. Knowledge of its boundaries and the depth order of its contents (nerve superficial, artery deepest) is a classic examination topic.

Step 1 — Boundaries:

- Superolateral: Biceps femoris.
- Superomedial: Semitendinosus and semimembranosus.
- Inferolateral: Lateral head of gastrocnemius.
- Inferomedial: Medial head of gastrocnemius.
- Roof: Deep fascia (popliteal fascia).
- Floor: Popliteal surface of femur, posterior capsule, popliteus.

Step 2 — Contents (superficial to deep):

- **Most superficial**: Tibial nerve (and common peroneal nerve superolaterally).
- **Middle**: Popliteal vein.
- **Deepest**: Popliteal artery (hence difficult to palpate; pulsatile aneurysm may be missed).

Why other options are wrong:

- Option A: Semitendinosus and semimembranosus are *superomedial*, not superolateral; common peroneal nerve is NOT the deepest structure.
- Option C: The popliteal artery is the *deepest* structure, not the most superficial.
- Option D: Common peroneal nerve passes *laterally* along the medial border of biceps femoris, then winds around the *lateral* (not medial) aspect of the fibular neck.

Final Answer: Superolateral = biceps femoris; depth order: tibial nerve (superficial) $\rightarrow$ popliteal vein $\rightarrow$ popliteal artery (deepest) $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q 12

Q13.

Solution

Concept — Superficial inguinal lymph nodes: These nodes lie in the superficial fascia below the inguinal ligament, around the saphenous opening. They form two groups based on arrangement.

Step 1 — Arrangement:

- **Horizontal group** (parallel to inguinal ligament): Drains — perineum, scrotum/labia majora, lower anal canal, lower vagina, fundus of uterus (via round ligament), skin of buttock and anterior abdominal wall below umbilicus.
- **Vertical group** (along upper great saphenous vein): Drains — entire lower limb *except* the back of the calf (which drains to popliteal nodes).

Step 2 — Deep inguinal nodes:

- Lie medial to the femoral vein, within the femoral canal (uppermost = Cloquet's node).
- Drain glans penis/clitoris, deep structures of the lower limb.

Why other options are wrong:

- Option A: Superficial inguinal nodes lie in superficial fascia, NOT deep to deep fascia; testes drain to para-aortic nodes (L1 level).
- Option B: There are two groups (horizontal and vertical), not one.
- Option C: Deep inguinal nodes (not superficial) drain the glans; they are not "divided into deep and superficial."

Final Answer: Superficial inguinal nodes: horizontal group (inguinal ligament — perineum, scrotum) + vertical group (great saphenous vein — lower limb); deep nodes medial to femoral vein $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 13

Q14.

Solution

Concept — Common fibular (peroneal) nerve injury at fibular neck: The common fibular nerve is the most commonly injured nerve in the lower limb. It winds around the neck of the fibula, where it is subcutaneous and vulnerable to trauma (fracture, tight plaster cast, prolonged squatting, leg crossing).

Step 1 — Injury consequences:

- **Deep fibular (peroneal) nerve** supplies: tibialis anterior, extensor hallucis longus, extensor digitorum longus (dorsiflexors) $\rightarrow$ injury = foot drop.
- **Superficial fibular nerve** supplies: peroneus longus and brevis (evertors) $\rightarrow$ injury = loss of eversion.
- **Sensory loss**: dorsum of foot (superficial fibular) and first web space (deep fibular).
- **Spared**: plantar flexion (tibial nerve) and inversion (tibial nerve via tibialis posterior).

Why other options are wrong:

- Option A: Tibial nerve does not wind around fibular neck; tibial nerve injury causes claw toes and loss of plantar flexion.
- Option B: Plantar flexion and inversion are preserved (tibial nerve); it is dorsiflexion and eversion that are lost.
- Option D: Quadriceps is supplied by femoral nerve; common fibular nerve does not supply the knee extensors.

Final Answer: Common fibular nerve at fibular neck $\rightarrow$ foot drop (loss of dorsiflexion + eversion) + sensory loss on dorsum of foot $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q 14

Q15.

Solution

Concept — Adductor canal (Hunter's canal): An aponeurotic tunnel in the middle third of the medial thigh, transmitting the femoral vessels (artery and vein) and the saphenous nerve (terminal branch of femoral nerve). The femoral nerve itself is NOT in the canal — it has already ended in the femoral triangle.

Step 1 — Boundaries:

- Anterior: Sartorius (aponeurotic roof).
- Lateral: Vastus medialis.
- Posterior: Adductor longus (upper part) and adductor magnus (lower part).

Step 2 — Contents:

- Femoral artery.
- Femoral vein (posterior to artery in the canal).
- Saphenous nerve (accompanies femoral artery then exits anteriorly).
- Nerve to vastus medialis (briefly).
- **NOT**: femoral nerve, profunda femoris artery.

Why other options are wrong:

- Option A: Femoral nerve does NOT traverse the adductor canal; it divides and ends in the femoral triangle.
- Option C: Adductor canal is distal/inferior to the femoral triangle; they are separate structures.
- Option D: Profunda femoris leaves the femoral artery in the femoral triangle, proximal to the canal.

Final Answer: Adductor canal contains femoral artery + vein + saphenous nerve (not femoral nerve); bounded by sartorius, vastus medialis, adductor muscles $\Rightarrow$ B

Answer: (B) Go Back to Q 15

Q16.

Solution

Concept — Bronchopulmonary segments: Each segment is an independent structural and functional lung unit with its own bronchus, artery, and vein (intersegmental). The right lung has 10 segments; the left has 8–9 (due to fusion).

Step 1 — Right lung lobes and segment count:

- **Right upper lobe**: 3 segments (apical, posterior, anterior).
- **Right middle lobe**: 2 segments (lateral, medial).
- **Right lower lobe**: 5 segments (superior/apical, medial basal, anterior basal, lateral basal, posterior basal).

Step 2 — Clinical relevance: Aspiration in the supine position most commonly

affects the superior segment of the right lower lobe or right upper lobe posterior segment (gravitationally dependent when supine). The posterobasal segment is the most gravity-dependent in upright patients.

Why other options are wrong:

- Option B: "3 segments — apical, middle, basal" is not the correct bronchopulmonary segmental terminology.
- Option C: Left lower lobe has 4–5 segments; it does not have the same pattern as the right.
- Option D: The cardiac notch and lingula belong to the *left* lung; right lower lobe has 5 segments.

Final Answer: Right lower lobe = 5 bronchopulmonary segments: Superior, Medial basal, Anterior basal, Lateral basal, Posterior basal $\Rightarrow$ A

Answer: (A) Go Back to Q 16

Q17.

Solution

Concept — Aortic arch development and double aortic arch: During embryonic development, six pairs of aortic arches form from the aortic sac. Normally, most regress in a specific pattern. Abnormal persistence leads to vascular rings.

Step 1 — Normal arch fate:

- 1st and 2nd: largely regress (remnants in face).
- 3rd: contributes to common and internal carotid arteries.
- **4th**: Left side $\rightarrow$ permanent aortic arch; Right side $\rightarrow$ right subclavian artery.
- 5th: Transient, disappears.
- 6th: Pulmonary arteries; left side distal portion $\rightarrow$ ductus arteriosus.

Step 2 — Double aortic arch: Results from persistence of **both the right and left 4th aortic arches**, creating a complete vascular ring that encircles the trachea and esophagus $\rightarrow$ stridor + dysphagia lusoria in neonates.

Why other options are wrong:

- Option A: A persistent right 4th arch alone forms a right-sided aortic arch, not a double arch.
- Option B: Ductus arteriosus (6th arch) regression is separate from double arch formation.

- Option D: 6th arch forms pulmonary arteries; its bilateral persistence causes different anomalies.

Final Answer: Double aortic arch = persistence of both right and left 4th aortic arches → complete vascular ring ⇒ C

Answer: (C) Go Back to Q 17

Q18.

Solution

Concept — Esophageal constrictions: The esophagus has three physiological (normal) constrictions. These are clinically important as sites of: foreign body impaction, stricture formation, and carcinoma development.

Step 1 — Three constrictions:

(a) **Pharyngo-esophageal (cricopharyngeal) junction**: 15 cm from incisors; narrowest part; Killian's dehiscence — site of pharyngeal pouch (Zenker's diverticulum).
(b) **Aortic/bronchial constriction**: Where the aortic arch crosses (22 cm) and left main bronchus crosses (25 cm) — often counted as one or two constrictions.
(c) **Diaphragmatic/cardiac constriction**: At oesophageal hiatus/gastroesophageal junction (40 cm); site of hiatus hernia and lower oesophageal carcinoma.

Why other options are wrong:

- Option A: The pylorus is in the stomach, not the esophagus.
- Option B: Constrictions represent sites of *reduced* distensibility, not maximum distensibility.
- Option C: The junction of pharynx and larynx is not the first constriction; carcinoma *does* occur at constrictions.

Final Answer: Three constrictions: pharyngo-esophageal (15 cm), aortic/bronchial (22–25 cm), diaphragmatic/cardiac (40 cm) — sites of carcinoma and foreign body impaction ⇒ D

Answer: (D) Go Back to Q 18

Q19.

Solution

Concept — Thoracic duct: The thoracic duct is the largest lymphatic vessel in the body, draining about 3/4 of the body's lymph. It is at risk during left neck dissection, oesophageal surgery, and thoracic procedures.

Step 1 — Course of the thoracic duct:

- Begins at the **cisterna chyli** at L1–L2 (confluence of lumbar and intestinal trunks).
- Enters thorax through the **aortic hiatus** (T12).
- Ascends in the posterior mediastinum on the **right** side of the thoracic aorta, between aorta (left) and azygos vein (right).
- At T4–T5, crosses to the **left** behind the esophagus.
- Ascends through the superior mediastinum to the neck.
- Arches laterally to terminate at the **left venous angle** (junction of left internal jugular + left subclavian veins).

Step 2 — What it drains: Both lower limbs, abdomen, left thorax, left upper limb, left head and neck. (Right lymphatic duct drains the right upper quadrant.)

Why other options are wrong:

- Option A: Thoracic duct drains into left (not right) venous angle.
- Option C: It drains both lower halves AND the left upper quadrant.
- Option D: Right upper limb and right thorax/head drain into the right lymphatic duct (not thoracic duct).

Final Answer: Thoracic duct begins at cisterna chyli (L1–L2), crosses to left at T4–T5, terminates at left venous angle $\Rightarrow$ B

Answer: (B) Go Back to Q 19

Q20.

Solution

Concept — Diaphragm openings: The diaphragm has three main openings at specific vertebral levels. A classic mnemonic: **I 8 (ate) 10 Eggs At 12 (noon)**.

Step 1 — Openings and their contents:

- **T8 — Vena caval opening**: IVC + right phrenic nerve. In the central tendon; the most anterior and highest.

- **T10 — Esophageal hiatus**: Esophagus + left and right vagal trunks (anterior vagus = left; posterior = right) + esophageal branches of left gastric vessels. Surrounded by the right crus (diaphragmatic sling).
- **T12 — Aortic hiatus**: Aorta + thoracic duct + azygos vein. Technically posterior to the diaphragm (between diaphragm and vertebral column), so compression does not occur.

Why other options are wrong:

- Option B: Aorta is at T12, not T8; IVC is at T8, not T10.
- Option C: Esophagus is at T10, not T8; IVC is at T8, not T12.
- Option D: Thoracic duct is at T12 (with aorta), not T8; aorta is at T12.

Final Answer: T8 = IVC + right phrenic nerve; T10 = Esophagus + vagal trunks; T12 = Aorta + thoracic duct + azygos vein $\Rightarrow$ A

Answer: (A) Go Back to Q 20

Q21.

Solution

Concept — Couinaud hepatic segmentation: Couinaud (1954) divided the liver into 8 functionally independent segments based on the distribution of portal pedicles (portal vein + hepatic artery + bile duct) and the three main hepatic veins. Each segment can be resected independently.

Step 1 — Segment numbering (clockwise in French convention):

- **Segment I**: Caudate lobe — unique in that it receives blood from both left and right portal branches and drains directly to the IVC via short hepatic veins (independent of the three main hepatic veins).
- **Segments II–IV**: Left lobe (left portal pedicle).
- **Segments V–VIII**: Right lobe (right portal pedicle).
- **Segment VI**: Right posteroinferior segment.

Why other options are wrong:

- Option A: Based on portal pedicles (not hepatic artery alone); there are 8 (not 5) segments.
- Option B: Based on portal pedicles *and* hepatic veins combined; caudate lobe = segment I.

- Option D: Segments V–VIII are in the right lobe, not left; numbering sequence is not strictly left to right.

Final Answer: Couinaud: 8 independent segments based on portal pedicles; segment I = caudate lobe (drains directly to IVC) $\Rightarrow$ C

Answer: (C) Go Back to Q 21

Q22.

Solution

Concept — Portosystemic anastomoses: In portal hypertension, blood is diverted through pre-existing anastomoses between the portal and systemic venous systems. Oesophageal varices (from the oesophageal anastomosis) are the most dangerous, as rupture causes life-threatening haemorrhage.

Step 1 — Four main anastomotic sites:

(a) **Oesophageal**: Left gastric v. (portal) $\leftrightarrow$ oesophageal veins/azygos v. (systemic) $\rightarrow$ oesophageal varices.
(b) **Paraumbilical (caput medusae)**: Para-umbilical veins (portal) $\leftrightarrow$ epigastric veins (systemic) $\rightarrow$ dilated periumbilical veins.
(c) **Anorectal**: Superior rectal v. (portal, IMV) $\leftrightarrow$ middle and inferior rectal v. (systemic) $\rightarrow$ anorectal varices (distinct from haemorrhoids).
(d) **Retroperitoneal (Retzius veins)**: Colic/splenic veins $\leftrightarrow$ lumbar/renal veins.

Why other options are wrong:

- Option A: Only listing two sites — incomplete and incorrect.
- Option B: Portosystemic anastomoses are critically relevant; they are the basis of variceal complications.
- Option C: Umbilical/paraumbilical veins ARE involved (caput medusae) — patent para-umbilical veins through falciform ligament.

Final Answer: Four sites: oesophageal, paraumbilical, anorectal, retroperitoneal; oesophageal varices are most dangerous $\Rightarrow$ D

Answer: (D) Go Back to Q 22

Q23.

Solution

Concept — Pancreatic head, uncinate process, and superior mesenteric vessels: The uncinate process is a hook-like projection of the lower part of the pancreatic head that passes posteriorly behind the superior mesenteric vessels (SMA and SMV). This makes tumours in this location extremely difficult to resect (Whipple procedure).

Step 1 — Key anatomical relationships:

- **Neck of pancreas**: lies *anterior* to the portal vein/SMV confluence and anterior to the superior mesenteric artery.
- **Uncinate process**: hooks *behind* the SMA and SMV → direct vascular involvement by uncinate tumours makes R0 resection challenging.
- The portal vein is formed behind the neck of the pancreas by the union of SMV and splenic vein.

Why other options are wrong:

- Option A: SMV passes *anterior* to the neck of pancreas (not posterior to it).
- Option C: Uncinate wraps around *superior* mesenteric vessels, not the inferior mesenteric artery.
- Option D: SMA passes *posterior* to the pancreatic neck — it emerges from the aorta behind the pancreas.

Final Answer: Uncinate process hooks behind the SMA and SMV; pancreatic neck lies anterior to SMA and portal vein confluence ⇒ B

Answer: (B) Go Back to Q 23

Q24.

Solution

Concept — Spleen anatomy: The spleen is the largest lymphoid organ. It lies in the left hypochondrium, protected by ribs 9–11. Its notched superior border is a palpable landmark in splenomegaly.

Step 1 — Relations and blood supply:

- Position: Left hypochondrium; long axis along rib 10.
- Protected by ribs 9–11 posterolaterally.
- **Notch**: On the **superior** (anterior) border — felt in splenomegaly.

- Surfaces related to: stomach (via gastrosplenic ligament), left kidney and suprarenal gland (via splenorenal/lienorenal ligament), left colic flexure, tail of pancreas.
- **Blood supply**: Splenic artery (largest branch of coeliac trunk), which has a tortuous course along the superior border of the pancreas.
- Splenic vein (joins SMV to form portal vein).

Why other options are wrong:

- Option B: Splenic artery comes from coeliac trunk, not left gastric; the spleen is in the left hypochondrium, not iliac fossa.
- Option C: The spleen is an intraperitoneal organ (not retroperitoneal); its blood supply is the splenic artery, not SMA.
- Option D: The notch is on the *superior* (anterior) border; the spleen lies between ribs 9–11 (not 7–9); it is related to the left kidney, not right.

Final Answer: Spleen: left hypochondrium, ribs 9–11, notch on superior border, supplied by splenic artery (coeliac trunk branch) $\Rightarrow$ A

Answer: (A) Go Back to Q 24

Q25.

Solution

Concept — Greater omentum: The greater omentum is a double-layered fold of peritoneum hanging from the greater curvature of the stomach. It has 4 layers (two descending, two ascending) and serves as the "abdominal policeman" — migrating to wall off infection.

Step 1 — Layers:

- Hangs from the greater curvature (anterior two layers descend).
- Folds back on itself (posterior two layers ascend to the transverse colon).
- Total = **4 layers of peritoneum**.
- Contains fat, macrophages, lymphatics, and blood vessels.

Step 2 — Blood supply:

- **Right gastroepiploic (gastro-omental) artery**: Branch of the gastroduodenal artery (from common hepatic $\rightarrow$ coeliac).
- **Left gastroepiploic artery**: Branch of the splenic artery (from coeliac).
- They anastomose along the greater curvature.

Why other options are wrong:

- Option A: Greater omentum has 4 layers (not 2); it is not supplied by SMA exclusively.
- Option B: It has a rich blood supply; it is not avascular.
- Option C: Supplied by *both* right and left gastroepiploic arteries, not exclusively the left.

Final Answer: Greater omentum = 4 peritoneal layers; blood supply from right and left gastroepiploic arteries (gastroduodenal and splenic artery branches) $\Rightarrow$ D

Answer: (D) Go Back to Q 25

Q26.

Solution

Concept — Cavernous sinus contents: The cavernous sinus is a paired venous dural sinus on either side of the sella turcica. Its unique feature is the passage of cranial nerves *through or in its walls*, making cavernous sinus thrombosis a clinical emergency.

Step 1 — Contents:

- **Within the sinus lumen (free in blood)**: Internal carotid artery (with sympathetic plexus) + **CN VI (abducens nerve)** — therefore CN VI palsy is the earliest sign.
- **In the lateral wall (embedded, superior to inferior)**: CN III (oculomotor) $\rightarrow$ CN IV (trochlear) $\rightarrow$ CN V1 (ophthalmic) $\rightarrow$ CN V2 (maxillary).
- **NOT in cavernous sinus**: CN V3 (mandibular), CN II (optic), CN VII, CN VIII.

Step 2 — Clinical features of cavernous sinus thrombosis: Proptosis, ophthalmoplegia (CN III, IV, VI palsy), sensory loss over face (V1, V2), Horner's syndrome (sympathetic plexus on ICA).

Why other options are wrong:

- Option A: CN III and IV are also in the lateral wall — omitting them is incorrect.
- Option C: Middle meningeal artery does not pass through the cavernous sinus; V3 is NOT in the sinus.

- Option D: CN II (optic nerve) passes through the optic canal, not the cavernous sinus.

Final Answer: Within sinus: ICA + CN VI; lateral wall (top to bottom): CN III, IV, V1, V2 $\Rightarrow$ B

Answer: (B) Go Back to Q 26

Q27.

Solution

Concept — Pterygopalatine fossa communications: The pterygopalatine fossa (PPF) is a small pyramidal space behind the maxilla, acting as a "crossroads" between multiple regions of the skull. The maxillary nerve (V2) and pterygopalatine ganglion reside here.

Step 1 — Six communications of the PPF:

(a) **Orbit**: Via inferior orbital fissure (infraorbital nerve, zygomatic nerve).
(b) **Middle cranial fossa**: Via **foramen rotundum** (maxillary nerve V2 enters PPF here).
(c) **Infratemporal fossa**: Via pterygomaxillary fissure (maxillary artery enters).
(d) **Nasal cavity**: Via sphenopalatine foramen (nasopalatine and superior nasal nerves, sphenopalatine artery).
(e) **Oral cavity**: Via greater and lesser palatine canals (greater and lesser palatine nerves/arteries).
(f) **Nasopharynx**: Via palatovaginal canal (pharyngeal branch of maxillary nerve).

Why other options are wrong:

- Option A: Only listing two communications; the fossa has six.
- Option B: It is a highly connected space, not closed.
- Option D: Foramen ovale carries V3 (mandibular nerve) to the infratemporal fossa, NOT the pterygopalatine fossa.

Final Answer: PPF has 6 communications: orbit (inf. orbital fissure), skull base (foramen rotundum), infratemporal fossa, nasal cavity, oral cavity, nasopharynx $\Rightarrow$ C

Answer: (C) Go Back to Q 27

Q28.

Solution

Concept — Tongue nerve supply: Tongue nerve supply is a classic FMGE/USMLE topic. The key exception is palatoglossus (supplied by CN X via pharyngeal plexus, not CN XII).

Step 1 — Motor supply:

- **CN XII (Hypoglossal)**: ALL intrinsic muscles + ALL extrinsic muscles (genioglossus, hyoglossus, styloglossus) EXCEPT palatoglossus.
- **Palatoglossus**: CN X (vagus) via pharyngeal plexus.
- In a right CN XII lesion: tongue deviates to the *right* (ipsilateral) on protrusion (genioglossus of the opposite side unopposed).

Step 2 — Sensory supply:

- Anterior 2/3 *general sensation*: Lingual nerve (V3, branch of mandibular).
- Anterior 2/3 *taste*: Chorda tympani (CN VII, via lingual nerve).
- Posterior 1/3 *general sensation* + *taste*: Glossopharyngeal nerve (CN IX).
- Posterior-most (epiglottic region): Internal laryngeal nerve (CN X).

Why other options are wrong:

- Option B: CN XI (accessory nerve) does not supply tongue muscles; taste from anterior 2/3 is via chorda tympani (VII), not IX.
- Option C: Lingual nerve carries sensation (not motor) only; CN XII supplies intrinsic AND extrinsic muscles.
- Option D: Palatoglossus is supplied by CN X (not XII); lingual nerve does not carry taste (chorda tympani does).

Final Answer: All tongue muscles (except palatoglossus) = CN XII; taste anterior 2/3 = chorda tympani (VII); posterior 1/3 = CN IX $\Rightarrow$ A

Answer: (A) Go Back to Q 28

Q29.

Solution

Concept — Infratemporal fossa contents: The infratemporal fossa is an irregular space below and medial to the zygomatic arch and posterior to the maxilla. It is the target for inferior alveolar nerve blocks and contains important structures at risk during complex dental procedures.

Step 1 — Muscles:

- Lower fibres of temporalis, medial pterygoid, lateral pterygoid.

Step 2 — Nerves (all branches of V3/mandibular nerve from foramen ovale):

- Inferior alveolar nerve (enters mandibular canal → supplies lower teeth).
- Lingual nerve (joined by chorda tympani from CN VII → taste + parasympathetics to sublingual/submandibular glands).
- Buccal nerve (sensory to cheek mucosa).
- Auriculotemporal nerve, nerve to mylohyoid.

Step 3 — Vessels:

- Maxillary artery (2nd part — lies in infratemporal fossa; gives middle meningeal artery, inferior alveolar artery, etc.).
- Pterygoid venous plexus (communicates with cavernous sinus → infection can spread).

Why other options are wrong:

- Option A: Ophthalmic (V1) and facial nerves (VII) are not in the infratemporal fossa.
- Option B: Masseter is *external* to the infratemporal fossa (on the lateral surface of the mandible).
- Option C: Maxillary nerve (V2) passes through the pterygopalatine fossa via foramen rotundum, not the infratemporal fossa.

Final Answer: Infratemporal fossa: pterygoid muscles, V3 branches (inferior alveolar, lingual, buccal), chorda tympani, maxillary artery (2nd part), pterygoid venous plexus ⇒ D

Answer: (D) Go Back to Q 29

Q30.

Solution

Concept — Parotid gland and facial nerve: The facial nerve (CN VII) exits the skull through the stylomastoid foramen and enters the posterior surface of the parotid gland, where it divides into temporofacial and cervicofacial divisions (and ultimately the five terminal branches: temporal, zygomatic, buccal, marginal mandibular, cervical). Injury during parotidectomy causes facial palsy.

Step 1 — Facial nerve within parotid:

- Exits stylomastoid foramen → gives branches to posterior belly of digastric, stylohyoid, posterior auricular muscles.
- Enters parotid from its **posteromedial** surface.
- Divides within the gland into the **pes anserinus** ("goose's foot") pattern: temporofacial trunk → temporal, zygomatic, buccal branches; cervicofacial trunk → marginal mandibular, cervical branches.
- The retromandibular vein lies deep to the facial nerve within the gland.

Step 2 — Parotid duct (Stensen's duct):

- Emerges from the anterior border of the gland.
- Passes horizontally across masseter.
- Turns medially to pierce buccinator.
- Opens into the vestibule of the mouth opposite the **upper second molar** tooth.

Why other options are wrong:

- Option A: Facial nerve passes through (not deep to) the parotid; duct opens opposite the upper 2nd molar (not lower 2nd molar).
- Option B: Facial nerve enters from the posteromedial surface; it lies superficial to the retromandibular vein within the gland; duct runs horizontally, not vertically.
- Option D: Facial nerve does enter the parotid gland; the duct opens at the upper 2nd molar (not 1st premolar).

Final Answer: Facial nerve enters parotid posteromedially, divides within it; Stensen's duct crosses masseter, pierces buccinator, opens at upper 2nd molar ⇒ C

Answer: (C) Go Back to Q 30

Q31.

Solution

Concept — Dorsal column-medial lemniscal (DCML) pathway: This pathway transmits fine touch, vibration, proprioception, and two-point discrimination. Unlike the spinothalamic tract, first-order neurons do NOT cross at the level of entry — they ascend ipsilaterally in the dorsal columns to the medulla.

Step 1 — Three-neuron pathway:

(a) **First-order neurons**: Cell bodies in dorsal root ganglia. Enter spinal cord → ascend in **ipsilateral** dorsal column (fasciculus gracilis = below T6, lower limb; fasciculus cuneatus = above T6, upper limb). Synapse in nucleus gracilis/cuneatus in the medulla (caudal medulla).

(b) **Second-order neurons**: Cross the midline in the medulla as **internal arcuate fibres** → form the **medial lemniscus** → ascend to the contralateral **VPL (ventral posterolateral) nucleus of the thalamus**.

(c) **Third-order neurons**: From VPL thalamus → project via the internal capsule (posterior limb) to the **primary somatosensory cortex** (postcentral gyrus, Brodmann areas 3, 1, 2).

Why other options are wrong:

- Option B: Pain and temperature are carried by the spinothalamic tract, not the dorsal columns.
- Option C: First-order neurons do NOT cross in the spinal cord — they cross in the medulla (this is the key difference from the spinothalamic tract which crosses at the level of entry).
- Option D: The dorsal column neurons bypass the posterior horn — they ascend without synapsing in the spinal cord.

Final Answer: DCML pathway: 1st neuron ascends ipsilateral dorsal column → synapse in medulla → cross as internal arcuate fibres → medial lemniscus → VPL thalamus → somatosensory cortex ⇒ A

Answer: (A) Go Back to Q 31

Q32.

Solution

Concept — VPL vs VPM thalamic nuclei: The ventral posterior nucleus is the main somatosensory relay of the thalamus. It has two subdivisions based on body region represented.

Step 1 — VPL and VPM functions:

- **VPL (Ventral PosteroLateral)**: Receives sensory inputs from the *contralateral body* (trunk and limbs) via:
  - Medial lemniscus (fine touch, proprioception, vibration from DCML pathway).
  - Spinothalamic tract (pain and temperature).
- **VPM (Ventral PosteroMedial)**: Receives sensory inputs from the *contralateral face* via:
  - Trigeminal lemniscus/trigeminothalamic tract (all modalities from face via CN V).
  - Also receives taste via CN VII (geniculate), IX, X via the nucleus of tractus solitarius.
- Both VPL and VPM project to the primary somatosensory cortex (postcentral gyrus) via the posterior limb of the internal capsule.

Why other options are wrong:

- Option A: VPL receives body sensation and VPM receives face sensation — the description in option A reverses these.
- Option B: VPL and VPM are sensory nuclei; motor information goes to VL (ventral lateral) nucleus.
- Option D: VPL and VPM are distinct; VPL projects to the somatosensory cortex (not cingulate cortex).

Final Answer: VPL = contralateral body sensation (DCML + spinothalamic); VPM = contralateral face (trigeminothalamic); both project to primary somatosensory cortex $\Rightarrow$ C

Answer: (C) Go Back to Q 32

Q33.

Solution

Concept — Hypothalamic nuclei and ADH: The hypothalamus contains multiple nuclei with specific functions. ADH (antidiuretic hormone, vasopressin) is synthesised in the supraoptic and paraventricular nuclei and transported to the posterior pituitary for release.

Step 1 — Key hypothalamic nuclei and their functions:

- **Supraoptic nucleus**: Primarily synthesises **ADH (vasopressin)**.
- **Paraventricular nucleus**: Primarily synthesises **oxytocin** (also some ADH).
- **Ventromedial nucleus**: Satiety centre (damage $\rightarrow$ hyperphagia and obesity).
- **Lateral hypothalamic area**: Hunger/feeding centre (damage $\rightarrow$ anorexia).
- **Posterior nucleus**: Temperature regulation (conservation of heat).
- **Anterior nucleus**: Parasympathetic, temperature dissipation ("cool" nucleus — anterior is cool, posterior is warm).
- **Arcuate nucleus**: GnRH, dopamine (inhibits prolactin); also GHRH.
- **Suprachiasmatic nucleus**: Circadian rhythm (receives input from retina).

Step 2 — Diabetes insipidus mechanism: Craniopharyngioma destroys the supraoptic nucleus or the pituitary stalk $\rightarrow$ no ADH release $\rightarrow$ inability to concentrate urine $\rightarrow$ polyuria (up to 20 L/day) of dilute urine + polydipsia.

Why other options are wrong:

- Option A: Ventromedial nucleus is the satiety centre; it does not produce ADH.
- Option B: ADH is produced in the *supraoptic* nucleus (not posterior nucleus) and stored in the *posterior* pituitary (not anterior).
- Option C: Arcuate nucleus produces GnRH and dopamine; it does not primarily produce ADH.

Final Answer: ADH synthesised in the supraoptic nucleus $\rightarrow$ transported to posterior pituitary (neurohypophysis) for release $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 33

Q34.

Solution

Concept — Broca's area vs Wernicke's area: Speech areas are located in the dominant (usually left) hemisphere in right-handed individuals (and in ~95% of all people). Broca's aphasia = non-fluent (expressive) aphasia with intact comprehension. Wernicke's aphasia = fluent but nonsensical speech with impaired comprehension.

Step 1 — Localisation:

- **Broca's area (motor speech)**: Brodmann areas **44** (pars opercularis) and **45** (pars triangularis) of the **inferior frontal gyrus** of the dominant hemisphere.
- **Wernicke's area (sensory speech)**: Brodmann area **22** in the **posterior part of the superior temporal gyrus** of the dominant hemisphere.
- **Arcuate fasciculus**: Connects Broca's and Wernicke's areas; damage = conduction aphasia (cannot repeat, but can comprehend and initiate speech).

Step 2 — Broca's aphasia features: Non-fluent, effortful, telegraphic speech; preserved comprehension; patient is aware of deficit (frustration). Caused by left MCA (inferior division) infarct.

Why other options are wrong:

- Option A: Brodmann areas 41 and 42 are primary auditory cortex (Heschl's gyri), not Broca's area; the locations are reversed.
- Option C: Broca's area is in the frontal lobe; Wernicke's is in the temporal lobe — not parietal and frontal.
- Option D: Speech areas are in the *left* (dominant) hemisphere in right-handed individuals, not the right.

Final Answer: Broca's area = BA 44, 45 (inferior frontal gyrus); Wernicke's area = BA 22 (posterior superior temporal gyrus); connected by arcuate fasciculus ⇒ B

Answer: (B) Go Back to Q 34

Q35.

Solution

Concept — Metanephros (permanent kidney) development: The permanent kidney (metanephros) develops during the 5th week from two mesodermal components: the ureteric bud (from the mesonephric/Wolffian duct) and the metanephric blastema (from the intermediate mesoderm of the sacral region). They induce each other in a critical reciprocal induction.

Step 1 — Reciprocal induction:

- **Ureteric bud** grows into the metanephric blastema → induces blastema to differentiate into nephrons (glomerulus, proximal tubule, loop of Henle, distal tubule).
- **Metanephric blastema** induces the ureteric bud to branch repeatedly → forms the collecting system (ureter, renal pelvis, major and minor calyces, collecting ducts).
- **Failure of ureteric bud to develop** or failure of induction → **renal agenesis** (bilateral → Potter sequence: oligohydramnios → pulmonary hypoplasia, limb deformities, Potter's facies).

Step 2 — Kidney ascent: Kidneys ascend from sacral to lumbar region; blood supply shifts from sacral arteries to lumbar arteries; failure to ascend = pelvic kidney; fusion = horseshoe kidney (trapped below IMA).

Why other options are wrong:

- Option A: The metanephros does NOT develop directly from the pronephros; it is a separate structure from a different mesoderm level.
- Option B: Mesonephric tubules do not invade the blastema; it is the *ureteric bud* (an outgrowth of the mesonephric duct) that induces the blastema.
- Option D: The roles are *reversed* — ureteric bud → collecting system (ureter, pelvis, calyces, collecting ducts); metanephric blastema → nephrons.

Final Answer: Ureteric bud induces metanephric blastema to form nephrons; blastema induces ureteric bud to branch into collecting system; failure = renal agenesis ⇒ C

Answer: (C) Go Back to Q 35

Q36.

Solution

Concept — Mullerian (paramesonephric) duct derivatives: In females, the Mullerian ducts are the primary internal genital structures (in the absence of MIF/AMH). In males, Sertoli cells secrete Anti-Mullerian Hormone (AMH/MIF), causing Mullerian duct regression; Wolffian ducts persist.

Step 1 — Female Mullerian duct derivatives:

- **Uterine (Fallopian) tubes**: From the cranial portions (unfused) of the paramesonephric ducts.
- **Uterus (body and cervix)**: From the caudal portions that fuse in the midline (uterovaginal canal).
- **Upper 1/3 of vagina**: From the fused Mullerian ducts (lower 2/3 from sinovaginal bulbs of urogenital sinus).

Step 2 — What Mullerian ducts do NOT form:

- **Ovaries**: Derived from the gonadal/genital ridge (mesoderm) populated by primordial germ cells (from yolk sac endoderm).
- **Lower 2/3 vagina**: From sinovaginal bulbs (urogenital sinus endoderm).

Why other options are wrong:

- Option A: Ovaries are NOT Mullerian duct derivatives; the vaginal epithelium is partly from urogenital sinus.
- Option B: Lower vagina is from urogenital sinus (not Wolffian/mesonephric duct); ovaries are from the genital ridge.
- Option C: Epididymis, vas deferens, seminal vesicles are *Wolffian* (mesonephric) duct derivatives in the male.

Final Answer: Mullerian duct female derivatives: uterine tubes + uterus (body and cervix) + upper 1/3 vagina; ovaries are from the genital ridge $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 36

Q37.

Solution

Concept — Normal intestinal rotation and malrotation: The midgut (from distal duodenum to mid-transverse colon) undergoes herniation into the umbilical cord and **270° counterclockwise** rotation (viewed from the front) around the superior mesenteric artery (SMA) axis during weeks 6–10 of development.

Step 1 — Stages of rotation:

(a) **Herniation (week 6)**: Midgut herniates into umbilical cord; pre-arterial segment goes to the left.
(b) **Rotation**: 90° counterclockwise (weeks 6–10); the cecum rotates from right to left and back.
(c) **Retraction (week 10)**: Midgut returns to abdomen with further 180° counterclockwise rotation = total **270°**.
(d) **Fixation**: Duodeno-jejunal (DJ) flexure = left of midline (ligament of Treitz); cecum = right iliac fossa.

Step 2 — Malrotation consequences:

- Incomplete rotation → DJ flexure on right, cecum in upper abdomen/epigastrium.
- **Ladd's bands**: Peritoneal bands from cecum to posterior abdominal wall crossing the duodenum → duodenal obstruction.
- **Midgut volvulus**: Small bowel can twist around the SMA (narrow mesenteric pedicle) → bilious vomiting + bowel ischaemia in neonates. Surgical emergency.

Why other options are wrong:

- Option B: Rotation is counterclockwise (not clockwise); cecum normally goes to the right iliac fossa.
- Option C: It is the *midgut* that rotates 270° (the hindgut does not rotate).
- Option D: Rotation axis is the SMA (not IMA); total rotation is 270° (not 180°).

Final Answer: Normal midgut rotation = 270° counterclockwise around SMA; DJ flexure left of midline + cecum in right iliac fossa; malrotation predisposes to volvulus ⇒ A

Answer: (A) Go Back to Q 37

Q38.

Solution

Concept — Hepatic lobule histology: The classic hepatic lobule is a hexagonal unit with the **central vein** (terminal hepatic venule) at its centre and 6 **portal triads** at its corners. Blood flows from the portal triads (via sinusoids) to the central vein; bile flows in the opposite direction.

Step 1 — Components of the hepatic lobule:

- **Hepatocytes**: Arranged in plates (one cell thick) radiating from the central vein.
- **Hepatic sinusoids**: Specialised capillaries between hepatocyte plates; lined by **fenestrated endothelium** (no basement membrane) and **Kupffer cells** (liver-resident macrophages).
- **Space of Disse**: Between sinusoidal endothelium and hepatocytes; contains Ito cells (hepatic stellate cells, store vitamin A; activated in cirrhosis $\rightarrow$ collagen deposition).
- **Portal triad**: Portal vein radicle + hepatic artery branch + bile ductule.
- **Bile canaliculi**: Minute channels between hepatocytes; bile flows from centre toward portal triad into bile ductules — **opposite to blood flow**.

Step 2 — Zones of the hepatic acinus (Rappaport): Zone 1 (periportal) = most oxygenated (paracetamol toxic here); Zone 3 (centrilobular) = least oxygenated (ischaemia $\rightarrow$ centrilobular necrosis; alcohol $\rightarrow$ zone 3 damage).

Why other options are wrong:

- Option A: Bile canaliculi flow *away* from the central vein (not towards it); Kupffer cells line sinusoids (not hepatic veins).
- Option B: Portal triad does NOT contain the central vein; the central vein is at the centre of the lobule.
- Option C: Sinusoids are lined by **fenestrated** endothelium **without** a basement membrane; hepatocytes do not secrete bile into sinusoids (into bile canaliculi instead).

Final Answer: Hepatic lobule: hexagonal, central vein at centre, portal triads at corners; blood flows periphery $\rightarrow$ centre; bile flows centre $\rightarrow$ periphery; Kupffer cells line sinusoids $\Rightarrow$ D

Answer: (D) Go Back to Q 38

Q39.

Solution

Concept — Glomerular filtration barrier and podocytes: The glomerular filtration barrier is a three-layer structure that filters blood by size and charge. Nephrotic syndrome (heavy proteinuria) results from disruption of any layer, most commonly podocyte foot process fusion (minimal change disease).

Step 1 — Three layers of the filtration barrier:

(a) **Fenestrated endothelium**: Large pores (70–100 nm) in glomerular capillaries; allow passage of water, solutes, proteins but retain blood cells.

(b) **Glomerular basement membrane (GBM)**: Composed primarily of type IV collagen, laminin, and heparan sulfate proteoglycans. The negative charge of heparan sulfate repels negatively charged albumin (charge selectivity). Thickened in diabetic nephropathy; antibodies to GBM type IV collagen = Goodpasture syndrome.

(c) **Podocytes with slit diaphragms**: Octopus-like cells with foot processes (pedicels) interdigitating around capillaries; slit diaphragm (nephrin protein) bridges the filtration slits; provides size selectivity. Foot process fusion (effacement) $\rightarrow$ loss of slit diaphragm $\rightarrow$ proteinuria (nephrotic syndrome).

Why other options are wrong:

- Option B: Bowman's capsule parietal layer is not part of the filtration barrier; podocytes line the visceral layer.
- Option C: Glomerular capillaries are *fenestrated*; GBM is type IV collagen (not type II).
- Option D: Podocytes are visceral epithelial cells (not mesangial cells); mesangial cells provide structural support but are not part of the filtration barrier.

Final Answer: Filtration barrier: fenestrated endothelium + GBM (type IV collagen + heparan sulfate) + podocyte slit diaphragm; foot process fusion $\rightarrow$ proteinuria $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q 39

Q40.

Solution

Concept — Thyroid histology: The thyroid gland is composed of follicles lined by follicular cells and dispersed parafollicular (C) cells. Understanding histology is critical for interpreting thyroid cancer types.

Step 1 — Follicular cells (principal cells):

- Simple cuboidal to columnar epithelium lining follicles.
- Synthesise **thyroglobulin** → stored as **colloid** in the follicular lumen.
- Thyroglobulin is iodinated (by TPO enzyme) → forms T3 and T4.
- Colloid appears as eosinophilic amorphous material with resorption vacuoles at the periphery (signs of active secretion).
- Give rise to **papillary** and **follicular** thyroid carcinoma.

Step 2 — Parafollicular (C) cells:

- Lie between follicles or within follicular epithelium (parafollicular).
- **Neural crest origin** (migrated from ultimobranchial body, derived from 4th/5th pharyngeal pouch).
- Produce **calcitonin** (lowers serum calcium by inhibiting osteoclasts).
- Pale cytoplasm on H&E.
- Give rise to **medullary thyroid carcinoma** (MTC) — secretes calcitonin; associated with MEN 2A and 2B.

Why other options are wrong:

- Option A: Parafollicular (C) cells are a minority; they produce calcitonin, not T3/T4.
- Option B: Follicular cells produce T3/T4 (not calcitonin); parafollicular cells produce calcitonin (not T3/T4) — this option reverses the functions.
- Option D: Follicular cells are endodermal (from thyroid anlage, not neural crest); they produce thyroid hormone (not PTH); C cells produce calcitonin (not T4); PTH is from parathyroid chief cells.

Final Answer: Follicular cells produce T3/T4 (via thyroglobulin/colloid); parafollicular C cells (neural crest) produce calcitonin; C cells → medullary thyroid carcinoma ⇒ C

Answer: (C) Go Back to Q 40

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	D	3	C	5	C	6	D
8	B	9	C	10	D	12	B	13	D
14	C	15	B	17	C	18	D	19	B
21	C	22	D	23	B	25	D	26	B
27	C	29	D	30	C	32	C	33	D
34	B	35	C	36	D	38	D	40	C