

Brain Builders Coaching Center

Class-X ICSE

Circulatory System

Body Fluids

Need for Transport Inside the Body

- Every organ requires body fluids for:
 - Digestion & nutrient transport
 - Oxygen & CO₂ exchange
 - Removal of wastes (excretory system)
 - Hormone distribution (endocrine system)

Fluids in Our Body

- **Blood** – Circulates in blood vessels (arteries, veins, capillaries)
- **Tissue Fluid** – Surrounds cells; allows exchange between blood and cells
- **Lymph** – In lymph vessels & organs (spleen, tonsils)

The Circulatory System

The Blood

- **Always in motion**
- **Colour:** Bright red in arteries, dark red in veins
- Blood is slightly alkaline (pH 7.3 – 7.45)

Functions of Blood

A. Transport:

1. Nutrients (digested food)
2. Oxygen ($\text{Hb} + \text{O}_2 \rightarrow \text{Oxyhaemoglobin}$)
3. CO₂ (as carbaminohaemoglobin)
4. Excretory wastes
5. Hormones
6. Heat

B. Protection:

1. Clotting (prevents blood loss)
2. WBCs fight infection
3. Antitoxins/antibodies neutralize poisons

Composition of Blood

- **Plasma** (55-60%): Water (90-92%), proteins (7-8%), salts (1%), hormones, enzymes
- **Cellular Elements** (40-45%):
 1. RBCs (erythrocytes)
 2. WBCs (leukocytes)
 3. Platelets (thrombocytes)

Clotting of Blood

- **Process:**
 - Injured cells + platelets release thrombokinase
 - Converts prothrombin → thrombin
 - Thrombin converts fibrinogen → fibrin → forms clot
- Platelets are crucial
- Low platelet count → slow/no clotting (e.g., dengue fever)

Blood Transfusion and Blood Groups

- Based on **ABO system** and **Rh factor**
- **Universal Donor:** O
- **Universal Recipient:** AB
- **Rh-positive:** Has Rh antigen
- **Rh-negative:** No Rh antigen
- **Importance:** Prevents mismatched transfusions

Blood Circulatory System

- Consists of: **Heart, blood vessels (arteries, veins, capillaries)**

Circulation of Blood in the Heart

- Blood flows from **atria** → **ventricles**
- **Heart valves** ensure one-way flow
 - Tricuspid, bicuspid (AV valves)
 - Semilunar valves (pulmonary & aortic)

Heart Beat

- One cycle = atrial systole + ventricular systole
- About **1,03,680 times/day**

Pacemaker

- **Sino-atrial node (SAN)** – initiates heartbeat
- Found in right atrium
- Controls rhythm with electrical impulses

The Blood Vessels

- **Arteries:** Thick-walled, carry blood away from heart, pulse felt
- **Veins:** Thin-walled, carry blood to heart, have valves
- **Capillaries:** Thin, allow exchange of gases and nutrients

Two Blood Circulations

1. **Pulmonary Circulation** – Between heart & lungs
2. **Systemic Circulation** – Between heart & rest of the body

Double circulation – blood passes through heart twice per cycle

Hepatic Portal System

- Blood from stomach/intestines goes to liver first via **hepatic portal vein**
- Liver regulates nutrients and detoxifies

The Pulse

- **Pulse** = Expansion of artery wall due to heartbeat
- Normal adult rate: 72 bpm

Tissue Fluid and Lymph

- **Tissue Fluid:** Plasma that leaks out of capillaries
- **Lymph:** Part of leaked plasma enters lymph vessels
 - Cellular part: lymphocytes
 - Non-cellular: water, proteins, etc.

Functions of Lymph:

1. **Nutritive:** Reaches places where blood doesn't
2. **Drainage:** Removes excess fluid from tissues
3. **Absorption:** Absorbs fats from intestines
4. **Defence:** Carries lymphocytes

The Spleen

- Largest lymphatic organ
- Functions:
 1. Acts as **blood reservoir**
 2. Produces **lymphocytes**
 3. Destroys **worn-out RBCs**
 4. In embryo – produces RBCs

Examination of Blood Corpuscles

- Method to make a blood smear
- Use **Leishman stain**
- Observe under microscope to identify:
 - RBCs
 - WBCs (neutrophils, lymphocytes, eosinophils, basophils, monocytes)
 - Platelets

WBCs (Leukocytes)

- 5 types (Table 7.1):
 1. Neutrophils (62%) – phagocytosis
 2. Eosinophils – allergic reactions
 3. Basophils – release histamine
 4. Lymphocytes – produce antibodies
 5. Monocytes – become macrophages
- WBCs fight infections, form pus, live ~2 weeks

RBCs (Erythrocytes)

- Small, biconcave, no nucleus
- Contain haemoglobin (Hb)
- Life span ~120 days
- Destroyed in spleen/liver/bone marrow
- In embryo, formed in liver/spleen

Platelets (Thrombocytes)

- Help in blood clotting
- Lifespan: 3–5 days
- Formed in bone marrow from megakaryocytes

Differences Between Arteries and Veins

Feature	Arteries	Veins
Direction of flow	Carry blood away from the heart	Carry blood towards the heart
Type of blood carried	Mostly oxygenated blood (except pulmonary artery)	Mostly deoxygenated blood (except pulmonary vein)
Wall thickness	Thick, muscular, and elastic	Thin, less muscular
Pressure	Blood flows under high pressure	Blood flows under low pressure
Valves	No valves (except in pulmonary artery)	Valves present to prevent backflow
Lumen (inner diameter)	Narrow lumen	Wider lumen
Pulse	Pulse can be felt	No pulse

Blood Plasma vs. Serum

Feature	Plasma	Serum
Definition	Liquid part of blood with clotting factors	Plasma minus clotting factors
Fibrinogen	Present	Absent
Function	Helps in transport + clotting	Used in diagnostic tests

RBCs vs. WBCs

Feature	RBCs (Erythrocytes)	WBCs (Leukocytes)
Nucleus	Absent	Present
Function	Transport oxygen and CO₂	Fight infections
Shape	Biconcave disc	Irregular or varied
Count	More numerous	Fewer in number

Lifespan	~120 days	~2 weeks
Pigment	Contain haemoglobin	No pigment

Brain Builders Coaching