INI CET Physiology

Sample Paper – 6

Duration: 14 Minutes **Maximum Marks: 15**

Instructions

- This paper contains **15** Multiple Choice Questions (Single Best Response), modelled on the Physiology content of **INI CET** (Institutes of National Importance Combined Entrance Test) conducted by AIIMS New Delhi.
- The **15-question** length matches the number of Physiology items you actually meet in the real 200-question paper.
- Each correct answer carries **+1 mark**. There is **negative marking of one-third (0.33) mark** for every incorrect answer; unattempted questions carry no penalty.
- Every question has **exactly one best answer**. Choose the single most appropriate option.
- Attempt this practice paper in one timed sitting of about **14 minutes**, the pace the real computer-based test demands.

General, Nerve and Muscle Physiology

Q1. The minimum stimulus current strength that, applied for an infinitely long duration, just excites a nerve fibre is termed the:

(A) Rheobase

(B) Chronaxie

(C) Utilization time

(D) Accommodation

Q2. Once a region of axon membrane has just fired an impulse, it briefly cannot be re-excited. This property is chiefly responsible for ensuring that the impulse travels in only one direction along the axon. It is called:

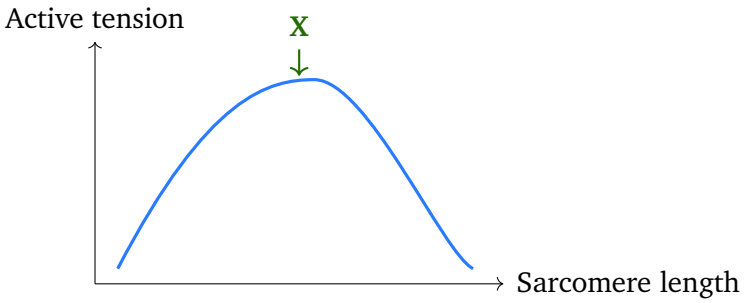
(A) Saltatory conduction

(B) The all-or-none law

(C) The refractory period of the recently excited membrane

(D) Temporal summation

Q3. The length-tension curve of skeletal muscle is shown below. The peak active tension marked **X** is generated at the sarcomere length that provides:



(A) Minimal overlap between actin and myosin filaments

(B) Optimal overlap of actin and myosin filaments, allowing maximal cross-bridge formation

(C) Excessive shortening with collision of the filaments

(D) Complete separation of the two filament sets

Blood and Body Fluids

Q4. During fibrinolysis, the fibrin meshwork of a clot is broken down and the clot dissolves. The active enzyme that directly digests fibrin is:

(A) Plasmin

(B) Thrombin

(C) Fibrinogen

(D) Factor XIII (fibrin-stabilising factor)

Q5. Which pairing correctly describes how iron is carried in the blood and how it is stored inside cells?

(A) Ferritin in plasma; transferrin in cells

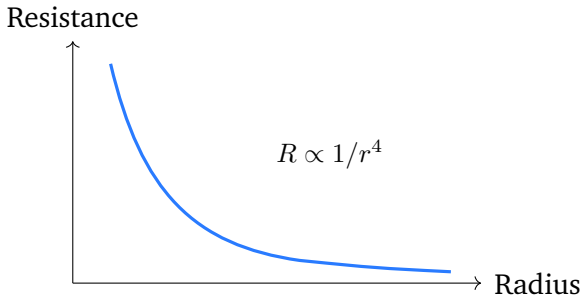
(B) Transferrin in plasma; ferritin in cells

(C) Haptoglobin in plasma; hemosiderin in cells

(D) Albumin in plasma; transferrin in cells

Cardiovascular System

Q6. The graph below shows how vascular resistance depends on vessel radius under Poiseuille's law, where resistance is inversely proportional to the fourth power of the radius. If the radius of a vessel falls to one-half of its original value, the resistance increases by a factor of:



(A) 2

(B) 4

(C) 8

(D) 16

Q7. A ventricle has an end-diastolic volume of 120 mL and an end-systolic volume of 48 mL. Taking ejection fraction as stroke volume divided by end-diastolic volume, the ejection fraction is:

(A) 40%

(B) 48%

(C) 72%

(D) 60%

Q8. The overall tone of the systemic blood vessels is set by a group of neurons that continuously adjust sympathetic outflow to vascular smooth muscle. This centre is located in the:

(A) Hypothalamus

(B) Vasomotor centre of the medulla oblongata

(C) Cerebellum

(D) Anterior pituitary gland

Respiratory System

Q9. Using the Bohr concept, the physiological dead space of the lung is best defined as:

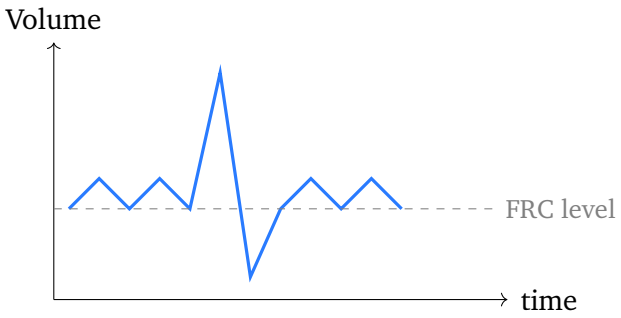
(A) The volume of air filling the conducting airways only

(B) The volume of gas in alveoli that are actively taking part in gas exchange

(C) The sum of the anatomical dead space and the alveolar dead space

(D) The residual volume left in the lungs after a maximal expiration

Q10. The spirogram below traces lung volume during quiet breathing and a maximal effort. The functional residual capacity (FRC), the volume remaining at the end of a normal expiration (dashed level), is the sum of which two volumes?



(A) Expiratory reserve volume + residual volume

(B) Tidal volume + inspiratory reserve volume

(C) Inspiratory reserve volume + tidal volume + expiratory reserve volume

(D) Tidal volume + residual volume

Renal System

Q11. In tubuloglomerular feedback, a rise in the sodium chloride concentration of the tubular fluid is detected by a specialised group of cells that then signal the afferent arteriole to constrict. These sensing cells are the:

(A) Glomerular podocytes

(B) Proximal tubule brush-border cells

(C) Juxtaglomerular granular cells alone

(D) Macula densa of the distal tubule

Q12. When the kidney senses a fall in tissue oxygen delivery (hypoxia), it increases secretion of a hormone that stimulates red blood cell production in the bone marrow. This hormone is:

(A) Erythropoietin

(B) Renin

(C) Antidiuretic hormone

(D) Aldosterone

Gastrointestinal, Endocrine and Neurophysiology

Q13. Bile salts assist the digestion of dietary fat in the small intestine. Their main physical action on the fat is to:

(A) Digest triglycerides directly into free fatty acids

(B) Emulsify dietary fat into much smaller droplets, greatly increasing the surface area for lipase

(C) Neutralise all of the acid arriving from the stomach

(D) Absorb water across the wall of the colon

Q14. Growth hormone promotes linear (long-bone) growth in children largely by an indirect route rather than acting on cartilage on its own. This is because it works mainly through:

(A) A direct action on bone with no chemical mediator

(B) Thyroxine released from the thyroid gland

(C) Insulin-like growth factor-1 (IGF-1) produced by the liver

(D) Cortisol from the adrenal cortex

Q15. Gamma motor neurons keep intrafusal fibres taut so that a stretch receptor stays sensitive to changes in muscle length even while the muscle shortens. The receptor whose sensitivity they set is the:

(A) Golgi tendon organ

(B) Pacinian corpuscle

(C) Muscle spindle (intrafusal fibres)

(D) Free nerve ending

Detailed Solutions

Q1.

Solution

Concept – strength-duration relationship: Excitability is described by how strength and duration of a stimulus trade off.

Step 1 – define the term: Rheobase is the minimum current strength that excites a fibre when applied for an infinitely long time.

Step 2 – contrast with chronaxie: Chronaxie is the shortest time a current of twice rheobase must flow to excite; it indexes excitability.

Why the other options are wrong:

- B, chronaxie: a duration measured at twice the rheobase, not the minimum strength.
- C, utilization time: the time needed at rheobase strength, not the strength itself.
- D, accommodation: the rise in threshold to a slowly increasing stimulus.

Final Answer: Rheobase $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q1

Q2.

Solution

Concept – one-way propagation of the impulse: The wave of excitation cannot re-invade membrane it has just left.

Step 1 – name the property: The **refractory period** of the recently excited membrane keeps that patch inexcitable for a short time.

Step 2 – the consequence: Because the region behind the impulse is refractory, the impulse can only move forward into unexcited membrane, giving unidirectional conduction.

Why the other options are wrong:

- A, saltatory conduction: speeds conduction in myelinated axons, it does not set direction.
- B, all-or-none law: describes spike size, not direction.
- D, temporal summation: adds subthreshold inputs over time at synapses.

Final Answer: The refractory period of the recently excited membrane ⇒ C

Answer: (C) Go Back to Q2

Q3.

Solution

Concept – the length-tension relationship: Active tension depends on how well the thin and thick filaments overlap.

Step 1 – read the curve: The peak **X** sits at the intermediate sarcomere length where the most cross-bridges can form.

Step 2 – explain the peak: At this optimal overlap every myosin head can reach an actin binding site, so active tension is maximal.

Why the other options are wrong:

- A, minimal overlap: too few cross-bridges, tension is low (the descending stretched limb).
- C, excessive shortening: filaments collide and interfere, tension falls (the ascending limb).
- D, complete separation: no cross-bridges at all, so no active tension.

Final Answer: Optimal overlap of actin and myosin filaments ⇒ B

Answer: (B) Go Back to Q3

Q4.

Solution

Concept – fibrinolysis: Clot removal is the mirror image of clot formation.

Step 1 – name the enzyme: Plasmin, formed from plasminogen, is the protease that digests the fibrin strands.

Step 2 – the outcome: Plasmin cleaves fibrin into fibrin degradation products, so the clot breaks down and blood flow is restored.

Why the other options are wrong:

- B, thrombin: makes fibrin, the opposite action.
- C, fibrinogen: the soluble precursor of fibrin, not an enzyme.
- D, Factor XIII: cross-links and stabilises fibrin, it does not dissolve it.

Final Answer: Plasmin ⇒ A

Answer: (A) Go Back to Q4

Q5.

Solution

Concept – iron transport and storage: Free iron is toxic, so it is always kept bound to proteins.

Step 1 – transport in blood: In plasma iron travels bound to **transferrin**, which delivers it to tissues.

Step 2 – storage in cells: Inside cells iron is stored within **ferritin**, releasing it as needed.

Why the other options are wrong:

- A: reverses the two proteins.
- C, haptoglobin: binds free haemoglobin, not the main iron carrier.
- D, albumin: a general plasma carrier, not the specific iron transporter.

Final Answer: Transferrin in plasma; ferritin in cells $\Rightarrow$ B

Answer: (B) Go Back to Q5

Q6.

Solution

Concept – Poiseuille's law: Resistance is inversely proportional to the fourth power of the radius.

Step 1 – write the ratio: If the radius becomes $r/2$, then $R \propto 1/(r/2)^4 = 1/(r^4/16) = 16/r^4$.

Step 2 – read the factor: The resistance is therefore **16 times** larger than before, which is why small radius changes have huge effects on flow.

Why the other options are wrong:

- A, 2: would apply if resistance varied with $1/r$.
- B, 4: would apply if resistance varied with $1/r^2$.
- C, 8: would apply if resistance varied with $1/r^3$.

Final Answer: $16 \Rightarrow$ D

Answer: (D) Go Back to Q6

Q7.

Solution

Concept – ejection fraction: Ejection fraction is the fraction of the filled ventricle that is pumped out each beat.

Step 1 – find the stroke volume: Stroke volume $=$ EDV $-$ ESV $= 120 - 48 = 72$ mL.

Step 2 – divide by EDV: Ejection fraction $= 72/120 = 0.60 =$ **60%**, a normal resting value.

Why the other options are wrong:

- A, 40%: this is ESV/EDV, the residual fraction, not the ejected fraction.
- B, 48%: simply the end-systolic volume in mL, not a fraction.
- C, 72%: this is the stroke volume in mL, not the ejection fraction.

Final Answer: 60% $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q7

Q8.

Solution

Concept – central control of vascular tone: A tonically active brainstem centre keeps blood vessels partially constricted.

Step 1 – locate the centre: The **vasomotor centre in the medulla oblongata** sends continuous sympathetic outflow to vascular smooth muscle.

Step 2 – how it works: Raising its activity constricts vessels and increases resistance; lowering it dilates them, so it fine-tunes blood pressure.

Why the other options are wrong:

- A, hypothalamus: influences temperature and long-term set points, not the moment-to-moment vasomotor tone.
- C, cerebellum: coordinates movement, not vascular tone.
- D, anterior pituitary: an endocrine gland, not a vasomotor control centre.

Final Answer: Vasomotor centre of the medulla oblongata $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q8

Q9.

Solution

Concept – physiological dead space: Dead space is ventilated air that does not take part in gas exchange.

Step 1 – recall the two parts: Anatomical dead space is the conducting airways; alveolar dead space is ventilated alveoli that are poorly perfused.

Step 2 – combine them: The Bohr concept defines **physiological dead space** as the sum of the anatomical and the alveolar dead space.

Why the other options are wrong:

- A, conducting airways only: this is the anatomical dead space, only one component.
- B, alveoli exchanging gas: these are the opposite of dead space.
- D, residual volume: gas trapped after full expiration, unrelated to dead space.

Final Answer: The sum of anatomical and alveolar dead space $\Rightarrow$ C

Answer: (C) Go Back to Q9

Q10.

Solution

Concept – functional residual capacity: FRC is the air left in the lungs at the end of a quiet, normal expiration (the dashed level).

Step 1 – identify the components: From that resting level you can still breathe out the expiratory reserve volume, and below that lies the residual volume.

Step 2 – add them: FRC = **expiratory reserve volume** + **residual volume**.

Why the other options are wrong:

- B, TV + IRV: these lie above the resting level, not within FRC.
- C, IRV + TV + ERV: this is the vital capacity, the maximal usable volume.
- D, TV + RV: mixes a breath above the line with the residual below, not the FRC definition.

Final Answer: Expiratory reserve volume + residual volume $\Rightarrow$ A

Answer: (A) Go Back to Q10

Q11.

Solution

Concept – tubuloglomerular feedback: The nephron senses its own distal salt delivery and adjusts filtration.

Step 1 – name the sensor: The **macula densa**, a plaque of cells in the distal tubule wall, detects the tubular NaCl concentration.

Step 2 – the response: When distal NaCl rises, the macula densa signals the afferent arteriole to constrict, lowering the filtration rate back toward normal.

Why the other options are wrong:

- A, podocytes: form the filtration slits, they do not sense NaCl.
- B, proximal brush border: absorbs solutes, it is not the feedback sensor.
- C, granular cells alone: they release renin in response to the macula densa signal, but the sensing itself is by the macula densa.

Final Answer: Macula densa of the distal tubule $\Rightarrow$ D

Answer: (D) Go Back to Q11

Q12.

Solution

Concept – the kidney as an oxygen sensor: Peritubular cells respond to low oxygen by making a red-cell growth signal.

Step 1 – name the hormone: Hypoxia stimulates renal release of **erythropoietin**.

Step 2 – the effect: Erythropoietin acts on the bone marrow to increase red cell production, raising oxygen-carrying capacity.

Why the other options are wrong:

- B, renin: controls blood pressure and sodium via angiotensin, not red cell number.
- C, antidiuretic hormone: regulates water retention.
- D, aldosterone: an adrenal hormone acting on sodium and potassium.

Final Answer: Erythropoietin $\Rightarrow$ A

Answer: (A) Go Back to Q12

Q13.

Solution

Concept – bile salts and fat digestion: Bile salts are amphipathic and act at the fat-water interface.

Step 1 – describe the action: They **emulsify** large fat globules, breaking them into many tiny droplets.

Step 2 – why it matters: Emulsification hugely increases the surface area on which pancreatic lipase can act, speeding fat digestion.

Why the other options are wrong:

- A, digest triglycerides directly: that is the job of lipase, an enzyme, not bile salts.
- C, neutralise acid: that is done by pancreatic bicarbonate.
- D, absorb water in the colon: unrelated to bile-salt action on fat.

Final Answer: Emulsify dietary fat into smaller droplets $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q13

Q14.

Solution

Concept – growth hormone and linear growth: Much of growth hormone's effect on bone is indirect.

Step 1 – name the mediator: Growth hormone drives the liver to release **insulin-like growth factor-1 (IGF-1)**.

Step 2 – the effect: IGF-1 stimulates the epiphyseal growth plates, producing the linear growth of long bones.

Why the other options are wrong:

- A, direct action with no mediator: the major growth effect is mediated by IGF-1, not purely direct.
- B, thyroxine: permits normal growth but is not the mediator of growth hormone's action.
- D, cortisol: in excess it actually suppresses growth.

Final Answer: Through insulin-like growth factor-1 (IGF-1) $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q14

Q15.

Solution

Concept – the muscle spindle and gamma loop: The spindle reports muscle length, and gamma neurons keep it responsive.

Step 1 – identify the receptor: Gamma motor neurons contract the intrafusal fibres of the **muscle spindle**.

Step 2 – the effect: By keeping the intrafusal fibres taut as the whole muscle shortens, they preserve the spindle's sensitivity to further stretch.

Why the other options are wrong:

- A, Golgi tendon organ: senses tension in the tendon, and has no gamma innervation.
- B, Pacinian corpuscle: detects vibration and pressure in skin and joints.
- D, free nerve ending: mediates pain and temperature, not length.

Final Answer: Muscle spindle (intrafusal fibres) $\Rightarrow$ C

Answer: (C) Go Back to Q15

Answer Key

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