

# KATTAR NEET 2026

## Zoology By Samapti Sinha Ma'am

### Body Fluids and Circulation

- Q1** A patient presents with recurrent nosebleeds (epistaxis) and prolonged bleeding after minor injuries. Laboratory tests reveal normal red blood cell and white blood cell counts, but an elevated bleeding time. Based on the symptoms and findings, which of the following is most likely affected in this patient?
- (A) Platelet count
  - (B) Hematocrit
  - (C) Mean corpuscular volume (MCV)
  - (D) Reticulocyte count
- Q2** In an isolated heart experiment, the heart is supplied with a solution containing a higher concentration of calcium ions. If all other factors remain unchanged, what will most likely happen to the heart's pumping action?
- (A) Increased heart rate
  - (B) Increased stroke volume
  - (C) Decreased heart rate
  - (D) Decreased stroke volume
- Q3** In a scenario where an individual experiences a sudden drop in blood pressure, which of the following autonomic nervous system responses would be most critical for rapidly restoring blood pressure homeostasis?
- (A) Increased parasympathetic activity to the heart
  - (B) Decreased sympathetic activity to the peripheral vasculature
  - (C) Increased sympathetic activity to the heart and peripheral vasculature
  - (D) Increased parasympathetic activity to the sinoatrial node
- Q4** Which of the following statements correctly links an electrocardiogram (ECG) feature to its corresponding mechanical action within the heart?
- (A) Atrial contraction begins immediately following the QRS complex on the ECG.
  - (B) Ventricular contraction is initiated by the electrical activity represented by the P-wave.
  - (C) The mechanical pumping of blood from the ventricles occurs shortly after the appearance of the QRS complex on the ECG.
  - (D) The relaxation of the ventricles (ventricular diastole) is directly triggered by the T-wave on the ECG.
- Q5** Identify the incorrect statement regarding human blood groups:
- (A) Individuals with blood type 'O' possess both anti-A and anti-B antibodies in their plasma.
  - (B) A person with blood type 'B' cannot safely donate blood to an individual with blood type 'A'.
  - (C) Blood type classification is determined by the antibodies present within the blood plasma.
  - (D) Individuals with blood type 'AB' are considered universal recipients of blood.
- Q6** Consider the following statements regarding the heart's function and choose the correct relationship between them:
- Statement I:** The atria filled with blood returning from the body and lungs, subsequently delivers this blood to the ventricles.
- Statement II:** The electrical impulse originating at the sino-atrial (SA) node propagates through the atria and then to the ventricles.
- (A) The blood flow described in Statement I is dependent on the electrical activity described in Statement II.
  - (B)



The electrical activity described in Statement II is dependent on the blood flow described in Statement I.

- (C) The events described in Statements I and II occur independently of each other.  
 (D) The events described in Statements I and II occur simultaneously.

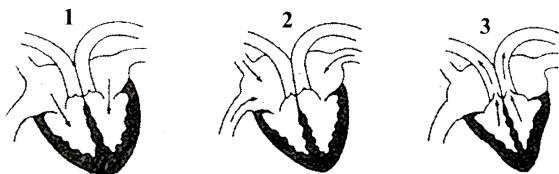
**Q7** Which of the following is the correct sequence of events during the cardiac cycle?

- (A) Atrial systole, ventricular systole, isovolumetric relaxation, ventricular diastole  
 (B) Ventricular diastole, atrial systole, ventricular systole, isovolumetric relaxation  
 (C) Isovolumetric relaxation, atrial systole, ventricular diastole, ventricular systole  
 (D) Ventricular systole, atrial systole, isovolumetric relaxation, ventricular diastole

**Q8** A researcher is studying a blood sample that has been treated to remove all fibrinogen. Compared to a normal blood sample, the treated sample would *most likely* exhibit:

- (A) A significantly reduced osmotic pressure.  
 (B) An inability to transport glucose and amino acids.  
 (C) A decreased ability to form a clot.  
 (D) An altered concentration of sodium and potassium ions.

**Q9** The figure given below shows three stages in the cardiac cycle



Which of the following sequences is **correct** regarding this ?

- (A) 2, 3, 1                      (B) 1, 2, 3  
 (C) 2, 1, 3                      (D) 3, 1, 2

**Q10** Which of the following statements are **correct**?

I. The closed circulatory system is found only in vertebrates, where blood is confined to blood vessels throughout the body.

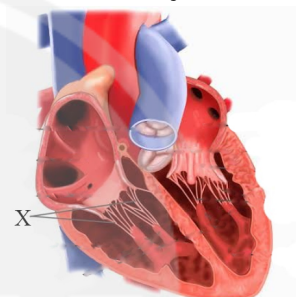
II. The heart is protected by a single-layered membrane called the pericardium, which contains pericardial fluid.

III. Sympathetic neural signals increase the rate of heartbeat, strength of ventricular contraction, and cardiac output.

IV. The medulla oblongata in the brain is responsible for regulating cardiac function through the autonomic nervous system (ANS).

- (A) I, and IV only  
 (B) I and II only  
 (C) II and III only  
 (D) III and IV only

**Q11** Observe the diagram of the human heart shown below. Identify structure 'X' and its function:



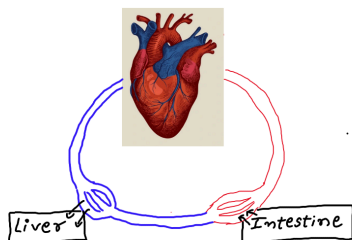
- (A) Cardiac muscles- connection between cusps of valve and papillary muscles  
 (B) Semilunar valves – regulate blood flow into arteries  
 (C) Chordae tendinae – prevent valve inversion during ventricular contraction  
 (D) Purkinje fibers – conduct impulse to ventricular muscles

**Q12** A patient has a condition that causes damage to their red bone marrow. Predict the *comparatively most immediate* consequence of this damage on their blood composition and function.

- (A) Increased clotting time due to decreased platelet production.  
 (B) Reduced oxygen-carrying capacity due to decreased erythrocyte production.  
 (C) Compromised immune response due to decreased lymphocyte production.  
 (D) Elevated inflammatory response due to increased basophil production.



- Q13** Identify the given portal system and choose the most appropriate statement about it:



- (A) Hepatic portal system – It consists of two sets of capillaries: one in the intestine (absorptive) and one in the liver (distributive).  
 (B) Renal portal system – It carries deoxygenated blood from the digestive organs to the liver.  
 (C) Hypophyseal portal system – It carries blood from the heart to the kidneys for filtration.  
 (D) Hepatic portal system – It delivers oxygenated blood to the liver from pulmonary circulation.

- Q14** Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

**Assertion (A):** Heart failure is not associated with high blood pressure.

**Reason (R):** Hypertension increases afterload, making the left ventricle work harder to pump blood, causing myocardial thickening and higher oxygen demand, which, if unmet, can lead to ischemia and impaired ventricular function.

In the light of the above statements, choose the **correct** answer from the options given below:

- (A) A is true but R is false.  
 (B) A is false but R is true.  
 (C) Both A and R are true and R is the correct explanation of A.  
 (D) Both A and R are true but R is NOT the correct explanation of A.
- Q15** Given below are two statements:
- Statement I:** The pulmonary circulation in mammals involves the transport of deoxygenated blood from the right ventricle to the lungs via the pulmonary arteries, where gas

exchange occurs, followed by the return of oxygenated blood to the left atrium through the pulmonary veins, completing a separate circuit from the systemic circulation.

**Statement II:** The systemic circulation, responsible for delivering oxygenated blood from the left ventricle to all tissues of the body and returning deoxygenated blood to the right atrium via the vena cavae, operates at a significantly higher pressure than the pulmonary circulation due to the greater resistance encountered in the longer and more extensive systemic vascular network.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (A) Statement I is correct but Statement II is incorrect.  
 (B) Statement I is incorrect but Statement II is correct.  
 (C) Both Statement I and Statement II are correct.  
 (D) Both Statement I and Statement II are incorrect.

- Q16** Given below are two statements:

**Statement I:** An ECG is a non-invasive diagnostic tool that records the electrical activity of the heart, providing valuable information about the rate and regularity of heartbeats, the size and position of the chambers, and the presence of any damage to the myocardium or conduction system, with each wave and segment correlating to specific electrical events during the cardiac cycle.

**Statement II:** Hormones from the adrenal medulla, supplement neural control by increasing heart rate and contractility, further augmenting cardiac output during stress or physical activity.

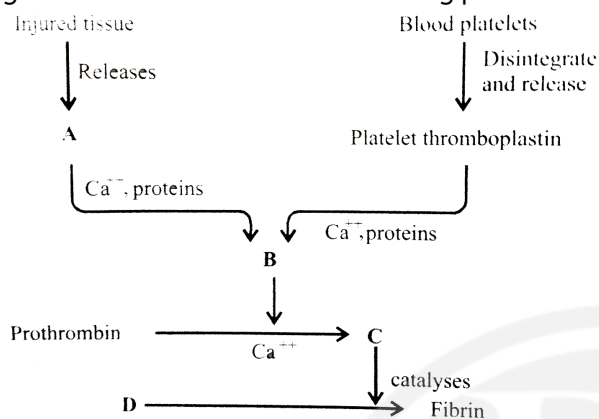
In the light of the above statements, choose the most appropriate answer from the options given below:

- (A) Statement I is correct but Statement II is incorrect.



- (B) Statement I is incorrect but Statement II is correct.  
 (C) Both Statement I and Statement II are correct.  
 (D) Both Statement I and Statement II are incorrect.

**Q17** Identify the components labelled (A-D) in the given flow chart of the blood clotting process.



- (A) A-Thrombo-plastinm, B-Prothrom-binase, C-Thrombin, D-Fibrinogen  
 (B) A-Fibrinogen, B-Thrombin, C-Prothrombinase, D-Thrombo-plastin  
 (C) A-Prothrom-binase, B-Fibrinogen, C-Thrombo-plastin, D-Thrombin  
 (D) A-Thromin, B-Thrombo-plastin, C-Fibrinogen, D-Prothrom-binase
- Q18** Imagine a scenario where the concentration of albumin in the blood plasma decreases significantly. What is the *most likely* physiological consequence of this change?  
 (A) Increased oxygen-carrying capacity of the blood.  
 (B) Impaired defense mechanisms against infections.  
 (C) Disruption of the blood's osmotic balance.  
 (D) Increased rate of blood clot formation.
- Q19** Read the following statements carefully  
 (i) In fishes, the heart pumps out deoxygenated blood which is oxygenated by the gills and supplied to the body parts from where deoxygenated blood is returned to the heart.  
 (ii) The openings of the right and the left

ventricle into pulmonary artery and aorta respectively are provided with the mitral valves.  
 (iii) The nodal musculature has the ability to generate action potential without any external stimuli, i.e., it is autoexcitable.

(iv) Angina pectoris, characterized by chest pain or discomfort, arises from myocardial ischemia, an imbalance between oxygen supply and demand in the heart muscle

Which of the above four statements are **incorrect**?

- (A) (i) and (ii) (B) (ii) only  
 (C) (i) and (ii) (D) (iii) and (iv)

**Q20** A drop of each of the following is placed separately on four slides. Which of them will coagulate?

- (A) Blood serum  
 (B) Blood plasma (without clotting factors)  
 (C) Whole blood from an artery  
 (D) Sample from the spleen (containing only white blood cells)

**Q21** Which of the following statements are correct ?

- (i)  $\text{Ca}^{+2}$  is necessary for blood coagulation  
 (ii) Coagulation in blood vessel is prevented during normal condition by heparin  
 (iii) In kidney patients, fluid buildup, especially in the lungs (pulmonary edema), can cause congestive heart failure.  
 (iv) Blood clotting involves cascading process involving a number of factors present always in the active form.  
 (A) (i),(iii) and (iv)  
 (B) (ii) and (iv)  
 (C) (i),(ii) and (iii)  
 (D) (iii) and (iv)

**Q22** Find out the **incorrect** option from the following?

- (A) Veins are typically larger in diameter than arteries  
 (B) Because of their small size, capillaries contain blood that is moving more quickly than in other parts of the circulatory system  
 (C)



The walls of arteries are elastic, enabling them to stretch and shrink during changes in blood pressure

(D) Veins contain more blood than any other part of the circulatory system

**Q23** Which of the following statements is incorrect?

(A) Double circulation is incomplete in amphibians and reptiles

(B) Our heart is composed of all four major tissue types: muscular tissue, connective tissue, epithelial tissue, and neural tissue

(C) Atrial diastole coincides with ventricular systole during the cardiac cycle.

(D) Unlike in birds and mammals, in amphibian and reptiles, the left atrium receives oxygenated blood and right atrium receives deoxygenated blood.

**Q24** Which of the following statements is **incorrect** regarding lymph?

(A) The exchange of nutrients, gases, etc., between the blood and the cells always occurs through the lymph.

(B) Lymph is a colourless fluid containing specialised lymphocytes which are responsible for the immune responses of the body.

(C) Lymph has a different mineral distribution than that in plasma.

(D) Fats are absorbed through lymph in the lacteals present in the intestinal villi.

**Q25** A patient shows elevated levels of a WBC type that normally makes up 2–3% of total count, while total WBC remains normal.

What is the likely cause and associated effect?

(A) Chronic bacterial infection; ↑ platelet count

(B) Acute viral infection; ↑ histamine release`

(C) Allergic reaction; ↑ heparin secretion

(D) Parasitic infestation; ↓ lymphocyte count

**Q26** The effect on pregnancy if a Rh+ve male marries a Rh-ve female is that:

(I) no pregnancy will occur.

(II) death of first child.

(III) their first child will survive.

(IV) Rh antibodies from the mother can leak into blood of second Rh+ve child and destroy its RBCs.

Select the **correct** option.

(A) (I) and (II)

(B) (II) and (IV)

(C) (III) and (IV)

(D) (IV) only

**Q27** Which of the following statements are incorrect?

I. Erythrocytes (RBCs) are biconcave, nucleate cells with haemoglobin in most of the mammals.

II. Neutrophils, eosinophils, and basophils are agranulocytes that contain prominent cytoplasmic granules and multilobed nuclei.

III. In fishes, blood is pumped in a single circuit: from the heart to the gills for oxygenation, and then to the body.

IV. Reptiles have a three-chambered heart, where oxygenated and deoxygenated blood mix in a single ventricle.

(A) I, and IV only

(B) I and II only

(C) II and III only

(D) III and IV only

**Q28** Which of the following sets of characteristics accurately describes a normal phase of the cardiac cycle?

Option	(i) Heart chamber State	(ii) Valve State (Tricuspid & Bicuspid / Semilunar)	(iii) Blood Flow
A.	All four chambers relaxed	Closed/Open	From pulmonary veins & vena cava into ventricles
B.	All four chambers contracted	Open/Closed	From pulmonary veins & vena cava into atria





C.	All four chambers relaxed	Open/Closed	From pulmonary veins & vena cava into ventricles (via atria)
D.	Atria relaxed, Ventricles contracted	Open/Closed	From ventricles to atria

**Q29** Which of the following is **true** regarding the composition of blood plasma in healthy adults?

- (A) Glucose is present in the plasma in transit in the body.
- (B) Plasma contains less than 50% of water.
- (C) A healthy individual has 32-36 gms of haemoglobin in every 100 ml of blood.
- (D) The ion concentration in plasma is predominantly composed of chloride and phosphate ions alone.

**Q30** Read the following statements (I-IV)

I. Successful blood transfusions critically depend on matching the donor and recipient blood types to prevent severe and potentially fatal antigen-antibody reactions, which can lead to red blood cell agglutination and destruction within the recipient's circulatory system.

II. The significantly elevated cardiac output in highly trained athletes, compared to sedentary individuals, primarily results from enhanced physiological adaptations like a larger stroke volume (due to increased ventricular filling and stronger contraction) and a lower resting heart rate, optimizing circulatory efficiency.

III. A big (or tall/wide) P wave in an ECG typically indicates atrial enlargement or hypertrophy, meaning one or both atria are larger than normal.

IV. The first heart sound, "lub," signals the closing of the the semilunar valves., while the

second heart sound, "dub," is linked to the closure of closing of the tricuspid and bicuspid valves.

How many of the above statements are **correct**?

- (A) One only
- (B) Three only
- (C) Four only
- (D) Five

**Q31** Which of the following haematological changes is most characteristically observed in individuals afflicted with Dengue fever?

- (A) Marked elevation in erythrocyte count
- (B) Marked elevation in leukocyte count
- (C) Marked reduction in thrombocyte count
- (D) Marked elevation in thrombocyte count

**Q32** Given below are two statements:

**Statement I:** Both simple and complex multicellular organisms utilize interstitial (tissue) fluid as a medium for the distribution of essential nutrients to individual cells, ensuring efficient intracellular access.

**Statement II:** In the absence of parasympathetic modulation, the intrinsic pacing of the human heart would elevate above the average resting rate of 80 beats per minute.

In the light of the above statements, choose the *most appropriate* answer from the options given below:

- (A) Statement I is correct but Statement II is incorrect.
- (B) Statement I is incorrect but Statement II is correct.
- (C) Both Statement I and Statement II are correct.
- (D) Both Statement I and Statement II are incorrect.

**Q33** Which of the following statements accurately reflects the events occurring during each cardiac cycle?

- (A) The volumes of blood ejected by the right and left ventricles are equal.
- (B) The volumes of blood ejected by the right and left ventricles are unequal.
- (C) The volumes of blood entering the right and left atria are unequal.



(D) The volumes of blood entering the aorta and pulmonary artery are unequal.

**Q34 Consider the following statements.**

- I. Murmur sound is one of the prominent sounds of a healthy heart.
  - II. O blood group has antibody A yet O blood can be donated to blood group A containing antigen A.
  - III. The AV node delays the electrical impulse moving from the SA node and atria to the ventricles by 0.1 second to allow the ventricles to empty completely, filling atria fully before they contract.
  - IV. Human blood normally contains high level of proteases and nucleases.
  - V. There are animals in which blood from the respiratory organs does not return to the heart directly and goes to the tissues instead.
- Which of the above statement is/are **correct**?

- (A) I, II and V only
- (B) II, III and IV only
- (C) II and IV only
- (D) II and V only

**Q35** Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

**Assertion A:** A person with blood group O cannot donate blood to an individual with blood group B under ABO blood grouping system.

**Reason R:** When blood group O (along with the plasma) is mixed with blood group A in a laboratory setting, agglutination (clumping) occurs.

In the light of the above statements, choose the **correct** answer from the options given below:

- (A) A is true but R is false.
- (B) A is false but R is true.
- (C) Both A and R are true and R is the correct explanation of A.
- (D) Both A and R are true but R is NOT the correct explanation of A.

**Q36**

A patient's ECG shows the following characteristics:

- P wave is present and normal
- QRS complex is widened.

Which of the following best explains the likely cardiac condition?

- (A) Atrial fibrillation due to disrupted sinoatrial node activity.
- (B) Ventricular hypertrophy causing delayed ventricular depolarization.
- (C) Myocardial infarction resulting in prolonged atrial contraction.
- (D) Normal cardiac rhythm with temporary emotional stress.

**Q37** Choose the **incorrect** statement.

- (A) In mammal, valves regulate the unidirectional flow of blood.
- (B) Absence of nucleus does not form one of the major basis of difference between erythrocytes and thrombocytes.
- (C) Plasma carries heat around the body.
- (D) If a person suspects major deficiency of clotting in himself, then he should look for the plasma proteins mainly serum albumins, serum globulins for confirmatory evidence.

**Q38** Select the **correct** match/representation.

- (A) Percentage of monocytes in total WBCs = Percentage of proteins in plasma
- (B) Percentage of neutrophils in total WBCs = Percentage of water in plasma
- (C) Percentage of plasma in blood = Percentage of eosinophils in total WBCs
- (D) Percentage of formed elements in blood = Percentage of lymphocytes in total WBCs

**Q39** If a person exercise regularly for several years, then following observations is seen w.r.t change in the function of his heart at rest, **except**

- (A) Decrease in resting heart rate
- (B) Heart muscles become stronger through regular exercise
- (C) Increase in stroke volume



(D) Increase in cardiac output at rest

**Q40** Match **List-I** with **List-II** and choose the **correct** option.

	List-I		List-II
(A)	Neutrophils	(I)	Kidney shaped
(B)	Monocytes	(II)	Spherical or slightly indented
(C)	Eosinophil	(III)	Multilobed
(D)	Lymphocytes	(IV)	Bilobed

- (A) A-III, B-I, C-II, D-IV  
 (B) A-II, B-I, C-III, D-IV  
 (C) A-III, B-I, C-IV, D-II  
 (D) A-IV, B-II, C-I, D-III

**Q41** A special case of Rh incompatibility (mismatching) has been observed between the Rh-ve blood of a pregnant mother with Rh+ve blood of the foetus. This condition is called erythroblastosis foetalis.

Given below are two statements about the above information:

**Statement I:** Erythroblastosis fetalis may arise when a Rh-negative mother conceives a child with a Rh-positive father, potentially leading to maternal sensitization and fetal haemolysis in subsequent pregnancies.

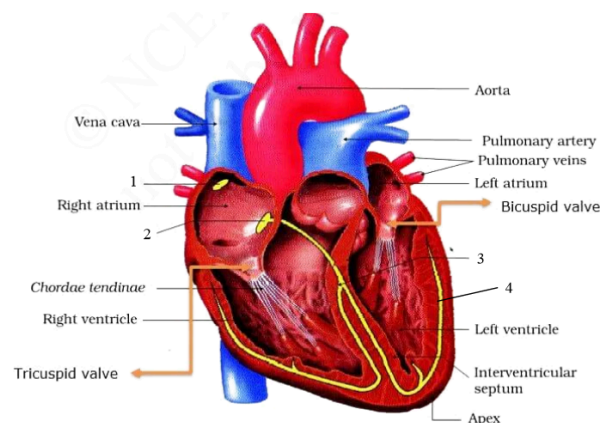
**Statement II:** If both parents are Rh-negative but the foetus is Rh-positive, the risk of erythroblastosis fetalis persists.

In the light of the above statements, choose the *most appropriate* answer from the options given below:

- (A) Statement I is correct but Statement II is incorrect.  
 (B) Statement I is incorrect but Statement II is correct.  
 (C) Both Statement I and Statement II are correct.  
 (D) Both Statement I and Statement II are incorrect.

**Q42**

In the given section of the human heart which part ensures that ventricles do not contract prior to the atria?



Section of a human heart

- (A) 1 (B) 2  
 (C) 3 (D) 4

**Q43** Transfusion of blood from an individual with blood group A into a recipient with blood group B results in a severe antigen-antibody reaction, leading to intravascular agglutination and potential hemolysis, which can prove fatal. Similarly, the administration of Rh-incompatible blood, even during the first transfusion, elicit an acute immunological response, posing a nearly death risk to recipient's life.

- (A) The statement is true for Rh antigen but false for ABO blood grouping.  
 (B) The statement is true for both the incompatibilities.  
 (C) The statement is false for Rh incompatibility but true for ABO blood grouping.  
 (D) The statement is false for both the incompatibilities.

**Q44** Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

**Assertion A:** Hypoxia and ischaemia are physiologically identical conditions.

**Reason R:** Both involve a deficiency of oxygen at the tissue level.

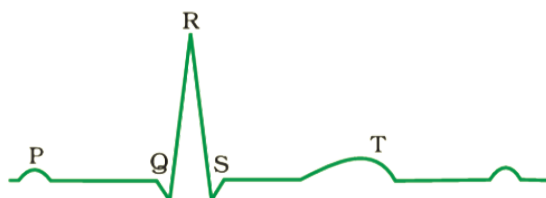
In the light of the above statements, choose the **correct** answer from the options given below:





- (A) A is true but R is false.  
 (B) A is false but R is true.  
 (C) Both A and R are true and R is the correct explanation of A.  
 (D) Both A and R are true but R is not the correct explanation of A.

Q45



How many of the following statements are **correct** regarding the given ECG?

- (I) The PQ segment shows atrial contraction i.e. actual depolarization begins during the mid of this segment itself.  
 (II) The S-T segment reflects the plateau phase of ventricular action potential and the period when ventricles are fully depolarized.  
 (III) The electrical activity of the heart can be recorded from the body surface.  
 (IV) The wave shown after T is P wave.  
 (V) By counting any peaks, we can calculate the total number of heart beats.  
 (VI) The PQ segment reflects the time the electrical impulse takes to travel from the atria to the ventricles via the atrioventricular (AV) node, bundle of His, and Purkinje fibers.  
 (A) Three (B) Four  
 (C) Five (D) Six

**Q46** Which of the following statement is **incorrect** regarding blood clotting?

- (A)  $\text{Ca}^{2+}$  helps in clotting by activating thrombokinase.  
 (B) Clotting involves a series of linked enzyme reaction and therefore is also known as a kind of waterfall process.  
 (C) Clotting disability increases in case of thrombocythemia.  
 (D) In case of bleeding, we put ice at the site of injury as a first aid to stop bleeding

**Q47** In humans, under normal physiological condition, the duration between heart sound having low pitch and heart sound having high pitch is;

- (A) 0.3 sec (B) 0.4 sec  
 (C) 0.5 sec (D) 0.8 sec

**Q48** Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

**Assertion A:** Capillaries in blood vascular system have lowest blood velocity in comparison to other blood vessels.

**Reason R:** Total cross-sectional area of all the capillaries is larger compared to artery, veins, venules, arterioles individually.

In the light of the above statements, choose the **correct** answer from the options given below:

- (A) A is true but R is false.  
 (B) A is false but R is true.  
 (C) Both A and R are true and R is the correct explanation of A.  
 (D) Both A and R are true but R is not the correct explanation of A.

**Q49** Match **List-I** with **List-II** and choose the correct option.

List-I		List-II	
(A)	Increased stroke volume	(I)	Same effect on heart rate as parasympathetic
(B)	Acetylcholine	(II)	Increase in venous return
(C)	Evolutionary change is observed in	(III)	Less than that in aorta
(D)	Blood pressure in pulmonary artery	(IV)	Heart of vertebrates

- (A) A-III, B-I, C-II, D-IV  
 (B) A-III, B-II, C-I, D-IV  
 (C) A-II, B-I, C-IV, D-III  
 (D) A-II, B-IV, C-I, D-III



**Q50** Select the **incorrect** statement.

- (A) Lymph acts as middle man and has less proteins than blood plasma.
- (B) Lymphatic capillaries are open at both ends.
- (C) Thoracic lymphatic duct open into left subclavian vein.
- (D) Lymph capillaries are absent in central nervous system.

**Q51** Consider the following statements.

- I. The number of circuits of circulation in humans and amphibians is the different.
- II. All chordates and few non chordates have a closed circulatory system.
- III. The presence of valves in veins is primarily attributed to the influence of gravitational force and intraluminal pressure gradients.
- IV. A, B, O blood grouping is called so due to the antigens A, B and O present on the surface of human RBCs.
- V. Blood pressure in the mammalian aorta is maximum during systole of the left atrium.
- VI. The blood vessels which carries largest amount of urea is renal vein.

Which of the above statement is/are **correct**?

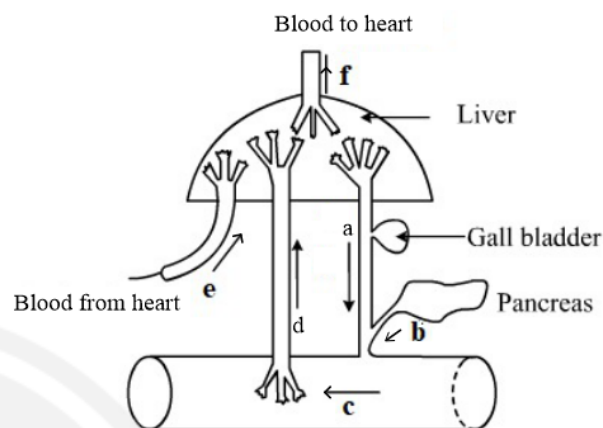
- (A) I, II, III and V only
- (B) II, III, IV and V only
- (C) II, III and IV only
- (D) II and III only

**Q52** In a normally developing human foetus, an interatrial opening permits the shunting of blood between the right and left atria. In certain individuals, this opening fails to close at birth. If left uncorrected surgically, what would be the most likely physiological consequence with respect to the oxygenation of blood entering the systemic circulation?

- (A) There would be no appreciable change in the oxygen content of systemic arterial blood.
- (B) The oxygen content of blood in the systemic circuit would be pathologically reduced.
- (C) The oxygen content of systemic arterial blood would be abnormally elevated.

(D) Both oxygen and carbon dioxide concentrations in systemic blood would simultaneously increase.

**Q53** The given diagram shows how things get to and from the liver. They are labelled as a, b, c, d, e, f which one of the following labelling is the **correct** one?



- (A) A is the hepatic portal vein and E is the hepatic vein
- (B) C is the intestine and F is the hepatic portal vein
- (C) D is the hepatic portal vein and F is the hepatic vein
- (D) B is the pancreatic artery and E is the hepatic artery

**Q54** Given below are two statements:

**Statement (I):** All ischaemia can lead to hypoxia but all hypoxia cannot lead to ischaemia.

**Statement (II):** If a healthy person has 5 litres blood in his body, then on an average his right ventricle pumps about 10 litres of blood in one minute.

In the light of the above statements, choose the *most appropriate* answer from the options given below:

- (A) Statement I is correct but Statement II is incorrect.
- (B) Statement I is incorrect but Statement II is correct.
- (C) Both Statement I and Statement II are correct.
- (D) Both Statement I and Statement II are incorrect.



- Q55** Which of the following statement is **mismatch** regarding cardiovascular maladies?
- (A) Angina pectoris - Hypoxia in cardiac tissues
- (B) Severely damaged chordae tendinea – reduced outflow to aorta
- (C) Heart block – Sudden damage to heart muscles due to inadequate blood supply
- (D) Dysfunction of SA node– AV node generates action potential

- Q56** How many of the following are incorrect regarding l/c Human circulatory system?
- Both SA node and AV node work together.
  - Every 1dl of blood possess 12-16 mg of Haemoglobin.
  - Human RBCs appear biconcave, disc shaped and enucleated after maturation.
  - 70% of blood is filled in the ventricles during joint diastole.
  - Lymph and tissue fluids are exactly same.
- (A) Two (B) Three
- (C) Four (D) Five

- Q57** Which of the following do not show diapedesis?
- (A) Macrophages (B) Neutrophils
- (C) Monocytes (D) Erythrocytes

- Q58** Match **List-I** with **List-II** and choose the correct option.

List-I		List-II	
(A)	Leucocytes (0.5-1%)	(I)	Serum
(B)	Fluid that does not clot when kept on a glass slide	(II)	Human heart
(C)	Cells that cannot metabolize glucose to CO <sub>2</sub> anaerobically	(III)	Secretes natural anticoagulant

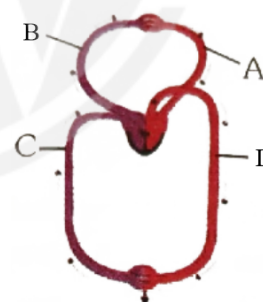
	If taken out from body		
(D)	continues to beat for some time	(IV)	RBCs

- (A) A-III, B-I, C-II, D-IV
- (B) A-II, B-I, C-III, D-IV
- (C) A-III, B-I, C-IV, D-II
- (D) A-IV, B-II, C-I, D-III

- Q59** Select the **incorrect** statement.

- (A) Systems biology makes us believe that all living phenomena are emergent properties due to interaction among components of the system under study.
- (B) It is now being increasingly realised that neither a purely organismic approach nor a purely reductionistic molecular approach would reveal the truth about biological processes or living phenomena.
- (C) Parasympathetic system decreases heart rate but increases stroke volume.
- (D) All parts of nodal system can generate action potentials.

**Q60**



In the schematic of human blood circulation shown, vessels A, B, C, and D carry blood with different oxygen partial pressures ( $PO_2$ ). Which of the following correctly identifies the vessel carrying blood from the heart to the lungs, along with its typical  $PO_2$  value and function?

- (A) Vessel A — Pulmonary vein,  $PO_2 = 60$  mm Hg; carries oxygen-poor blood from body to heart.
- (B) Vessel B — Pulmonary artery,  $PO_2 = 90$  mm Hg; carries oxygen-poor blood from heart to



lungs.

(C) Vessel C — Vena cava,  $PO_2 = 45$  mm Hg;  
carries oxygen-rich blood from body to right

atrium.

(D) Vessel D — Dorsal aorta,  $PO_2 = 95$  mm Hg;  
carries oxygen-rich blood from heart to body.



[Android App](#)



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## Answer Key

Q1 (A)  
Q2 (B)  
Q3 (C)  
Q4 (C)  
Q5 (C)  
Q6 (A)  
Q7 (A)  
Q8 (C)  
Q9 (C)  
Q10 (D)  
Q11 (C)  
Q12 (A)  
Q13 (A)  
Q14 (B)  
Q15 (A)  
Q16 (C)  
Q17 (A)  
Q18 (C)  
Q19 (B)  
Q20 (C)  
Q21 (C)  
Q22 (B)  
Q23 (D)  
Q24 (C)  
Q25 (C)  
Q26 (C)  
Q27 (B)  
Q28 (C)  
Q29 (A)  
Q30 (B)

Q31 (C)  
Q32 (B)  
Q33 (A)  
Q34 (D)  
Q35 (B)  
Q36 (B)  
Q37 (D)  
Q38 (A)  
Q39 (D)  
Q40 (C)  
Q41 (A)  
Q42 (B)  
Q43 (C)  
Q44 (B)  
Q45 (B)  
Q46 (C)  
Q47 (A)  
Q48 (C)  
Q49 (C)  
Q50 (B)  
Q51 (D)  
Q52 (B)  
Q53 (C)  
Q54 (A)  
Q55 (C)  
Q56 (B)  
Q57 (D)  
Q58 (C)  
Q59 (C)  
Q60 (D)





## Hints & Solutions

### Q1 Text Solution:

Platelets are small, disc-shaped cell fragments in blood (formed from megakaryocytes).

They play a **major role in blood clotting (hemostasis)**.

A. A **reduction in platelet count** (thrombocytopenia) or defective platelet function leads to:

- Prolonged bleeding time
- Easy bruising and frequent nosebleeds
- Excessive bleeding from small cuts

B. **Hematocrit** – reflects the proportion of RBCs in blood. It relates to oxygen-carrying capacity, not bleeding time.

C. **M CV (Mean Corpuscular Volume)** – measures the average size of RBCs; related to types of anemia, not bleeding disorders.

D. **Reticulocyte count** – indicates the bone marrow's production of RBCs; not related to platelet function or bleeding time.

### Q2 Text Solution:

- **Calcium ions** are essential for the **contraction of cardiac muscle**.
- When **more calcium is available outside the heart cells**, more calcium enters the heart muscle cells during each heartbeat.
- This leads to **stronger muscle contractions**, so the heart pumps **more blood with each beat** — this is called **increased stroke volume**.
- **Heart rate** is controlled mainly by the **SA node** and **autonomic nerves**, not directly by calcium levels in this setup.

### Q3 Text Solution:

Increased sympathetic activity to the heart and peripheral vasculature

The sympathetic nervous system is crucial for rapidly increasing blood pressure.

Increased sympathetic activity causes:

Increased heart rate and contractility, raising cardiac output.

Vasoconstriction of peripheral blood vessels, increasing systemic vascular resistance.

Both of these effects elevate blood pressure.

Parasympathetic activity generally lowers blood pressure.

### Q4 Text Solution:

1. Atrial contraction begins immediately following the QRS complex on the ECG. This is incorrect. The QRS complex represents ventricular depolarization, which leads to ventricular contraction. Atrial contraction is initiated by the P-wave.
2. Ventricular contraction is initiated by the electrical activity represented by the P-wave. This is incorrect. The P-wave represents atrial depolarization, leading to atrial contraction. Ventricular contraction is initiated by the QRS complex, which represents ventricular depolarization.
3. The mechanical pumping of blood from the ventricles occurs shortly after the appearance of the QRS complex on the ECG. This is correct. The QRS complex signifies ventricular depolarization, the electrical stimulus that triggers the mechanical contraction (systole) of the ventricles. This contraction results in the pumping of blood to the lungs (from the right ventricle) and to the rest of the body (from the left ventricle).
4. The relaxation of the ventricles (ventricular diastole) is directly triggered by the T-wave on the ECG. This is incorrect. The T-wave represents ventricular repolarization, which is the electrical event that precedes and allows for ventricular relaxation (diastole). The T-wave sets the stage for relaxation, but it doesn't directly trigger the mechanical relaxation itself.



**Q5 Text Solution:**

Blood type classification is primarily based on **antigens present on the surface of RBCs**, not antibodies in plasma. Antibodies help determine compatibility, not the type itself.

**Q6 Text Solution:**

**Electrical drives Mechanical:** The heart's mechanical pumping action (the filling and expulsion of blood, as described in Statement I) is directly initiated and coordinated by its electrical activity (the propagation of impulses from the SA node, as described in Statement II).

**Precedence:** The electrical depolarization of the heart muscle cells *precedes* and triggers their mechanical contraction. Without the organized electrical impulses generated by the SA node and conducted through the heart, the atria and ventricles would not contract in a synchronized manner, and efficient blood flow would not occur.

**Functional Unit:** The heart functions as a single, coordinated unit where electrical events dictate the mechanical events. They are not separate or independent processes.

**Q7 Text Solution:****Atrial systole**

- Atria contract and push blood into the ventricles.

**Ventricular systole**

- Ventricles contract. This includes:

**Isovolumetric contraction phase:** All valves closed, pressure builds.

**Ventricular ejection phase:** Semilunar valves open, blood is pumped out.

**Isovolumetric relaxation**

- Ventricles relax, all valves closed, pressure drops.

**Ventricular diastole** (ventricular filling phase)

- Blood flows passively into ventricles from atria as AV valves open again.

**Q8 Text Solution:****Fibrinogen**

It is a plasma protein produced by the liver.

Its main function is to convert into fibrin during blood clotting, forming the mesh that stabilizes a clot.

**Now evaluate each option:**

- Fibrinogen contributes only a small part to the osmotic pressure. Albumin is the primary protein maintaining blood's oncotic (osmotic) pressure.
- Transport of glucose and amino acids is handled by plasma and RBCs, not fibrinogen. Their transport is independent of clotting proteins.
- Fibrinogen is essential for blood clot formation. Without it, the blood cannot form fibrin, which is crucial for stable clot formation.
- Electrolyte levels are not dependent on fibrinogen. These ions are regulated by kidneys and cellular mechanisms.

**Q9 Text Solution:**

Figure (2):

Blood is entering the right atrium via the superior and inferior vena cava, and into the left atrium via the pulmonary veins.

→ This indicates atrial diastole / passive filling of atria.

Figure (1):

Blood moves from atria into ventricles.

→ This indicates atrial systole, where atria contract to push blood into ventricles.

Figure (3):

Blood is ejected from the right ventricle into the pulmonary artery and from the left ventricle into the aorta.

→ This indicates ventricular systole.

**Q10 Text Solution:**

A closed circulatory system is **not exclusive to vertebrates**. Some invertebrates like **annelids (e.g., earthworms)** also have a closed circulatory system.

The **pericardium is a double-layered membrane**, not single-layered. It has:

- An **outer fibrous layer**



- An **inner serous layer**, with **pericardial fluid** in between

The **sympathetic nervous system** does exactly this — it stimulates the heart to beat faster and more forcefully, increasing cardiac output. This is **true**.

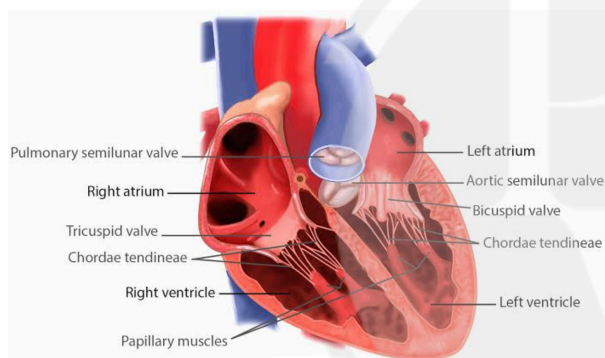
The **medulla oblongata** contains cardiac centers that regulate heart function through **sympathetic and parasympathetic** signals of the ANS. This statement is **true**.

**Q11 Text Solution:**

Cardiac muscles – not specific; chordae tendinae are fibrous, not muscular.

Semilunar valves – located at the base of aorta and pulmonary artery, unrelated to AV valves.

Purkinje fibers – part of the conduction system, not related to valve structure.



**Q12 Text Solution:**

Increased clotting time due to decreased platelet production

- Correct on a lifespan basis.
  - Platelets are short-lived (7–10 days). A drop in their production due to red bone marrow damage would lead to impaired clotting relatively quickly.
  - This could manifest within a few days, especially during injury or trauma.
- Reduced oxygen-carrying capacity due to decreased erythrocyte production
- RBCs live for ~120 days, so the body already has a large reserve.
  - The effect on oxygen transport would be delayed, not immediate release.

Compromised immune response due to decreased lymphocyte production

- Lymphocytes are long-lived; immune suppression would appear much later.
- Elevated inflammatory response due to increased basophil production
- Not relevant—damage to bone marrow reduces, not increases, basophil production.

**Q13 Text Solution:**

The **hepatic portal system** carries **nutrient-rich, deoxygenated blood** from the **intestine to the liver** via the **hepatic portal vein**.

It involves **two capillary beds**:

First in the **intestine** (site of nutrient absorption)  
Second in the **liver** (site of nutrient processing and detoxification)

**Q14 Text Solution:**

**Explanation of Increased Difficulty:**

- A: Accurately describes the progression from hypertension to heart failure.
- R: Provides a detailed pathophysiological explanation of left ventricular hypertrophy.
- Relationship: The reason directly explains the mechanism by which hypertension causes left ventricular hypertrophy, thus justifying the assertion.

**Q15 Text Solution:**

**Explanation**

- I: Precisely describes the pulmonary circulation pathway and its separation.
- II: Correctly compares the pressure differences between pulmonary and systemic circulation and explains the underlying reason.

**Q16 Text Solution:**

**I:** Provides a comprehensive overview of the clinical utility of ECG and its correlation with cardiac electrical events.

**II:** Hormones from the adrenal medulla, such as epinephrine and norepinephrine, supplement neural control by increasing heart rate and



contractility, further augmenting cardiac output during stress or physical activity.

**Q17 Text Solution:**

A-Thrombo-plastin, B-Prothrom-binase, C-Thrombin, D-Fibrinogen

**Q18 Text Solution:**

Albumin is the most abundant protein in blood plasma and plays a critical role in maintaining the **colloid osmotic pressure (oncotic pressure)** of the blood. This pressure is essential for drawing water from the interstitial fluid (the fluid surrounding cells) back into the capillaries.

- When albumin concentration decreases significantly, the blood's oncotic pressure drops.
- This reduced pressure means that less fluid is drawn back into the capillaries.
- As a result, fluid tends to accumulate in the interstitial spaces, leading to **edema** (swelling) and a disruption of the overall fluid balance between the blood and tissues.

**Q19 Text Solution:**

The mitral valve (also called bicuspid valve) is located between the left atrium and left ventricle, not at the opening of the ventricles into arteries.

The valves at the openings of ventricles into pulmonary artery and aorta are called semilunar valves.

**Q20 Text Solution:**

To coagulate (form a clot), the sample must contain:

- Clotting factors (especially fibrinogen)
- Platelets (which help initiate the clotting cascade)
- Calcium ions (cofactor for clotting enzymes)

**(A) Blood serum**

- Serum = plasma – clotting factors
- Will NOT coagulate (clotting factors already removed)

(B) Blood plasma (without clotting factors)

- Plasma without fibrinogen/clotting proteins
  - Will NOT coagulate
- (C) Whole blood from an artery
- Contains RBCs, WBCs, platelets, plasma with clotting factors
  - Will coagulate under normal conditions
- (D) Sample from the spleen (containing only WBCs)
- No platelets or plasma
  - Will NOT coagulate

**Q21 Text Solution:**

Calcium ions ( $\text{Ca}^{2+}$ ) play a vital role as cofactors in several steps of the blood clotting cascade, including the activation of prothrombin to thrombin and fibrinogen to fibrin.

Heparin is a natural anticoagulant produced by certain cells (like mast cells and basophils). It works by enhancing the activity of antithrombin, which inhibits various clotting factors, thereby preventing unwanted blood clot formation inside intact blood vessels.

Diseased kidneys often lose their ability to effectively remove excess fluid and waste from the body. This fluid overload can lead to increased blood volume and pressure, putting a strain on the heart. The excess fluid can back up into the lungs, causing pulmonary edema, which is a common manifestation or complication of congestive heart failure in kidney patients.

While blood clotting is a cascading process involving many factors, these factors are normally present in the blood in an inactive (zymogen) form. They only become active sequentially when triggered by injury, preventing inappropriate clotting under normal conditions.

**Q22 Text Solution:**

The lumen (internal diameter) of comparable veins and arteries. Veins have thinner walls and larger lumens, allowing them to hold a greater volume of blood.

Arteries, particularly elastic arteries like the aorta, have significant elastic tissue in their walls. This elasticity allows them to stretch and recoil



with each heartbeat, helping to maintain blood pressure and smooth out blood flow.

The venous system (veins and venules) serves as a large blood reservoir, holding approximately 60-70% of the body's total blood volume at any given time.

**Q23 Text Solution:**

In **amphibians**, the heart has **three chambers** (two atria and one ventricle), causing **mixing of oxygenated and deoxygenated blood**, hence **incomplete double circulation**.

- In **amphibians and reptiles**, the **left atrium** receives **oxygenated blood** from the lungs (and skin in amphibians).
- The **right atrium** receives **deoxygenated blood** from the body.
- This is **similar** to birds and mammals — not **unlike**.
- After atrial systole, the atria relax (diastole) while the ventricles contract (systole). So they occur simultaneously.

**Q24 Text Solution:**

It has the same mineral distribution as that in plasma.

**Q25 Text Solution:**

- Allergic reactions are a well-established cause of eosinophilia. Eosinophils play a role in modulating allergic responses.
- Increase heparin secretion: Heparin is secreted by basophils and mast cells, which are also involved in allergic reactions. While not directly secreted by eosinophils, the overall immune response during an allergic reaction does involve the release of mediators like heparin (and histamine). Among the given choices, this represents the most plausible associated effect with the cause.

**Q26 Text Solution:**

No pregnancy will occur.

This is Incorrect. Rh incompatibility does not prevent conception or pregnancy from occurring.

The first Rh+ve child is usually unaffected. Sensitization of the Rh-negative mother typically happens during the first delivery, when fetal Rh+ red blood cells enter the mother's circulation. Therefore, sufficient Rh antibodies are generally not produced in time to harm the first child.

The first Rh+ve child is typically born without complications because the mother's immune system has not yet been significantly sensitized to produce a harmful level of Rh antibodies.

If the Rh-negative mother has been sensitized during a previous pregnancy or exposure to Rh+ blood, her immune system will have produced Rh antibodies. In subsequent pregnancies with another Rh+ve fetus, these pre-existing maternal Rh antibodies can cross the placenta into the fetal circulation, attack the fetal Rh+ red blood cells, and cause their destruction (hemolysis), leading to a condition known as erythroblastosis fetalis. This can result in severe anemia, jaundice, and potentially life-threatening complications for the second (or subsequent) Rh+ve child.

**Q27 Text Solution:**

Erythrocytes (RBCs) are biconcave, anucleate cells with haemoglobin in most of the mammals. Neutrophils, eosinophils, and basophils are granulocytes that contain prominent cytoplasmic granules and multilobed nuclei.

**Q28 Text Solution:**

Option (C) accurately describes the Joint Diastole phase of the cardiac cycle.

(i) All four chambers of the heart are in a relaxed state: This is characteristic of joint diastole.

(ii) The tricuspid and bicuspid (AV) valves are open to allow blood flow into the ventricles, and the semilunar valves are closed: This ensures passive filling of the ventricles from the atria, while preventing backflow from the arteries.

(iii) Blood from the pulmonary veins and vena cava flows into the left and right ventricles respectively through the left and right atria: During joint diastole, blood passively flows from the great veins into the atria and then directly





into the ventricles (about 70% of ventricular filling occurs this way).

(A) "All four chambers relaxed" conflicts with "semilunar valves are open" (which implies ventricular ejection).

(B) "All four chambers contracted" is physiologically impossible in a normal cardiac cycle; atrial and ventricular contractions are sequential.

(D) "Blood flows from the ventricles to the atria through open tricuspid and bicuspid valves" describes severe regurgitation (backflow) due to valve incompetence, not a normal event.

### Q29 Text Solution:

Blood plasma is approximately 90-92% water, as stated in biological texts.

Hemoglobin is primarily found within red blood cells, not freely in plasma. Normal hemoglobin levels for healthy adults are typically in the range of 12-18 grams per 100 ml of blood (g/dL), not 32-36 gms.

The ion concentration in plasma is not predominantly composed of chloride and phosphate ions alone. While chloride and phosphate are present, they are not the only or even the most abundant ions. The main ions in plasma are sodium ( $\text{Na}^+$ ) and chloride ( $\text{Cl}^-$ ).

### Q30 Text Solution:

- ABO and Rh blood group matching is crucial for safe blood transfusions to avoid immune reactions, agglutination (clumping), and hemolysis (destruction of red blood cells) in the recipient.
- Athletes develop a more efficient stroke volume (pumping more blood per beat) and often a lower resting heart rate, which contributes to a higher cardiac output when needed and better overall circulatory efficiency.
- On an electrocardiogram (ECG), an abnormally tall or wide P wave is a common indicator of atrial enlargement (hypertrophy),

reflecting the increased electrical activity needed to depolarize a larger atrial mass.

This statement is Incorrect. According to standard cardiac physiology, the first heart sound ("lub") is caused by the closure of the tricuspid and bicuspid (AV) valves, while the second heart sound ("dub") is caused by the closure of the semilunar valves (aortic and pulmonary valves). This statement has inverted the causes of the "lub" and "dub" sounds.

### Q31 Text Solution:

(C)

In Dengue fever, the most prominent and clinically significant haematological abnormality is a marked reduction in platelet count, which poses a risk of haemorrhage and is crucial for disease monitoring. The **Dengue virus** infects and activates immune cells, triggering a **cytokine storm**.

This leads to:

- **Bone marrow suppression**, reducing platelet production.
- **Increased destruction** of platelets due to immune-mediated mechanisms.

Normal platelet count: **150,000–450,000/ $\mu\text{L}$**  whereas In Dengue, it may fall **below 100,000/ $\mu\text{L}$** , and in severe cases even **below 20,000/ $\mu\text{L}$** .

**Low platelet count** is a critical parameter for **monitoring severity** and **managing complications** such as bleeding and shock.

No primary change in count of RBCs.

Dengue typically causes **leukopenia** (reduced WBC count), not an increase.

### Q32 Text Solution:

(B)

Interstitial fluid is the fluid that bathes and surrounds the tissue cells of multicellular animals. It acts as the medium between blood (or other transport fluids) and the cells, facilitating nutrient and gas exchange. In simple multicellular organisms, diffusion through



extracellular/interstitial fluid is sufficient due to smaller size and fewer cell layers. In complex organisms, despite having circulatory systems, interstitial fluid still serves as the immediate environment for cellular exchange.

The sinoatrial (SA) node of the heart has an intrinsic firing rate of ~100–110 beats per minute. However, at rest, the parasympathetic nervous system (via the vagus nerve) inhibits the SA node, reducing the resting heart rate to around 70–80 bpm. If parasympathetic influence is removed, the heart rate increases toward its intrinsic rate (above 80 bpm).

**Q33 Text Solution:**

**(A)**

The cardiac cycle includes the systole (contraction) and diastole (relaxation) of the atria and ventricles. The left ventricle pumps blood into the systemic circulation (via the aorta). The right ventricle pumps blood into the pulmonary circulation (via the pulmonary artery).

The stroke volume (the volume of blood pumped per beat) from the left and right ventricles is nearly identical under normal conditions — typically about 70 mL per beat. This balance is essential to prevent congestion or backup of blood in either the pulmonary or systemic circuit and maintain stable pressure and fluid volume in both circuits.

Unequal volumes would lead to pulmonary or systemic edema over time and venous return to both atria is also balanced over the cardiac cycle. The aorta and pulmonary artery receive output from the left and right ventricles respectively, so the volume entering both must be equal.

**Q34 Text Solution:**

**(D)**

A murmur is an abnormal heart sound, typically indicating turbulent blood flow due to conditions like valvular defects. Normal heart sounds are “lub” and “dub”, representing valve closures.

People with blood group O have neither A nor B antigens on their RBCs and both anti-A and anti-

B antibodies in plasma. However, in packed red cell transfusions, only the RBCs are transferred (not plasma), so type O blood can be given to A, B, AB, and O — making O the universal donor. The AV node does delay the impulse (~0.1 sec), but the purpose is to allow the atria to contract and empty blood into the ventricles, not for ventricles to empty.

Proteases and nucleases are normally present in very controlled amounts, involved in processes like clotting (e.g., thrombin = protease) and DNA/RNA breakdown (e.g., DNase, RNase in immune responses). These enzymes are tightly regulated to avoid tissue damage.

In fish, for example, blood flows from: Heart → Gills (respiratory organ) → Tissues → back to heart. This is called single circulation, where oxygenated blood bypasses the heart and goes directly to tissues.

**Q35 Text Solution:**

**(B)**

**Blood group O** individuals have **no A or B antigens** on their red blood cells. Hence, their **RBCs can be safely donated to any ABO group** — including **B** — making them **universal donors** for **red cell transfusions**. The only risk arises if the **plasma** (which contains **anti-A and anti-B antibodies**) is also transfused in large volumes — which is **not typical** in packed red blood cell transfusions.

Blood group O plasma contains **anti-A** and **anti-B** antibodies. If you mix **O plasma with A red cells**, the **anti-A antibodies** attack the **A antigens**, causing **agglutination** in a **lab setting** (e.g., during compatibility testing). This is why **whole blood** from group O is **not** given to A, B, or AB individuals — only **packed RBCs** are used.

**Q36 Text Solution:**

**(B)**

The patient's ECG presents with a normal P wave, indicating that atrial depolarization and sinoatrial (SA) node function is intact. This rules out arrhythmias like atrial fibrillation, where P waves



are absent or chaotic due to disorganized atrial electrical activity. However, the QRS complex is widened, which indicates delayed ventricular depolarization. A widened QRS suggests that the electrical impulse is either delayed or conducted abnormally through the ventricles, as seen in ventricular hypertrophy or bundle branch blocks. Normal P wave → Atria and SA node are functioning normally.

Widened QRS complex → Suggests delayed ventricular conduction, typically due to ventricular hypertrophy or bundle branch block. Thus, the best explanation is ventricular hypertrophy, which causes delayed depolarization (widened QRS) while not affecting the P wave.

### Q37 Text Solution:

(D)

**Heart valves** (atrioventricular and semilunar) ensure that blood flows in **one direction**, preventing **backflow** during contraction and relaxation phases. This unidirectional flow is essential for **efficient circulation**. While both **erythrocytes (RBCs)** and **thrombocytes (platelets)** are **anucleate** in mammals, this **shared characteristic** means it's **not a major basis of difference**. Their **function, structure, origin**, and **lifespan** are more significant distinguishing features: **RBCs**: biconcave, oxygen transport, lifespan ~120 days and **Platelets**: small, disc-shaped fragments from megakaryocytes, involved in **clotting**, lifespan ~8–10 days. **Plasma**, being a fluid with high water content, plays a key role in **thermoregulation**. It **absorbs, transports, and redistributes heat** throughout the body, helping maintain core temperature. **Clotting factors** are specific plasma proteins like **fibrinogen (Factor I)**, **prothrombin (Factor II)**, and **others** (Factors V, VII, VIII, IX, etc.), while **serum albumin** and **globulins** are important plasma proteins, that are **not the main clotting factors**. **Serum** is plasma **without clotting factors**, so **clotting deficiencies** are investigated

by assessing **coagulation factors**, not just serum albumins or globulins.

Tests like **PT (Prothrombin Time)**, **aPTT (Activated Partial Thromboplastin Time)**, and **fibrinogen level** are used instead.

### Q38 Text Solution:

(A)

**Monocytes**: Account for about **6–8%** of total white blood cells (WBCs) whereas plasma contains about **6–8% proteins** (mainly albumin, globulins, fibrinogen).

**Neutrophils**: Make up the **majority of WBCs** — around **60–70%**, **Water in plasma**: Plasma is about **90–92% water**.

**Plasma in blood**: Makes up about **55%** of total blood volume. **Eosinophils**: Account for only about **1–3%** of total WBCs.

**Formed elements** (RBCs, WBCs, platelets): Comprise **~45%** of blood volume. **Lymphocytes**: Make up about **20–25%** of total WBCs.

### Q39 Text Solution:

(D)

Regular exercise leads to **bradycardia** (a **lower resting heart rate**), typically due to **increased vagal (parasympathetic) tone and more efficient stroke volume**, so the heart doesn't need to beat as often to maintain output. Exercise strengthens the **myocardium**, especially the **left ventricle**, enabling more **forceful and efficient contractions**.

With stronger heart muscle and enhanced chamber filling, **more blood is ejected per beat** (i.e., **stroke volume increases** at rest and during exercise).

At **rest**, in trained individuals, **heart rate ↓**, **stroke volume ↑**. These changes **balance each other**, so **resting cardiac output remains roughly the same** as in untrained individuals (about 5 L/min). Cardiac output increases **only during exercise**, not at rest.

### Q40 Text Solution:

(C)

A-III, B-I, C-IV, D-II.



**Q41 Text Solution:****(A)**

*Erythroblastosis fetalis*, is a condition in which maternal antibodies attack the red blood cells of the fetus. This occurs when the mother is Rh-negative (Rh-), the father is Rh-positive (Rh+). And the fetus inherits the Rh+ factor. During first pregnancy, there's typically no issue but during delivery, some fetal Rh+ blood can enter the maternal circulation, sensitizing the mother's immune system to produce anti-Rh antibodies. In subsequent Rh+ pregnancies, these antibodies cross the placenta and cause destruction (hemolysis) of fetal red blood cells.

If both parents are Rh-negative, they cannot pass on an Rh-positive allele to the child. The child will also be Rh-negative, so no Rh incompatibility will occur. Therefore, erythroblastosis fetalis cannot happen in this scenario.

**Q42 Text Solution:****(B)**

The AV node receives the impulse from the SA node (in the right atrium). It introduces a ~0.1 second delay, allowing the atria to finish contracting and push blood into the ventricles. Then the impulse is sent to the Bundle of His and Purkinje fibers, causing ventricular contraction.

**Q43 Text Solution:****(C)**

In ABO blood group system, individuals naturally have pre-formed antibodies against the A or B antigens they do not possess. Blood group A has anti-B antibodies and blood group B has anti-A antibodies. So, if a blood group A donor gives blood to a blood group B recipient, the recipient's anti-A antibodies immediately attack the donor's A antigens, causing agglutination (clumping) and hemolysis (rupture) of red blood cells. This led to acute, life-threatening transfusion reactions.

Rh-negative individuals do not have pre-formed anti-Rh antibodies, so if Rh-positive blood is transfused into a Rh-negative person the first

exposure generally does not cause an acute reaction. Instead, the immune system is sensitized, and anti-Rh antibodies are formed over time. A severe reaction occurs in subsequent exposures due to memory immune response. This contrasts with the ABO system, where antibodies are naturally present and can cause an immediate reaction.

**Q44 Text Solution:****(B)**

**Hypoxia** refers to **low oxygen availability in tissues** and **ischaemia** refers to **reduced or blocked blood flow** to tissues, which causes **oxygen deficiency**. So both **result in reduced oxygen at the tissue level**, although by different mechanisms.

Although **both involve oxygen deficiency**, they are **not physiologically identical** as **hypoxia** may occur **despite normal blood flow**, such as in high altitude, respiratory disorders, or anemia whereas **ischaemia** is a **circulatory problem**, where **blood supply (and thus oxygen and nutrients)** is reduced or obstructed — e.g., in a heart attack (myocardial ischaemia). Ischaemia often results in **more severe tissue damage** because it deprives tissues of **both oxygen and metabolic substrates**, and prevents removal of waste products.

**Q45 Text Solution:****(B)**

Atrial depolarization occurs during the P wave, and the mechanical atrial contraction follows shortly after. Atrial contraction does occur during the PQ segment, but depolarization is already completed by the end of the P wave.

S-T segment corresponds to phase of the ventricular action potential where ventricles are electrically depolarized.

Only the QRS complexes (or more precisely R wave the most tallest peak of the QRS complex) is reliably used to count heartbeats.

The PQ segment represents AV nodal delay and conduction through the bundle of His and



Purkinje system.

**Q46 Text Solution:**

(C)

**Calcium ions ( $\text{Ca}^{2+}$ )** play a crucial role in **several steps** of the coagulation cascade. One of their key roles is in the **activation of prothrombinase (thrombokinese)**, which converts **prothrombin to thrombin**.

Blood clotting involves a **cascade of enzymatic activations** — one factor activates the next in a chain-like or "**waterfall**" effect.

This amplification mechanism makes the process rapid and effective.

**Thrombocythemia** refers to a condition where there is an **abnormally high platelet count**. This often leads to **increased clotting risk** (thrombosis), **not a disability** in clotting. **Clotting disability** would occur in **thrombocytopenia** (low platelet count), not thrombocythemia.

Applying **ice** causes **vasoconstriction (narrowing of blood vessels)**, which **reduces blood flow** and helps **slow or stop bleeding** as a **first-aid measure**.

**Q47 Text Solution:**

(A)

First Heart Sound ("Lub") – low-pitched, longer duration caused by the closure of the atrioventricular (AV) valves (tricuspid and bicuspid/mitral valves) marks the beginning of ventricular systole.

Second Heart Sound ("Dub") – High-pitched, shorter duration caused by the closure of the semilunar valves (aortic and pulmonary valves) marks the end of ventricular systole and beginning of diastole.

The duration between "Lub" (first sound) and "Dub" (second sound) is the ventricular systole phase. Under normal physiological conditions, this lasts approximately 0.3 seconds.

**Q48 Text Solution:**

(C)

Blood flows slowest through the capillaries. This low velocity allows efficient exchange of gases,

nutrients, and waste between blood and tissues. Capillaries are the primary site for exchange, so a slower rate is physiologically advantageous. Although each capillary is tiny, the number of capillaries is enormous. This results in a huge total cross-sectional area. Compared to arteries or veins (which are larger but fewer), the cumulative cross-sectional area of capillaries is vastly greater.

**Q49 Text Solution:**

(C)

A-II, B-I, C-IV, D-II

Stroke volume is the amount of blood ejected from the ventricle per beat. An increase in venous return stretches the ventricular wall, leading to a stronger contraction and thus increased stroke volume.

Acetylcholine (ACh) is the neurotransmitter released by parasympathetic nerve endings. It slows down the heart rate by acting on muscarinic receptors in the SA node. So, it has the same effect as parasympathetic stimulation. The heart of vertebrates shows progressive evolution Fish (2-chambered) → Amphibians (3-chambered) → Reptiles (partially divided 3-chambered) → Birds and Mammals (4-chambered). This evolutionary adaptation allows better separation of oxygenated and deoxygenated blood.

The pulmonary circulation is a low-pressure system compared to the systemic circulation. Hence, blood pressure in the pulmonary artery is significantly lower than in the aorta.

**Q50 Text Solution:**

(B)

Lymph is often referred to as the "**middle man**" in transport between **blood and tissues**. It forms from **interstitial fluid** and has a **lower protein content** than plasma because large proteins don't usually escape the blood capillaries easily. **Lymphatic capillaries are closed at one end, forming blind-ended tubes**. They collect fluid from the interstitial spaces and move it





**unidirectionally** toward larger lymph vessels and eventually back into the circulatory system.

**Q51 Text Solution:**

(D)

Both humans and amphibians have double circulation (two circuits: pulmonary and systemic).

The difference lies in efficiency and separation, not the number of circuits: Humans: *complete* double circulation (4-chambered heart).

Amphibians: *incomplete* double circulation (3-chambered heart with mixed blood).

All chordates (including vertebrates) possess a closed circulatory system. Some non-chordates (e.g., annelids like earthworms) also have closed systems.

Valves in veins prevent backflow of blood, especially in the limbs. They counteract the effect of gravity and aid unidirectional flow during low pressure conditions, relying on muscle contractions and pressure gradients.

Antigens A and B are present on RBCs. O group means absence of both A and B antigens — not the presence of "O antigen".

Aortic pressure peaks during left ventricular systole, not atrial systole. Atrial systole contributes only a small additional volume to ventricular filling and does not cause peak aortic pressure.

Renal vein carries filtered blood, with less urea. The highest urea concentration is found in the hepatic vein (post liver metabolism) or renal artery (before filtration).

**Q52 Text Solution:**

(B)

In a normally developing human fetus, there is an opening between the right and left atria called the foramen ovale. This opening allows oxygenated blood from the placenta (which enters the right atrium) to be shunted directly into the left atrium and then into systemic circulation—bypassing the non-functional fetal lungs. At birth, with the first breaths and the

expansion of the lungs, pulmonary resistance drops, left atrial pressure increases, and the foramen ovale normally closes functionally and eventually anatomically.

If the opening remains patent (open), it allows for abnormal communication between the right and left atria. In cases where right atrial pressure becomes elevated deoxygenated blood from the right atrium can flow into the left atrium and mix with oxygenated blood. This right-to-left shunt causes reduced oxygen saturation in the blood being pumped into the systemic circulation.

**Q53 Text Solution:**

(C)

Blood from the gastrointestinal tract and pancreas flows into the liver via the hepatic portal vein.

The liver processes this blood, and then the cleaned blood exits through the hepatic vein into the inferior vena cava, returning to the heart.

**Label A:** This represents common bile duct.

**Label B:** Pancreatic duct.

**Label C:** This large structure below represents the intestine (part of the gastrointestinal tract).

**Label D:** Hepatic portal vein.

**Label E:** This vessel is draining blood from the heart to the liver → This is the hepatic artery.

**Label F:** The vessel joining from below, going to the heart → Hepatic vein.

**Q54 Text Solution:**

(A)

**Ischaemia = inadequate blood supply to an organ or part of the body, especially the heart muscles or brain. This directly results in hypoxia, because tissues are not receiving oxygen-rich blood.**

**Hypoxia** = a state where oxygen availability to tissues is diminished, **regardless of blood flow**. Ischaemia always causes hypoxia, but hypoxia does **not necessarily** involve ischaemia. This can occur **without ischaemia**, such as:

- In **anemia** (reduced haemoglobin).



- In **carbon monoxide poisoning** (where oxygen can't bind to haemoglobin).
- In **high altitude** environments.
- In **respiratory diseases**.

A healthy adult has ~**5 litres of total blood volume**.

**Cardiac output at rest** (amount of blood pumped by each ventricle per minute) is:

- $CO = \text{Heart Rate} \times \text{Stroke Volume} \approx 70\text{bpm} \times 70\text{mL} = 4900\text{mL/min} \approx 5\text{litres/min}$

**10 litres/min** is **not average** — it's seen during **moderate to heavy exercise**.

**Q55 Text Solution:**

(C)

Angina pectoris is chest pain caused by reduced oxygen supply (hypoxia) to the heart muscle, usually due to coronary artery disease. Chordae tendineae help anchor the atrioventricular (AV) valves. If severely damaged, they can lead to valvular incompetence, which may cause backflow and reduced forward flow, ultimately reducing outflow to the aorta. Heart block refers to impairment in the conduction of electrical impulses in the heart, particularly between the atria and ventricles (usually at the AV node). It is not defined by sudden muscle damage due to poor blood supply — that description fits myocardial infarction (heart attack).

If the SA node (primary pacemaker) is dysfunctional, the AV node can take over as a secondary pacemaker to generate impulses, though at a slower rate.

**Q56 Text Solution:**

(B)

The SA node initiates the heartbeat and the AV node receives the impulse and relays it to the ventricles. They do function in sequence as part of the cardiac conduction system.

Normal haemoglobin concentration is 12–16 grams per deciliter (g/dL), not milligrams (mg).

Mature human red blood cells (RBCs) are biconcave, disc-shaped, and enucleated — this allows more room for haemoglobin and efficient gas exchange.

During joint diastole (when atria and ventricles are relaxed), about 70–80% of ventricular filling occurs passively.

Lymph and tissue fluid are similar but not exactly the same. Tissue fluid (interstitial fluid) bathes the cells. Lymph is the interstitial fluid that enters the lymphatic vessels, and its composition changes slightly (e.g., enriched with lymphocytes).

**Q57 Text Solution:**

(D)

Diapedesis is the process by which certain white blood cells (WBCs) and macrophages move out of the bloodstream through the capillary walls into tissues, particularly in response to infection or inflammation.

**Q58 Text Solution:**

(C)

Write the correct answer.

List-I		List-II	
(A)	Leucocytes (0.5-1%)	(III)	Secretes anticoagulant
(B)	Fluid that does not clot	(I)	Serum
(C)	Cells can't metabolize to $\text{CO}_2$	(IV)	RBCs
(D)	Heart keeps beating outside	(II)	Human heart

**Q59 Text Solution:**

(C)

Systems biology makes us believe that all living phenomena are emergent properties due to interaction among components of the system under study reflects the idea that biological



functions arise from **complex interactions** among system components, leading to **emergent properties** not evident when studying parts in isolation.

Modern biology recognizes the need to integrate both **organismic (holistic)** and **reductionistic (molecular)** approaches for a complete understanding of life processes.

The **parasympathetic nervous system**, mainly through **vagus nerve stimulation**, **decreases both heart rate and stroke volume**. It slows down cardiac activity overall. Stroke volume may **decrease or remain unchanged**, but it is **not increased**.

**Q60 Text Solution:**  
(D)

Vessel	Name	Direction	PO <sub>2</sub> (approx)	Function
A	Pulmonary artery	Heart → Lungs	~40 mm Hg	Carries deoxygenated

				blood to lungs
B	Pulmonary vein	Lungs → Heart	~95 mm Hg	Carries oxygenated blood to left atrium
C	Vena cava	Body → Heart	~45 mm Hg	Carries deoxygenated blood to right atrium
D	Dorsal aorta	Heart → Body	~95 mm Hg	Carries oxygenated blood from heart to body



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