INI CET Physiology

Sample Paper – 8

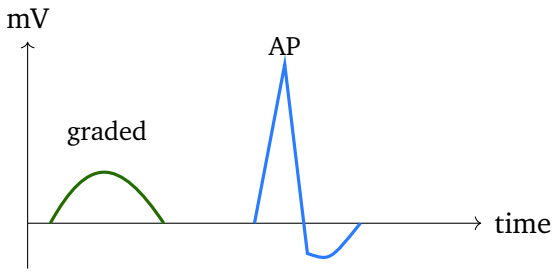
Duration: 14 Minutes **Maximum Marks: 15**

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 figure contrasts a small membrane response with a large spike. Which statement correctly distinguishes a graded (local) potential from a propagated action potential?



(A) A graded potential is all-or-none, while an action potential is not

(B) Both spread over long distances without any loss of amplitude

(C) A graded potential varies in amplitude with stimulus strength, whereas an action potential is all-or-none

(D) An action potential decays within a short distance, but a graded potential does not

Q2. Transmission at the skeletal neuromuscular junction is normally terminated by which of the following events?

(A) Active reuptake of intact acetylcholine into the motor nerve terminal

(B) Rapid diffusion of acetylcholine away into the bloodstream

(C) Hydrolysis of acetylcholine by acetylcholinesterase in the synaptic cleft

(D) Irreversible binding of acetylcholine to the nicotinic receptor

Q3. During a purely isometric muscle contraction:

(A) the muscle shortens while its tension stays constant

(B) muscle tension increases but the muscle length does not change

(C) the muscle lengthens as it is stretched by the load

(D) external work equals force multiplied by the distance moved

Blood and Body Fluids

Q4. Normal adult haemoglobin (HbA) is a tetramer made up of:

(A) two alpha and two beta globin chains

(B) two alpha and two gamma globin chains

(C) four identical alpha globin chains

(D) two beta and two delta globin chains

Q5. Primary haemostasis is best described as:

(A) cross-linking of fibrin strands by activated factor XIII

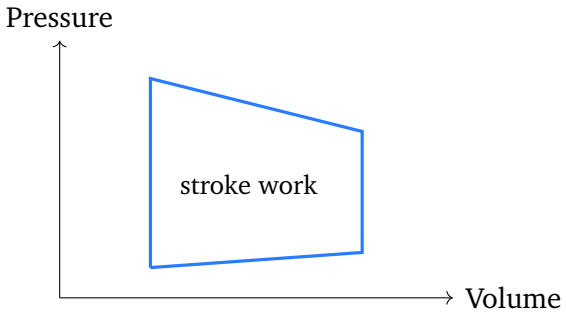
(B) formation of a platelet plug by platelet adhesion and aggregation

(C) activation of the coagulation cascade to generate fibrin

(D) clot retraction followed by fibrinolysis

Cardiovascular System

Q6. In the left-ventricular pressure-volume loop shown, the area enclosed by the loop represents:



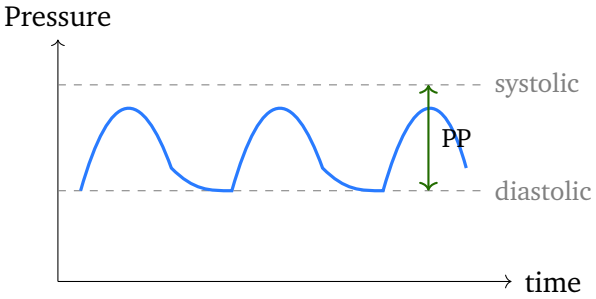
(A) the stroke work performed by the left ventricle

(B) the resting membrane potential of the myocyte

(C) the total peripheral resistance

(D) the ejection fraction

Q7. The arterial pressure trace below marks a value **PP**. Pulse pressure is correctly calculated as:



(A) (systolic pressure + 2 × diastolic pressure) / 3

(B) systolic pressure plus diastolic pressure

(C) systolic pressure minus diastolic pressure

(D) cardiac output multiplied by peripheral resistance

Q8. A marked, sustained tachycardia can reduce left-ventricular coronary blood flow mainly because:

(A) systole lengthens and compresses the coronary vessels continuously

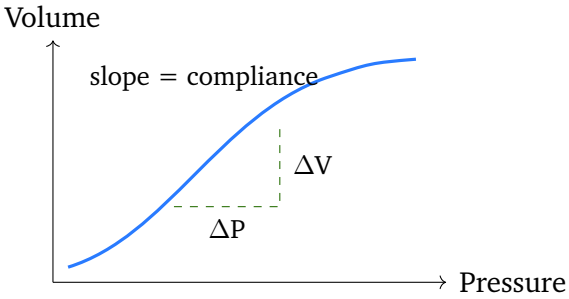
(B) aortic pressure falls to zero throughout systole

(C) diastole is shortened, cutting the time available for left coronary perfusion

(D) the coronary arteries constrict in response to increased venous return

Respiratory System

Q9. The volume-pressure curve below describes the lung. Lung compliance is defined as:



(A) the change in lung volume per unit change in transpulmonary pressure

(B) the change in distending pressure per unit change in lung volume

(C) the pressure needed to overcome airway resistance

(D) the volume of air remaining after a maximal expiration

Q10. The central chemoreceptors that regulate ventilation lie in the medulla and respond most directly to:

(A) the arterial oxygen tension

(B) arterial pH sensed at the carotid body

(C) plasma bicarbonate sensed at the aortic bodies

(D) the hydrogen ion concentration of the cerebrospinal fluid

Renal System

Q11. For acid-base balance, the great majority of filtered bicarbonate is reabsorbed in the:

(A) distal convoluted tubule

(B) proximal convoluted tubule

(C) thin descending limb of the loop of Henle

(D) cortical collecting duct

Q12. Autoregulation keeps the glomerular filtration rate nearly constant over a range of arterial pressures. It depends mainly on:

(A) antidiuretic hormone acting on the collecting duct

(B) changes in plasma oncotic pressure alone

(C) sympathetic constriction of the efferent arteriole alone

(D) the myogenic response together with tubuloglomerular feedback

Gastrointestinal, Endocrine and Neurophysiology

Q13. Which set of digestive enzymes is secreted by the exocrine pancreas?

(A) pepsin, gastric lipase and intrinsic factor

(B) trypsin, pancreatic lipase and pancreatic amylase

(C) salivary amylase, lysozyme and mucin

(D) brush-border lactase, sucrase and maltase

Q14. The adrenal medulla secretes which pair of hormones directly into the blood?

(A) adrenaline and noradrenaline (catecholamines)

(B) cortisol and aldosterone

(C) insulin and glucagon

(D) thyroxine and calcitonin

Q15. Regarding the transmitters released by autonomic postganglionic fibres at most target organs:

(A) both divisions release acetylcholine at their target organs

(B) the sympathetic division releases acetylcholine and the parasympathetic releases noradrenaline

(C) both divisions release noradrenaline at their target organs

(D) most sympathetic fibres release noradrenaline, whereas parasympathetic fibres release acetylcholine

Detailed Solutions

Q1.

Solution

Concept – graded potentials versus action potentials: The two signals differ in how amplitude relates to stimulus and how far they travel.

Step 1 – describe the graded potential: Its size **varies with stimulus strength** and it fades over a short distance (decremental).

Step 2 – describe the action potential: It is **all-or-none**, a fixed amplitude once threshold is reached, and it propagates without decrement.

Why the other options are wrong:

- A: reverses the two; the action potential, not the graded potential, is all-or-none.
- B: graded potentials do lose amplitude with distance, so they do not spread far.
- D: the action potential propagates without decay; the graded potential is the decremental one.

Final Answer: A graded potential varies with stimulus strength, whereas an AP is all-or-none $\Rightarrow$ C

Answer: (C) Go Back to Q1

Q2.

Solution

Concept – ending neuromuscular transmission: The signal must be switched off quickly so the muscle can respond to the next impulse.

Step 1 – name the mechanism: Acetylcholinesterase in the synaptic cleft rapidly hydrolyses acetylcholine into choline and acetate.

Step 2 – the consequence: Transmitter action stops within milliseconds, and the choline is recycled back into the nerve terminal.

Why the other options are wrong:

- A: intact acetylcholine is not taken back up; only choline is recaptured after hydrolysis.
- B: diffusion into blood is far too slow to end fast transmission.
- D: binding is brief and reversible, not irreversible.

Final Answer: Hydrolysis by acetylcholinesterase in the cleft $\Rightarrow$ C

Answer: (C) Go Back to Q2

Q3.

Solution

Concept – isometric contraction: "Isometric" means same length.

Step 1 – define it: The muscle develops **tension** while its overall **length stays constant**, for example pushing against an immovable wall.

Step 2 – contrast with isotonic: In an isotonic contraction the muscle shortens at a roughly constant load and does external work.

Why the other options are wrong:

- A: shortening at constant tension is isotonic, not isometric.
- C: lengthening under load is an eccentric contraction.
- D: force times distance is external work, which is zero when length does not change.

Final Answer: Tension rises but muscle length does not change $\Rightarrow$ B

Answer: (B) Go Back to Q3

Q4.

Solution

Concept – structure of adult haemoglobin: Each haemoglobin molecule is a tetramer of globin chains, each carrying a haem group.

Step 1 – state the composition: HbA is made of **two alpha and two beta** globin chains ($\alpha_2\beta_2$).

Step 2 – link to function: The four subunits give cooperative oxygen binding and the sigmoid dissociation curve.

Why the other options are wrong:

- B: two alpha and two gamma chains is fetal haemoglobin (HbF).
- C: four alpha chains is not a normal functional haemoglobin.
- D: two alpha and two delta chains form the minor HbA2; the option even omits the alpha chains.

Final Answer: Two alpha and two beta chains $\Rightarrow$ A

Answer: (A) Go Back to Q4

Q5.

Solution

Concept – primary versus secondary haemostasis: Primary haemostasis is the immediate platelet response; secondary haemostasis is the clotting cascade.

Step 1 – define primary haemostasis: Platelets adhere to exposed collagen and aggregate to form a **platelet plug**.

Step 2 – contrast secondary haemostasis: The coagulation cascade then generates fibrin, which stabilises and reinforces the plug.

Why the other options are wrong:

- A: fibrin cross-linking by factor XIII is a late step of secondary haemostasis.
- C: activating the cascade to make fibrin is secondary haemostasis.
- D: clot retraction and fibrinolysis occur after the clot is already formed.

Final Answer: Formation of the platelet plug $\Rightarrow$ B

Answer: (B) Go Back to Q5

Q6.

Solution

Concept – the pressure-volume loop: One cardiac cycle traces a closed loop of ventricular pressure against volume.

Step 1 – identify the enclosed area: The area inside the loop equals the **stroke work** done by the left ventricle in that beat.

Step 2 – read the loop: Filling runs along the bottom, isovolumetric contraction up the right, ejection across the top, and relaxation down the left.

Why the other options are wrong:

- B: the resting membrane potential is an electrical value, not a mechanical area.
- C: peripheral resistance is not represented by the loop area.
- D: ejection fraction is a ratio of volumes, not the enclosed work.

Final Answer: The stroke work of the ventricle $\Rightarrow$ A

Answer: (A) Go Back to Q6

Q7.

Solution

Concept – pulse pressure: It is the swing of arterial pressure across one beat.

Step 1 – give the formula: Pulse pressure $=$ **systolic pressure** $-$ **diastolic pressure**.

Step 2 – worked value: For 120 over 80 mmHg, pulse pressure $= 120 - 80 = 40$ mmHg, the double arrow marked PP.

Why the other options are wrong:

- A: (systolic $+$ 2 diastolic)$/3$ is the mean arterial pressure.
- B: adding the two pressures has no physiological meaning here.
- D: cardiac output times resistance gives mean arterial pressure, not pulse pressure.

Final Answer: Systolic minus diastolic pressure $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q7

Q8.

Solution

Concept – timing of coronary perfusion: Blood flow to the left ventricular wall happens mainly during diastole, because systolic compression squeezes those vessels shut.

Step 1 – link rate to diastole: As heart rate rises, **diastole shortens** much more than systole does.

Step 2 – the effect: Less diastolic time means less time for left coronary perfusion, so myocardial flow can fall.

Why the other options are wrong:

- A: systole shortens too and does not compress continuously; flow returns each diastole.
- B: aortic pressure stays high in systole, it does not fall to zero.
- D: increased venous return does not directly constrict the coronaries here.

Final Answer: Diastole shortens, reducing coronary perfusion time $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q8

Q9.

Solution

Concept – lung compliance: Compliance measures how easily the lung stretches.

Step 1 – give the definition: Compliance = **change in volume per unit change in transpulmonary (distending) pressure**, the slope of the volume-pressure curve.

Step 2 – interpret it: A steeper slope means a more compliant, easily inflated lung; a flat slope means a stiff lung.

Why the other options are wrong:

- B: change in pressure per change in volume is elastance, the inverse of compliance.
- C: pressure to overcome airway resistance is a flow-resistive property, not compliance.
- D: air remaining after maximal expiration is the residual volume.

Final Answer: Change in volume per unit change in transpulmonary pressure $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q9

Q10.

Solution

Concept – location and stimulus of central chemoreceptors: These receptors sit near the ventral surface of the medulla, bathed by cerebrospinal fluid.

Step 1 – name the direct stimulus: They respond to the **hydrogen ion concentration of the CSF**.

Step 2 – the pathway: CO_2 crosses the blood-brain barrier, forms carbonic acid in CSF and raises H^+, which the medullary receptors detect.

Why the other options are wrong:

- A: oxygen tension is sensed by peripheral, not central, chemoreceptors.
- B: the carotid body is a peripheral receptor, not the medullary central one.
- C: aortic bodies are peripheral and do not sense CSF bicarbonate.

Final Answer: Hydrogen ions in the cerebrospinal fluid $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q10

Q11.

Solution

Concept – bicarbonate reabsorption: Reclaiming filtered bicarbonate is essential to prevent metabolic acidosis.

Step 1 – name the site: About 80 to 90 percent of filtered bicarbonate is reabsorbed in the **proximal convoluted tubule**.

Step 2 – the mechanism: H^+ secreted via the Na^+/H^+ exchanger combines with filtered HCO_3^-; carbonic anhydrase then drives its reclamation.

Why the other options are wrong:

- A: the distal tubule fine-tunes acid excretion but reabsorbs little bicarbonate.
- C: the thin descending limb is permeable to water, not the main bicarbonate site.
- D: the collecting duct handles the small remaining fraction and new bicarbonate generation.

Final Answer: Proximal convoluted tubule $\Rightarrow$ $\boxed{B}$

Answer: (B) Go Back to Q11

Q12.

Solution

Concept – autoregulation of GFR: The kidney holds filtration steady despite swings in arterial pressure using intrinsic mechanisms.

Step 1 – name the two mechanisms: The **myogenic response** and **tubuloglomerular feedback** adjust afferent arteriolar tone together.

Step 2 – how they act: A pressure rise stretches and constricts the afferent arteriole (myogenic); the macula densa senses the resulting NaCl load and signals constriction (feedback).

Why the other options are wrong:

- A: ADH controls water reabsorption, not GFR autoregulation.
- B: oncotic pressure changes are not the autoregulatory driver.
- C: efferent sympathetic constriction alone does not provide the steady autoregulation.

Final Answer: Myogenic response plus tubuloglomerular feedback $\Rightarrow$ $\boxed{D}$

Answer: (D) Go Back to Q12

Q13.

Solution

Concept – pancreatic digestive enzymes: The exocrine pancreas secretes enzymes for all three major nutrient classes.

Step 1 – list them: Trypsin (protein), **pancreatic lipase** (fat) and **pancreatic amylase** (starch) are all pancreatic.

Step 2 – note activation: Trypsin is secreted as trypsinogen and activated by enterokinase in the duodenum.

Why the other options are wrong:

- A: pepsin, gastric lipase and intrinsic factor come from the stomach.
- C: salivary amylase, lysozyme and mucin are salivary secretions.
- D: lactase, sucrase and maltase are brush-border enzymes of the small intestine.

Final Answer: Trypsin, lipase and amylase $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q13

Q14.

Solution

Concept – adrenal medullary hormones: The medulla acts like a modified sympathetic ganglion.

Step 1 – name the hormones: It secretes the catecholamines **adrenaline and noradrenaline** (roughly 80 percent adrenaline).

Step 2 – the trigger: Preganglionic sympathetic fibres release acetylcholine onto the chromaffin cells, driving catecholamine release into the blood.

Why the other options are wrong:

- B: cortisol and aldosterone are from the adrenal cortex.
- C: insulin and glucagon are pancreatic islet hormones.
- D: thyroxine and calcitonin are thyroid hormones.

Final Answer: Adrenaline and noradrenaline $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q14

Q15.

Solution

Concept – autonomic postganglionic transmitters: The two divisions differ in the transmitter their postganglionic fibres release at the target organ.

Step 1 – state the rule: Most **sympathetic** postganglionic fibres release **noradrenaline**, while **parasympathetic** fibres release **acetylcholine**.

Step 2 – note the exception: Sympathetic fibres to sweat glands are cholinergic, but the general pattern is adrenergic sympathetic, cholinergic parasympathetic.

Why the other options are wrong:

- A: only the parasympathetic target release is cholinergic, not both.
- B: this reverses the two divisions.
- C: the parasympathetic target release is acetylcholine, not noradrenaline.

Final Answer: Sympathetic noradrenaline, parasympathetic acetylcholine $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q15

Answer Key

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