

Body Fluids and Circulation — Assignment 2

Class 11 Biology · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
(2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
(3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Blood — Composition and Functions

1. State two functions of blood.
2. Name the three types of blood cells and give one function of each.
3. Describe the composition of blood.

Lymph

1. State two functions of lymph.
2. How does lymph differ from blood?
3. Describe the composition and functions of lymph.

Blood Groups — ABO and Rh Systems

1. Explain the ABO blood group system.
2. Why is blood group O called the universal donor?
3. Describe the ABO and Rh blood grouping systems.

Coagulation of Blood

1. State the steps of blood clotting.
2. What is the role of platelets in clotting?
3. Describe the mechanism of blood coagulation.

The Human Heart — Structure and Cardiac Cycle

1. State the events of the cardiac cycle.
2. What is the role of the SA node?
3. Describe the structure of the human heart.

Double Circulation and ECG

1. Distinguish between pulmonary and systemic circulation.
2. What is the significance of double circulation?
3. Explain double circulation with a schematic.

Disorders of the Circulatory System

1. Distinguish between hypertension and hypotension.
2. State two disorders of the circulatory system.
3. Describe the disorders of the circulatory system.

Part B — Integrated problems (multi-topic)

1. Describe the composition of blood, naming the plasma proteins and the formed elements.
2. State the functions of lymph and explain how it differs from blood.
3. Explain the ABO and Rh blood group systems and their importance in transfusion.
4. Describe the mechanism of blood coagulation.
5. Describe the structure of the human heart and the events of the cardiac cycle.
6. Explain double circulation, and describe the waves of a normal ECG.

Answer Key

Blood — Composition and Functions

Functions: transport of O₂, CO₂, nutrients, hormones and wastes, and defence and temperature regulation. Blood cells: RBCs (oxygen transport), WBCs (defence) and platelets (clotting). Blood is a fluid connective tissue with plasma (~55%) and formed elements (~45%); plasma contains albumin, globulins and fibrinogen plus water, salts and nutrients.

Lymph

Functions of lymph: it returns tissue fluid to the blood and transports fats and fat-soluble vitamins. Lymph differs from blood in lacking RBCs and having less protein. Lymph is the tissue fluid that drains into lymph vessels; it is similar to plasma but has less protein and no RBCs.

Blood Groups — ABO and Rh Systems

The ABO system is based on A and B antigens on RBCs and the corresponding antibodies in plasma: A (A antigen, anti-B), B (B antigen, anti-A), AB (both antigens, no antibodies) and O (no antigens, both antibodies). O is the universal donor because its RBCs carry no A/B antigens. The Rh system is based on the D antigen: Rh⁺ has it, Rh⁻ lacks it.

Coagulation of Blood

Steps: platelets release factors; a series of reactions converts prothrombin to thrombin; thrombin converts fibrinogen to fibrin, which forms the clot. Platelets adhere to the injured site and release clotting factors. Injury → platelets + factors → thrombin → fibrinogen to fibrin → clot.

The Human Heart — Structure and Cardiac Cycle

Cardiac cycle events: atrial systole, ventricular systole and joint diastole, producing the first and second heart sounds. The SA node (pacemaker) initiates the heartbeat. The heart has four chambers: right atrium and ventricle (deoxygenated blood) and left atrium and ventricle (oxygenated blood), with valves (tricuspid, bicuspid, semilunar) ensuring one-way flow.

Double Circulation and ECG

Pulmonary circulation: heart → lungs → heart; systemic circulation: heart → body → heart. Double circulation ensures oxygenated and deoxygenated blood do not mix, allowing efficient oxygen supply. Double circulation: blood passes twice through the heart per cycle — pulmonary (right side to lungs and back) and systemic (left side to body and back). Heartbeat rate ~72/min.

Disorders of the Circulatory System

Hypertension: high blood pressure; hypotension: low blood pressure. Two disorders: hypertension and angina. Hypertension is persistently high blood pressure ($\geq 140/90$ mm Hg); angina is chest pain due to reduced oxygen supply to the heart muscle; other disorders include heart failure, thrombosis and haemophilia.

Integrated problems

1: Plasma (albumin, globulins, fibrinogen) + RBCs, WBCs, platelets. 2: Lymph returns tissue fluid and carries fats; it has no RBCs and less protein than blood. 3: A/B/AB/O antigens and antibodies; O has no antigens (universal donor); Rh = D antigen. 4: Injury → platelets/factors → prothrombin to thrombin → fibrinogen to fibrin → clot. 5: Four chambers; SA node pacemaker; atrial systole, ventricular systole, joint diastole. 6: Pulmonary (heart–lungs) + systemic (heart–body) circulation; ECG: P (atrial depolarisation), QRS (ventricular depolarisation), T (ventricular repolarisation).