INI CET Physiology

Sample Paper – 1

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 resting membrane potential of a typical mammalian neuron is closest to:

(A) -90 mV

(B) 0 mV

(C) -70 mV

(D) $+30$ mV

Q2. During the rapid depolarising (rising) phase of the neuronal action potential, the membrane becomes highly permeable to which ion?

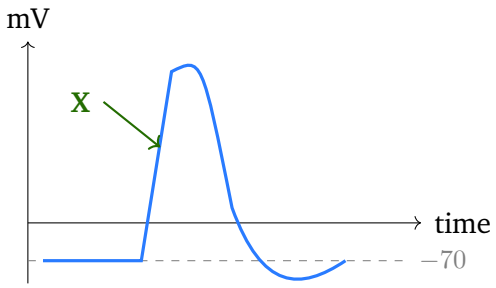
(A) Sodium (Na^{+})

(B) Potassium (K^+)

(C) Chloride (Cl^-)

(D) Calcium (Ca^{2+})

Q3. In the neuronal action potential trace below, the rapid upstroke marked **X** is produced by:



(A) Opening of voltage-gated potassium channels

(B) Closure of sodium channels

(C) Opening of voltage-gated sodium channels

(D) Activation of the sodium-potassium pump

Blood and Body Fluids

Q4. Which blood group is described as the “universal recipient”?

(A) AB positive

(B) O negative

(C) A positive

(D) O positive

Q5. The intrinsic and extrinsic coagulation pathways converge on the activation of which clotting factor?

(A) Factor VII

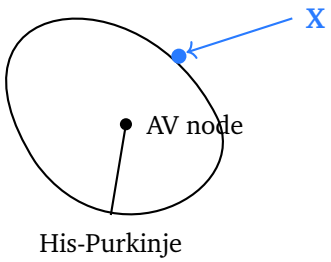
(B) Factor X

(C) Factor XII

(D) Fibrinogen

Cardiovascular System

Q6. In the schematic of the cardiac conduction system below, the structure with the fastest intrinsic rate, which normally paces the heart, is marked **X**. It is the:



(A) Atrioventricular (AV) node

(B) Bundle of His

(C) Purkinje fibres

(D) Sinoatrial (SA) node

Q7. The dicrotic notch (incisura) seen on the aortic pressure curve is produced by:

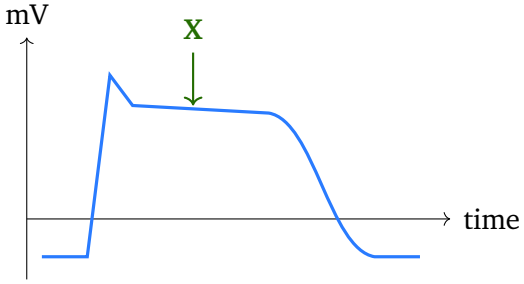
(A) Opening of the aortic valve

(B) Closure of the aortic valve

(C) Contraction of the atria

(D) Closure of the mitral valve

Q8. In the ventricular myocyte action potential shown, the sustained plateau marked **X** (phase 2) is mainly due to:



(A) Rapid sodium influx

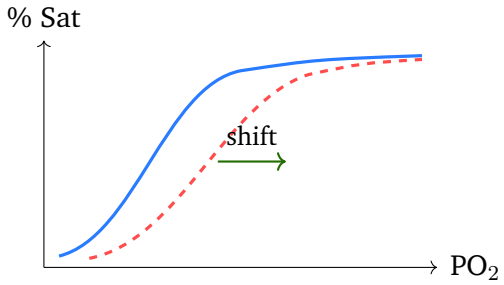
(B) Potassium efflux alone

(C) Chloride influx

(D) Calcium influx through L-type calcium channels

Respiratory System

Q9. The dashed curve in the figure shows a **rightward** shift of the oxygen-haemoglobin dissociation curve. Which change produces this shift?



(A) Decreased temperature

(B) Increased pH (alkalosis)

(C) Increased 2,3-bisphosphoglycerate (2,3-BPG)

(D) Decreased PCO_2

Q10. The main chemical stimulus that drives normal resting ventilation, acting on the central chemoreceptors, is:

(A) A rise in arterial PCO_2

(B) A fall in arterial PO_2

(C) A rise in arterial pH

(D) A fall in body temperature

Renal System

Q11. Which substance is used to measure the glomerular filtration rate because it is freely filtered but neither reabsorbed nor secreted by the tubules?

(A) Glucose

(B) Para-aminohippuric acid (PAH)

(C) Inulin

(D) Sodium

Q12. Which hormone increases water reabsorption by inserting aquaporin-2 channels into the apical membrane of the collecting duct?

(A) Aldosterone

(B) Atrial natriuretic peptide

(C) Renin

(D) Antidiuretic hormone (vasopressin)

Gastrointestinal, Endocrine and Neurophysiology

Q13. Gastric parietal cells secrete hydrochloric acid into the lumen using which pump on their apical (canalicular) membrane?

(A) H^+/K^+ ATPase (proton pump)

(B) Na^+/K^+ ATPase

(C) Na^+/glucose cotransporter

(D) Ca^{2+} ATPase

Q14. The hormone secreted by the thyroid parafollicular (C) cells that lowers plasma calcium is:

(A) Parathyroid hormone

(B) Calcitonin

(C) Thyroxine

(D) Cortisol

Q15. The neurotransmitter released at the neuromuscular junction, which acts on nicotinic receptors of the motor end plate, is:

(A) Noradrenaline

(B) Acetylcholine

(C) Dopamine

(D) Gamma-aminobutyric acid (GABA)

Detailed Solutions

Q1.

Solution

Concept – resting membrane potential: It is set mainly by the potassium equilibrium potential and the Na-K pump.

Step 1 – recall the value: A typical neuron rests near -70 **mV**, inside negative relative to outside.

Step 2 – why: The membrane is most permeable to K^+ at rest, so the potential sits close to the K^+ equilibrium.

Why the other options are wrong:

- A, -90 mV: closer to a cardiac or skeletal muscle fibre, not a neuron.
- B, 0 mV: no net polarisation, not physiological at rest.
- D, $+30$ mV: the peak of the action potential, not rest.

Final Answer: -70 mV $\Rightarrow$ C

Answer: (C) Go Back to Q1

Q2.

Solution

Concept – depolarisation: The upstroke is driven by an inward positive current.

Step 1 – name the ion: Voltage-gated **sodium (Na^+)** channels open, and Na^+ rushes in.

Step 2 – the effect: The inward Na^+ current makes the inside rapidly less negative, then positive.

Why the other options are wrong:

- B, K^+: its efflux repolarises, it does not depolarise.
- C, Cl^-: contributes to inhibition, not the upstroke.
- D, Ca^{2+}: important in cardiac and synaptic events, not the neuronal upstroke.

Final Answer: Sodium (Na^+) $\Rightarrow$ A

Answer: (A) Go Back to Q2

Q3.

Solution

Concept – reading the action potential trace: The label **X** sits on the steep upstroke.

Step 1 – identify the event: The upstroke is the **opening of voltage-gated sodium channels**.

Step 2 – confirm: Na^+ influx sharply depolarises the membrane toward $+30$ mV.

Why the other options are wrong:

- A, K^+ channels: these open later, for repolarisation.
- B, closure of Na channels: ends the upstroke, does not cause it.
- D, the Na-K pump: restores gradients slowly, it does not shape the spike.

Final Answer: Opening of voltage-gated sodium channels $\Rightarrow$ $\boxed{C}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept – ABO compatibility: The recipient must lack antibodies against the donor antigens.

Step 1 – identify the recipient: AB positive has A, B and Rh antigens but no anti-A or anti-B antibodies, so it accepts all groups.

Step 2 – contrast: O negative is the universal *donor*, the opposite idea.

Why the other options are wrong:

- B, O negative: universal donor, not recipient.
- C and D, A positive and O positive: carry antibodies that limit which blood they can receive.

Final Answer: AB positive $\Rightarrow$ $\boxed{A}$

Answer: (A) Go Back to Q4

Q5.

Solution

Concept – coagulation cascade: Two pathways feed into a shared common pathway.

Step 1 – name the convergence point: Both the intrinsic and extrinsic pathways activate **Factor X**, starting the common pathway.

Step 2 – what follows: Factor Xa converts prothrombin to thrombin, which turns fibrinogen into fibrin.

Why the other options are wrong:

- A, Factor VII: belongs to the extrinsic pathway only.
- C, Factor XII: starts the intrinsic pathway only.
- D, Fibrinogen: acted on later, downstream of the convergence.

Final Answer: Factor X $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q5

Q6.

Solution

Concept – cardiac pacemaker hierarchy: The fastest intrinsic rate sets the rhythm.

Step 1 – identify X: The **sinoatrial (SA) node**, firing about 60 to 100 per minute, is the normal pacemaker.

Step 2 – the hierarchy: Slower sites (AV node, His-Purkinje) take over only if the SA node fails.

Why the other options are wrong:

- A, AV node: about 40 to 60 per minute, an escape pacemaker.
- B and C, His and Purkinje: 20 to 40 per minute, even slower.

Final Answer: Sinoatrial (SA) node $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q6

Q7.

Solution

Concept – the dicrotic notch: It is a brief pressure blip on the falling aortic curve.

Step 1 – name the cause: It marks **closure of the aortic valve** at the start of diastole.

Step 2 – mechanism: Backflow briefly bounces off the closing cusps, raising aortic pressure momentarily.

Why the other options are wrong:

- A, aortic valve opening: begins ejection, not the notch.
- C, atrial contraction: gives the atrial "a" wave, not the notch.
- D, mitral valve closure: produces the first heart sound, on the venous/ventricular side.

Final Answer: Closure of the aortic valve $\Rightarrow$ $\boxed{B}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept – ventricular action potential plateau: Phase 2 balances inward and outward currents.

Step 1 – name the current: The plateau is maintained by **Ca^{2+} influx through L-type calcium channels**, offsetting K^+ efflux.

Step 2 – significance: This long plateau gives the long refractory period that prevents tetany of the heart.

Why the other options are wrong:

- A, Na^+ influx: causes phase 0, the upstroke.
- B, K^+ efflux alone: causes repolarisation (phase 3), not the plateau.
- C, Cl^- influx: not the main plateau current.

Final Answer: Calcium influx through L-type channels $\Rightarrow$ $\boxed{D}$

Answer: (D) Go Back to Q8

Q9.

Solution

Concept – oxygen dissociation curve shifts: A right shift means haemoglobin releases oxygen more easily (lower affinity).

Step 1 – list right-shifters: Increased CO_2, increased temperature, decreased pH and **increased 2,3-BPG** all shift the curve right.

Step 2 – match the option: Only increased 2,3-BPG appears; it lowers Hb affinity, aiding tissue oxygen delivery.

Why the other options are wrong:

- A, decreased temperature: shifts left.
- B, increased pH: alkalosis shifts left (Bohr effect).
- D, decreased PCO_2: shifts left.

Final Answer: Increased 2,3-BPG $\Rightarrow$ C

Answer: (C) Go Back to Q9

Q10.

Solution

Concept – control of ventilation: Central chemoreceptors respond to CSF acidity.

Step 1 – name the stimulus: A **rise in arterial PCO_2** raises CSF H^+ and is the dominant drive for resting ventilation.

Step 2 – contrast the hypoxic drive: Low PO_2 acts on peripheral chemoreceptors and matters mainly in chronic hypoxia.

Why the other options are wrong:

- B, low PO_2: a peripheral, secondary drive at rest.
- C, high pH: would reduce, not drive, ventilation.
- D, low temperature: not a primary ventilatory stimulus.

Final Answer: A rise in arterial PCO_2 $\Rightarrow$ A

Answer: (A) Go Back to Q10

Q11.

Solution

Concept – the ideal GFR marker: It must be filtered but not handled by the tubules.

Step 1 – name it: Inulin is freely filtered and neither reabsorbed nor secreted, so its clearance equals GFR.

Step 2 – contrast PAH: PAH is filtered and secreted, so it measures renal plasma flow instead.

Why the other options are wrong:

- A, glucose: fully reabsorbed, clearance near zero.
- B, PAH: measures renal plasma flow.
- D, sodium: heavily reabsorbed and regulated.

Final Answer: Inulin $\Rightarrow$ C

Answer: (C) Go Back to Q11

Q12.

Solution

Concept – water handling in the collecting duct: Aquaporin-2 insertion is hormonally controlled.

Step 1 – name the hormone: Antidiuretic hormone (vasopressin) inserts aquaporin-2 channels, raising water reabsorption.

Step 2 – the result: Urine becomes concentrated and plasma osmolality falls back toward normal.

Why the other options are wrong:

- A, aldosterone: acts on Na^+ and K^+, not directly on aquaporins.
- B, ANP: promotes sodium and water loss.
- C, renin: an enzyme starting the angiotensin cascade, not a direct water channel signal.

Final Answer: Antidiuretic hormone (vasopressin) $\Rightarrow$ D

Answer: (D) Go Back to Q12

Q13.

Solution

Concept – gastric acid secretion: Parietal cells pump protons against a steep gradient.

Step 1 – name the pump: The apical **H^+/K^+ ATPase (proton pump)** secretes H^+ in exchange for K^+.

Step 2 – clinical link: Proton pump inhibitors block this enzyme to reduce acid.

Why the other options are wrong:

- B, Na^+/K^+ ATPase: basolateral, maintains cell gradients.
- C, Na^+/glucose cotransporter: intestinal absorption, not acid.
- D, Ca^{2+} ATPase: handles calcium, not acid secretion.

Final Answer: H^+/K^+ ATPase $\Rightarrow$ $\boxed{A}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept – calcium-lowering hormone: One thyroid cell type opposes parathyroid hormone.

Step 1 – name it: Calcitonin, from parafollicular (C) cells, lowers plasma calcium.

Step 2 – mechanism: It inhibits osteoclasts and reduces bone resorption.

Why the other options are wrong:

- A, parathyroid hormone: raises calcium, the opposite action.
- C, thyroxine: sets metabolic rate, not calcium.
- D, cortisol: a glucocorticoid, not a calcium regulator here.

Final Answer: Calcitonin $\Rightarrow$ $\boxed{B}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept – neuromuscular transmission: The motor nerve uses one classic transmitter.

Step 1 – name it: Acetylcholine is released and binds nicotinic receptors on the motor end plate.

Step 2 – the effect: This opens cation channels, depolarises the end plate and triggers muscle contraction.

Why the other options are wrong:

- A, noradrenaline: a sympathetic transmitter, not at the skeletal NMJ.
- C, dopamine: central, in basal ganglia pathways.
- D, GABA: an inhibitory central transmitter.

Final Answer: Acetylcholine $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q15

Answer Key

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