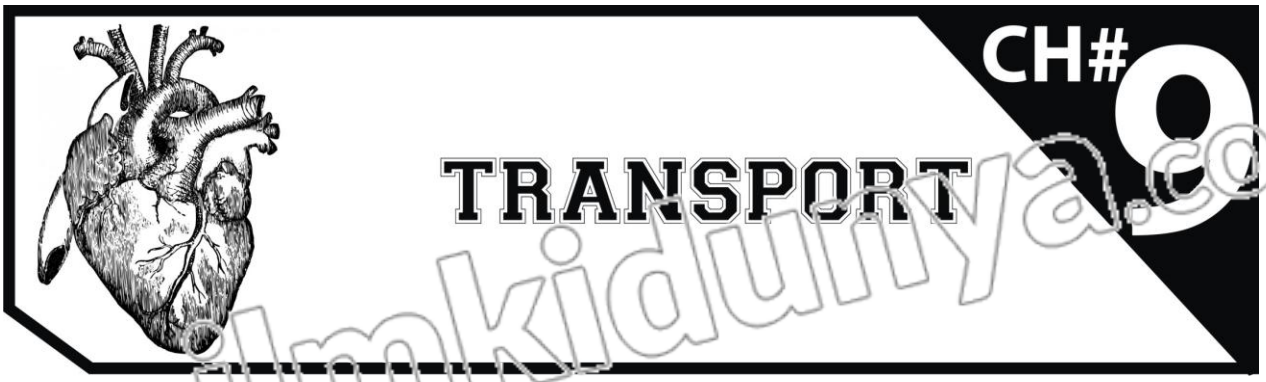


9.1 TRANSPORT IN PLANTS

LONG QUESTIONS

Q.1 How water and other ions are taken up from roots to other parts of plant? Explain.

(U.B) **(Ex Q. No 1)**

Ans:

WATER AND ION UPTAKE

Functions of Roots:

In addition to anchor the plant, roots perform two other vital functions. These are:

- **They absorb water and salts from soil.**
- **They provide conducting tissues for distributing these substances to the tissues of stem.**

INTERNAL STRUCTURE OF ROOT

Vascular Tissues:

The conducting tissues (xylem and phloem) of the root are grouped in the centre to form a rod-shaped core. This rod extends throughout the length of the root.

Pericycle:

Outside the conducting tissues, **there is a narrow layer of thin-walled cells, the pericycle.**

Endodermis:

A single layer of cells called endodermis surrounds the pericycle.

Cortex:

External to endodermis, **there is a broad zone of cortex**. It **consists of large** and **thin-walled cells**.

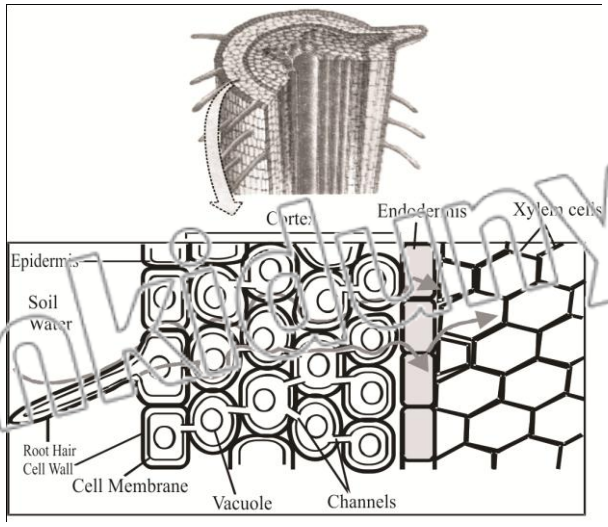


Figure: Uptake of Water and Ions by Root

Epidermis:

The **cortex is bounded on outside by a single layer of epidermal cells**.

Root Hairs:

Roots **have clusters of tiny root hairs**. These are **actually the extensions of epidermal cells.**

Function:

Root hairs provide **a large surface area for absorption**. They **grow out into the spaces between soil particles** where they are in direct contact with water.

MECHANISM OF TRANSPORTATION

Movement of Water into Root Hairs:

The **cytoplasm of root hairs has higher concentration of salts than the soil water**, so water moves by osmosis into the root hairs.

Movement of Salts into Root Hairs:

Salts **enter root hairs by diffusion or active transport.**

Entry into Xylem Tissues:

After their entry into the root hairs, **water and salts travel through intercellular spaces** or through cells (via channels, called plasmodesmata) and **reach xylem tissue**. Once in xylem, water and salts are carried to all the aerial parts of plant.

Q.2 Write a note on transpiration. ***(Knowledge Base)*** **(Ex Q. No 2) (LHR 2012)**

Ans:

TRANSPIRATION

Definition:

"The loss of water from plant surface through evaporation is called transpiration."

Types of Transpiration:

There are three types of transpiration:

i. **Stomatal transpiration**
ii. **Cuticular transpiration**
iii. **Lenticular transpiration**

i. Stomatal Transpiration:

Most of the transpiration occurs through stomata of the leaves and is called stomatal transpiration.

Mechanism

- The **mesophyll cells of leaf provide large surface area** for the evaporation of water.
- **Water is drawn from xylem into mesophyll cells,** from where it comes out and makes a water film on the cell walls of mesophyll cell.
- From here, **water evaporates into air spaces of the leaf.**
- **Water vapours then diffuse from air spaces** towards the stomata and then pass to outside air.

ii. Cuticular Transpiration:

The **transpiration which is through the cuticle present on the leaf epidermis**

iii. Lenticular Transpiration:

The **transpiration which is through special openings** called lenticels present on the stems of some plants.

Quantity of Transpired Water:

Roughly **90% of the water that enters a plant** is lost via transpiration.

Q.3 Describe the mechanism of opening and closing of stomata. ***(Knowledge Base)*** **(LHR 2016)**

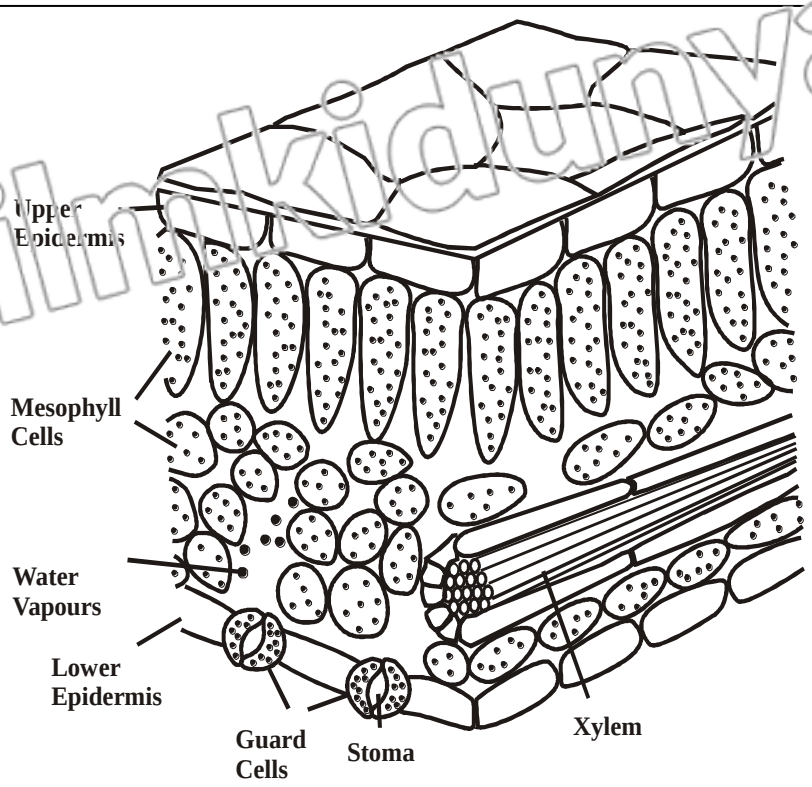


Figure: Events of Transpiration shown in the Section of a Leaf

Ans:

OPENING AND CLOSING OF STOMATA

Most plants keep their stomata open during the day and close them at night.

Structure of Stomata:

The **two guard cells of a stoma are attached to each other at their ends**. The inner concave sides of guard cells that enclose a stoma are thicker than the outer convex sides.

Function:

Stomata regulate transpiration by the action of guard cells.

Opening of Stomata:

When the **guard cells get water** and **become turgid**, **their shapes are like two beans** and the stoma between them opens.

Closing of Stomata:

When **guard cells lose water and become flaccid**, their inner sides touch each other and **the stoma closes.**

Role of Glucose:

The **concentration of solutes** (glucose) **in guard cells is responsible for the opening and closing of stomata**.

Role of Potassium Ions:

Recent studies have revealed that light **causes the movement of potassium ions from epidermal cells into guard cells.**

During Daylight:

Light causes the movement of potassium ions from epidermal cells into guard cells. Water follows these ions and enters guard cells. Thus their turgidity increases and stoma opens. As the day progresses guard cells make glucose and become hypertonic. So water stays in them.

At Night:

At the end of the day, **potassium ions flow back from guard cells to the epidermal cells and the concentration of glucose also falls**. Due to it, water moves to epidermal cells and guard cells lose turgor. It causes closure of stomata.

Opening of Stomata at Night:

Some plants open their stomata at night when the overall water stress is low.

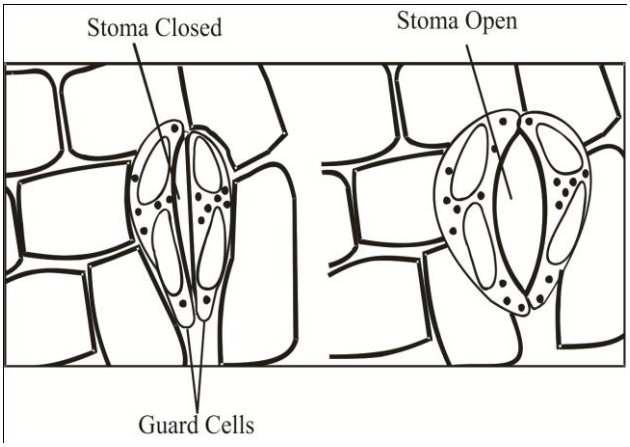


Figure: Opening and Closing stoma

Q.4 Describe the factors affecting the rate of transpiration. ***(Application Base)*** **(Ex Q. No 3)**
(GRW 2012, 2014, 2015, LHR 2013, 2014, FSD 2014, SGD 2014, DGK 2015)

Ans: **FACTORS AFFECTING RATE OF TRANSPIRATION**

The factors which affect the rate of transpiration are as follow:

i. **Light**
ii. **Temperature**
iii. **Humidity**
iv. **Wind**
v. **Leaf surface area**

i. Light:

The **rate of transpiration is directly controlled by the opening and closing of stomata** and it is under the influence of light. In strong light the rate of transpiration is very high as compared to dim or no light.

ii. Temperature.

High temperature **reduces the humidity of the surrounding air and also increases the kinetic energy of water molecules**. In this way it increases the rate of transpiration. The rate of transpiration doubles with every 10 ^{o}C rise in temperature.

Very High Temperature:

Very high temperature i.e. **40-45 ^{o}C causes closure of stomata,** so transpiration stops and the plant does not lose much needed water.

iii. Humidity:

Dry Air:

When air is dry, **water vapours diffuse more quickly from the surface of mesophyll cells** into leaf air spaces and then from air spaces to outside. This increases in the rate of transpiration.

Humid Air:

In humid air, the **rate of diffusion of water vapours is reduced** and the **rate** of **transpiration is low**.

iv. Wind:

Wind (air in motion) **carries the evaporated water from leaves** and **it causes an increase in the rate of evaporation from the surfaces** of mesophyll. When air is still, the rate of transpiration is reduced.

v. Leaf Surface Area:

The **rate of transpiration also depends upon the surface area of the leaf**. More surface area provides more stomata and there is more transpiration.

Q.5 Describe the significance of transpiration. ***(A.B)*** **(Ex Q. No 4) (SGD 2015, RWP 2015)**

Ans:

SIGNIFICANCE OF TRANSPIRATION

Necessary Evil:

Transpiration is called a necessary evil. It means that transpiration is a potentially harmful process but is unavoidable too.

Disadvantages:

Transpiration **may be a harmful process in the sense that during the conditions of drought, loss of water from plant results in:**

- Serious desiccation
- Wilting
- Often death

Advantages:

On the other hand, transpiration is necessary too in the following ways:

Transpirational Pull:

It **creates a pulling force called transpirational pull**, which is principally **responsible for the conduction of water** and salts from roots to the aerial parts of plant body.

Cooling Effect:

When **water transpires from the surfaces of plant, it leaves a cooling effect on plant**. This is especially important in warmer environments.

Gaseous Exchange:

The **wet surfaces of leaf cells allow** gaseous exchange.

Q.6 Describe transport of water in plants. ***(Knowledge Base)*** **(Ex Q. No 5) (LHR 2014, DGK 2015)**

Ans:

TRANSPORT OF WATER

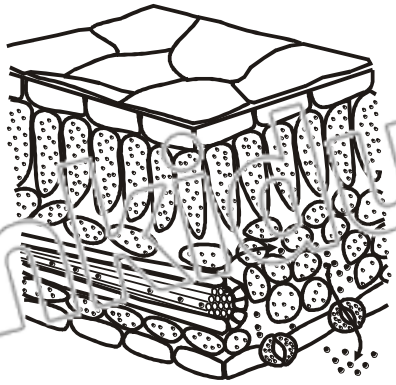
Introduction:

The **process by which water is raised to considerable heights** in plants has been studied for years in botany. The result of this research is "Cohesion-Tension Theory".

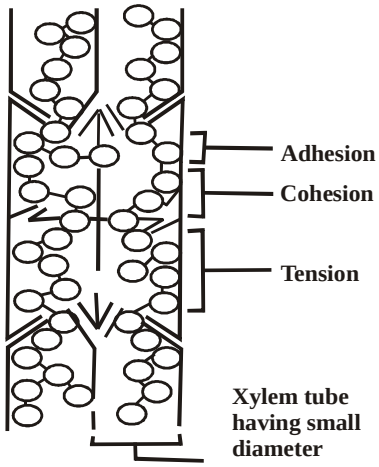
COHESION-TENSION THEORY

Statement:

According to this theory, the **force which carries water** (and dissolved materials) **upward through the xylem is transpirational pull**. Transpiration **creates a pressure difference** that pulls water and salts up from roots.



Transpiration



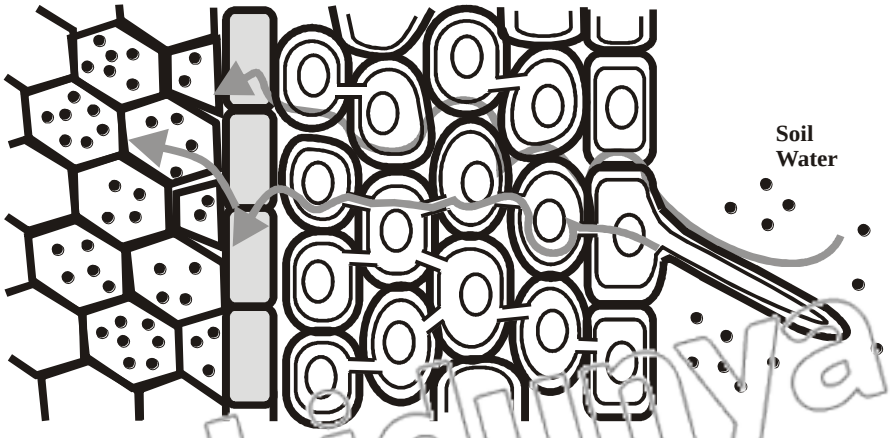


Figure: Transport of Water

Explanation:

When a **leaf transpires** (loses water), **the water concentration of its mesophyll cells drops**. This drop causes water to move by osmosis from the xylem of leaf into mesophyll cells.

Transpirational Pull:

When one water molecule moves up in the xylem tissue of leaf, it creates a pulling force that continues all the way to the root. This pulling force **created by the transpiration of water is called transpirational pull.** It also causes water to move transversely, from root epidermis to cortex and pericycle.

Reasons of Transpiration Pull:

Following are the reasons for the creation of transpiration pull:

i. Xylem Diameter:

Water held in a tube (xylem) **has a small diameter**.

ii. Adhesion:

Water molecules adhere to the walls of xylem tube, this phenomenon is called adhesion.

iii. Cohesion:

Water molecules cohere to each other, this phenomenon is called cohesion.

Formation of Water Column:

These **attractions make an overall tension among water molecules**. This **tension forms columns of water**. The columns of water move from root to shoot and the water content of the soil enters in these columns.

Direction of Water Flow:

Xylem **is a one way street from the root to the leaves** for water and salts.

Q.7 Describe transport of food in plants. ***(U.B)*** **(Ex Q. No 6)** **(GRW 2012, FSD 2015)**

Ans:

TRANSPORT OF FOOD

Phloem:

Phloem is responsible **for transporting food substance throughout plant body.**

Formation of Sucrose:

The **glucose formed during photosynthesis in mesophyll cells**, is **used in respiration** and the **excess of it is converted into sucrose**. In most plants, the food is transported in the form of sucrose.

PRESSURE-FLOW MECHANISM

Introduction:

The movement of food in plants has been studied for years. The currently accepted hypothesis states that transport of food is through pressure-flow mechanism.

Movement of Food:

In **pressure-flow mechanism, the food is moved from sources to sinks.**

Sources:

Sources include the exporting organs, typically:

- **A mature leaf**
- **A storage organ**

Sinks:

Sinks are areas of active metabolism or storage, such as:

- **Roots**
- **Tubers**
- **Developing fruits and leaves**
- **Growing regions**

Storage Organ:

A storage organ is **capable of storing food and exporting the stored materials.**

Example:

The root of beet is a sink in first growing season, but becomes source in the next growing season, when sugars are utilized in the growth of new shoots.

Explanation:

At the source end:

At source, **food** (sugars) **is moved by active transport into the sieve tubes of phloem**. Due to the presence of sugar in sieve-tubes, their solute concentration increases and water enters them from xylem via osmosis. **This results in a higher pressure of water in these tubes, which drives the solution of food towards sink.**

At the sink end:

The **food is unloaded by active transport**. Water also exits from the sieve tubes. The exit of water decreases pressure in sieve tubes, which causes a **mass flow from the higher pressure at the source to the lowered pressure at the sink.**

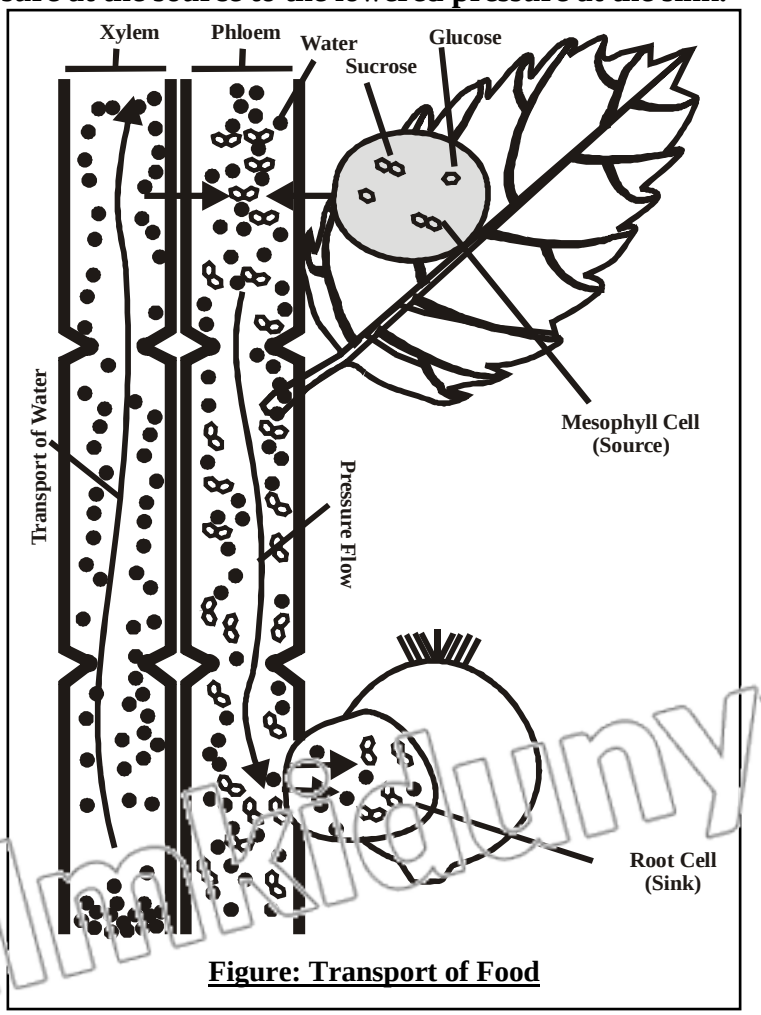


Figure: Transport of Food

Direction of Transport:

Xylem is a one way street from roots to leaves for water and salts. **Phloem is a two way street for food**. The direction of the movement of food is decided by demand and supply in sinks and sources.

SHORT QUESTIONS (Topic 9.1)

Q.1 Give the importance of water in plants. ***(K.B)***

Ans: Page No. 293

Q.2 What types of functions are performed by roots? ***(K.B)***

Ans: Page No. 289

Q.3 Why the cells are regarded as units of life? ***(U.B)***

Ans:

CELLS AS UNITS OF LIFE

Cells are the primary sites for metabolic processes. That is why they are regarded as the 'units of life'.

Q.4 Why there is a need for a transport system? ***(U.B)***

Ans: In order to run their metabolism, cells need some materials from environment and also need to dispose some materials into environments. For this purpose, there should be a transport system to and from cells.

Q.5 Why materials are transported to and from cells? ***(U.B)***

Ans:

TRANSPORT OF MATERIALS ACROSS CELLS

Complex metabolic reactions occur in living organisms. In order to run their metabolism, cells need some materials from the environment and also need to place some materials into the environment. For this purpose, materials are transported to and from cells.

Q.6 What is the role of micro-organisms in the absorption by plant? ***(U.B)***

Ans:

ROLE OF MICRO-ORGANISM

Plants also form beneficial relationship with soil bacteria and

Q.7 What is the limitation of phenomenon of diffusion for transport? ***(U.B)***

Ans:

LIMITATIONS OF DIFFUSION

One method for the movement of molecule is diffusion but it alone cannot fulfill the needs. It takes much time for materials in solution to diffuse even a few inches.

Q.8 Why diffusion can work efficiently in unicellular and simple multicellular organisms? ***(U.B)***

Ans:

EFFICIENCY OF DIFFUSION

Diffusion can work only in unicellular and simple multicellular organisms because every corner of their body is in close and direct contact with the environment.

Q.9 Why diffusion cannot work efficiently in complex multicellular organisms? ***(U.B)***

Ans:

DIFFUSION IN MULTICELLULAR ORGANISMS

In complex multicellular bodies, cells are far apart from the environment and such bodies need a comprehensive system for the transport of materials.

Q.10 What are the functions of roots in plants? ***(A.B)***

Ans: Page no 289.

Q.11 What is the difference between xylem and phloem tissues? ***(K.B)***

Ans:

DIFFERENTIATION

The differences between xylem and phloem tissues are as follows:

Xylem Tissue	Phloem Tissue
Function	
Xylem tissue is responsible for the transport of water and dissolved substances from roots to aerial parts.	Phloem tissue is responsible for the conduction of dissolved organic matter (food) between different parts of plant body.
Composition	
It consists of vessel elements and tracheids.	It consists of sieve tube cells and companion cells.

Q.12 Discuss role of root hairs in plants for water and ion uptake. *(A.B)*
Ans: Page no 290.
Q.13 Define transpiration. *(K.B)*
(LHR 2012, GRW 2015, DGK 2014, SWL 2015, BWP 2015, FSD 2014, SGD 2015)
Ans: Page no 290.
Q.14 Define stomatal transpiration. *(K.B)* **(LHR 2014, GRW 2015, DGK 2015)**
Ans: Page no 290.
Q.15 How air movement affects rate of transpiration? *(U.B)* **(LHR 2012)**
Ans: Page no 292.
Q.16 Which factors affect the rate of transpiration? *(A.B)* **(SWL 2014, LHR 2015)**
Ans: Page no 292.
Q.17 Define Transpiration pull. *(K.B)*
Ans: Page no 295.
Q.18 Why transpiration is known as necessary evil? *(U.B)* **(GRW 2014)**
Ans: Page no 290.
Q.19 What is cohesion tension theory? *(K.B)*
(LHR 2012, 2015, SWL 2014, 2015, RWP 2014, SGD 2015)
Ans: Page no 295.
Q.20 Define transpiration pull. *(K.B)*
Ans: Page no 295.
Q.21 What is the effect of water stress in plants? *(A.B)*
Ans: **EFFECT OF WATER STRESS IN PLANTS**
There is strong evidence that even mild water stress results in reduced growth rate in plants.
Q.22 What are reasons for creation of transpirational pull? *(U.B)*
Ans: Page no 295.
Q.23 How food is transported in different parts of plants? *(K.B)*
Ans: Page no 295.
Q.24 Differentiate between source and sink? *(K.B)*
Ans: Page no 295.
Q.25 Give an example that plants need a lot of water. *(K.B)*
Ans: Page no 295.

MULTIPLE CHOICE QUESTIONS (Topic 9.1)

1. Cells are the Primary sites for the: *(K.B)*
(A) Anabolic Process (B) Metabolic Process
(C) Catabolic Process (D) Photosynthesis
2. Xylem tissues are responsible for the transport of: *(K.B)*
(A) Sugar (B) Mineral
(C) Water & dissolved substance (D) Food
3. All land plants except _____ have developed complex vascular system. *(U.B)*
(A) Flowering Plants (B) Angiospermic Plants
(C) Gymnospermic Plants (D) Moses and liverworts
4 The outermost layer of the root: *(K.B)*
(A) Endodermis (B) Cortex
(C) Pericycle (D) Epidermis

5. Root performs vital function such as: *(A.B)*
(A) They absorb water and salts from soil (B) Provide conducting tissue
(C) They anchor the plant (D) All

6. Root hairs actually the extension of: *(K.B)*
(A) Epidermal Cells (B) Endodermal cells
(C) Xylem cells (D) Phloem cells

7. Roughly how much of water that enters a plant is lost via transpiration? *(A.B)*
(A) 50% (B) 70%
(C) 80% (D) 90%

8. In order to increase the absorption of minerals plants also form a _____ beneficial relationship with. *(A.B)*
(A) Soil bacteria (B) Fungi
(C) Alage (D) Both a and b

9. _____ provide large surface area for the evaporation of water.
(A) Mesophyll cell (B) Epidermal cell
(C) Endodermal cell (D) Cells of cortex

10. Transpiration from plant surface takes place through: *(K.B)* **(MTN 2015)**
(A) Cuticle (B) Stomata
(C) Lenticels (D) All of these

11. The roots and root hairs absorb water from soil by: *(K.B)* **(RWL 2015)**
(A) Osmosis (B) Diffusion
(C) Phloem (D) Filtration

12. After the entry into root hair, water and salts travels through cells via channels and reach xylem cells through: *(U.B)*
(A) Endodermis (B) Epidermis
(C) Plasmodesmata (D) Cortex

13. The rate of transpiration doubles with every rise of temperature. *(U.B)*
(A) 10ºC (B) 20 ºC
(C) 30ºC (D) 40 ºC

14. The temperature range at which transpiration stops: *(A.B)* **(FSD 2015)**
(A) 40ºC-45ºC (B) 10ºC-20ºC
(C) 20ºC-40ºC (D) 20ºC-45ºC

15. Transpiration rate depends upon: *(U.B)* **(GWL 2014)**
(A) Leaf surface area (B) Water content
(C) Temperature (D) All of these

16. The rate of transpiration doubles with every rise of _____ in temperature. *(A.B)*
(A) 20 Co (B) 10 Co
(C) 5 Co (D) 25 Co

17. IN humid air the rate of transpiration is: *(U.B)*
(A) High (B) Low
(C) Normal (D) Not at all

18. In most plants, food is transported in the form of: *(K.B)* **(GRW 2015, DGK 2014)**
(A) Glucose (B) Sucrose
(C) Lactose (D) Maltose

19. Which part of plant is responsible for transporting food? ***(K.B)*** **(FSD 2014)**

(A) Xylem (B) Phloem
(C) Root (D) Leaf

20. According to the pressure-flow mechanism, the actual force behind the movement of food in phloem: ***(U.B)***

(A) Drop in the pressure at the sink end (B) Rise in the pressure at the sink end.
(C) Drop in the pressure at the source end. (D) Rise in the pressure at the source end.

9.2 TRANSPORT IN HUMAN

LONG QUESTIONS

Q.1 Write a note on blood. ***(K.B)*** **(Ex Q. No 7) (SWL 2015)**

Ans:

BLOOD

Connective Tissue:

Blood is a specialized body **fluid** (a connective tissue) that is composed of:

- A liquid called blood plasma
- Blood cells

Weight:

The weight of blood in our body is about **1/12th of our body.**

Volume:

The average adult body has about **five liters of blood**.

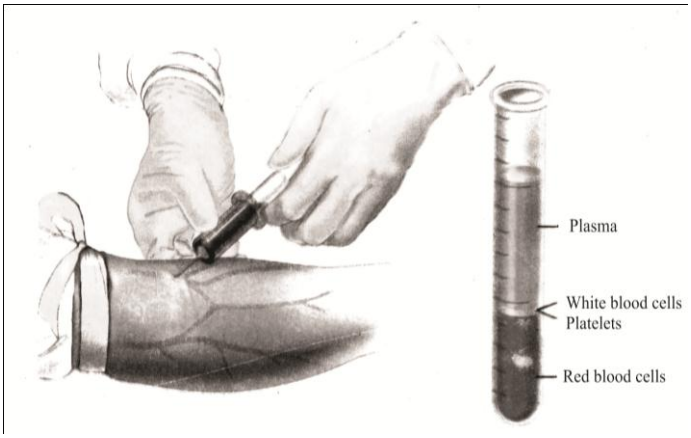


Figure: Percentage Composition of Human Blood

BLOOD PLASMA

Volume:

Plasma constitutes about **55% by volume of blood**.

Dissolved Substances:

Plasma is **mainly water** in which the following are dissolved:

- Proteins
- Salts
- Ions
- Metabolites
- Wastes

Percentage Composition:

- Water constitutes about **90-92%** of plasma.
- Dissolved substances constitute about **8-10%** of plasma.

Salts:

Salts make up **0.9% of the plasma by weight**. Sodium chloride (the table salt) and salts of bicarbonate are present in considerable amount.

Trace Elements:

The following trace elements are also found.

- Ca
- Mg
- Cu
- K
- Zn

pH:

Changes in the concentration of any salt can change the pH of blood. Normal **pH of blood is 7.4.**

Proteins:

Proteins make **7-9% by weight of plasma**. The important proteins present in plasma are:

- Antibodies
- Fibrinogen (blood clotting protein)
- Albumin (maintains the water balance of blood)

Other Substances:

Plasma also contains:

- Digested food (absorbed from digestive system)
- Nitrogenous wastes
- Hormones
- Respiratory gases (CO_2 and O_2)

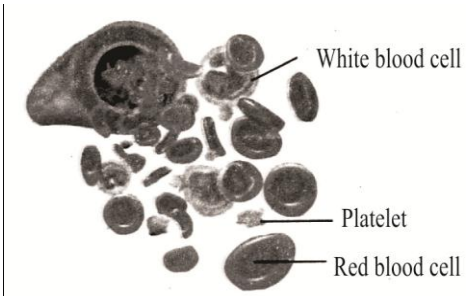


Figure: Different Cells and Cell-like Bodies in blood Plasma

RED BLOOD CELLS (ERYTHROCYTES)

Number:

RBCs are the **most numerous of all blood cells.**

In Males: A cubic millimeter of blood contains **5 to 5.5 million of RBCs in males.**

In Females: A cubic millimeter of blood contains **4 to 4.5 million of RBCs in females.**

Mature RBCs:

When RBCs are formed, they have a nucleus. In mammals, when a red blood cell matures, its nucleus is lost. After the loss of nucleus, RBC enters the blood.

Composition of Cytoplasm:
About 95% of the cytoplasm of RBCs is filled with haemoglobin. The remaining 5% consists of enzymes, salts and other proteins.

Function of Haemoglobin:
Haemoglobin transports oxygen and small amounts of carbon dioxide

Shape:
RBCs are **biconcave** and **have an elastic cell membrane.**

Production:
Embryonic Life: In embryonic and fetal life, they are **formed in liver and spleen**.
Adults: In adults, they are formed **in red bone marrow of short** and **flat bones** such as sternum, ribs and vertebrae.

Life Span:
Average life span of **RBC is about four months** (120 days). After which it breaks down in the liver and spleen by phagocytosis.

Rate of Destruction of RBCs:
In a normal person about **2-10 million RBCs are formed destroyed** every second.

WHITE BLOOD CELLS (LEUKOCYTES) (GRW 2014)

Colour:
Leukocytes are colourless because they do not contain pigments.

Migration:
WBC's are **not confined to blood vessels** and also **migrate out into the tissue fluid.**

Number:
One cubic millimeter of blood contains **7000 to 8000 WBCs.**

Life Span:
Their life **span ranges from months to even years**, depending on body's needs.

Function:
WBCs function as **main agents in body's defense system.**

Types:
Leukocytes are of two main types:

i. Granulocytes
ii. Agranulocytes

i. Granulocytes:
These **are the leukocytes with granular cytoplasm**.
These include:

Neutrophils:
Destroy small particles by phagocytosis.

Eosinophils:
Break inflammatory substances and kill parasites.

Basophils:
Prevent blood clotting.

ii. Agranulocytes:
These are the leukocytes with a clear cytoplasm.
These include:

Monocytes:
Produce macrophages which engulf germs.

B and T Lymphocytes:

Produce antibodies and kill germs.

Pus Formation:

WBCs **die in the process of killing the germs**. These **dead cells accumulate** and **make the white substance** called pus seen at the infection site.

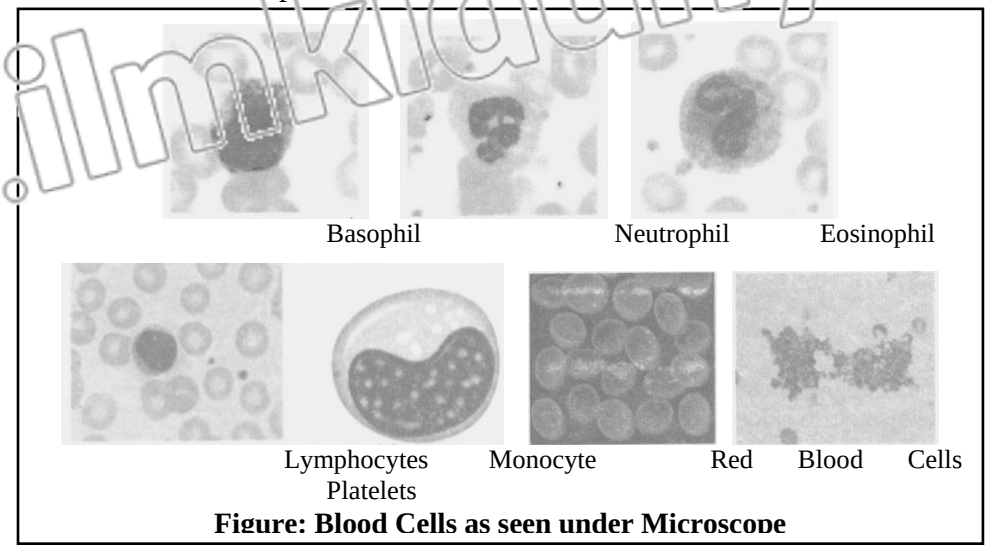


Figure: Blood Cells as seen under Microscope

PLATELETS (THROMBOCYTES)

Introduction:

They are not cells, but are fragments of large cells of bone marrow called megakaryocytes.

Nucleus:

They have no nucleus.

Pigment:

They have no pigment.

Number:

One cubic millimeter of blood contains **250,000 platelets.**

Life Span:

The average life span of a **blood platelet is about 7 to 8 days.**

Function:

Platelets **help in blood clotting**. The clot serves as a **temporary seal at the damaged area.**

Decrease in Dengue Fever:

In Dengue fever, there is a **sharp decrease in number of platelets blood**. Because of this, **patients bleed from nose, gums and under the skin.**

Q.2 Write a note on blood disorders. *(A.B)* (Ex Q. No 9) (DGK 2014, BWP 2014, SGD 2014, 2015)

Ans:

BLOOD DISORDERS

There are many types of blood disorders, including:

- Bleeding disorders
- Leukemia
- Thalassaemia

LEUKAEMIA (BLOOD CANCER)

Introduction:

Leukemia is the **production of a great number of immature** and abnormal white blood cells.

Cause:

This is caused **by a cancerous mutation** (change in gene) in bone marrow or lymph tissue cells.

Effect:

The mutation results **in an uncontrolled production of defective** white blood cells (leukocytes).

Treatment:

It is a **very serious disorder**. The blood needs to be changed regularly with normal blood **obtained from donors.**

Cure:

It can be **cured by bone marrow transplant**. It is effective in most cases, but very expensive treatment.

THALASSAEMIA

Meaning:

It is a Greek word.

- 'Thalassa' means 'sea'
- 'Haem' means 'blood'

Cooley's Anaemia:

It is also called Cooley's Anaemia **on the name of Thomas B.** Cooley, an American physician.

Cause:

It is a genetic problem due to **mutations in the gene of haemoglobin.**

Effect:

The mutation **results in the production of defective haemoglobin** and the **patient cannot transport oxygen properly.**

Treatment:

The blood of the patient is to **be replaced regularly with normal blood.**

Cure:

It can be cured **by bone marrow transplant** but it does not give **100% cure rate.**

Incidence of Thalassaemia:

There are about **60-80 million people in the world who carry thalassaemia**. India, Pakistan, and Iran **are seeing a large increase in thalassaemia patients**. Pakistan alone has 250,000 such patients. These patients **require blood transfusions for life-time.**

International Thalassaemia Day:

The world celebrates the **International Thalassaemia Day on 8th of May**. This day is dedicated to raise public awareness about thalassaemia and to highlight the importance of the care for thalassaemia patients.

Q.3 How blood is classified into groups? Discuss ABO blood group system.

(A.B) **Ex Q. No 8(LHR 2013, MTN 2014, 2015)**

Ans:

CLASSIFICATION OF BLOOD

Basis of Classification:

Blood group systems are a **classification of blood based on the presence or absence of antigens on the surface of red blood cells.**

Antigen:

An antigen is **a molecule that can stimulate an immune response** (antibody production etc.)

ABO BLOOD GROUP SYSTEM

It is the **most important blood group system** in humans.

Discovery:

It was discovered by the **Austrian scientist Karl Landsteiner**, who found four different blood groups (blood types) **in 1900.** He was awarded **Nobel Prize in Medicine** for his work.

Basis:

In this system, there **are four different blood groups** which are distinct from each other on the basis of specific antigens (antigen A and B) **present on the surface of RBCs**.

i. Blood Group A:

A person having antigen A has blood group A.

ii. Blood Group B:

A person having antigen B has blood group B.

iii. Blood Group AB:

A person having both antigens A and B has blood group AB.

iv. Blood Group O:

A person having none of the antigens A and B has blood group O.

Antibodies:

After birth, **two types of antibodies** i.e. **anti-A** and **anti-B antibodies** appear in blood serum of individuals.

These antibodies are **found according to the absence of corresponding antigen.**

Antigen and Antibody Relation:

Blood Group A:

In persons with blood group A, antigen A is present, so their blood will contain anti-B antibodies.

Blood Group B:

In persons with blood group B, antigen B is present, so their blood will contain no antibody.

Blood Group AB:

In persons with blood group AB, antigens A and B are present, so their blood will contain anti-B antibodies.

Blood Group O:

In persons with blood group O, neither antigen A nor antigen B is present. So their blood will contain both antibodies i.e. anti-A and anti-B antibodies.

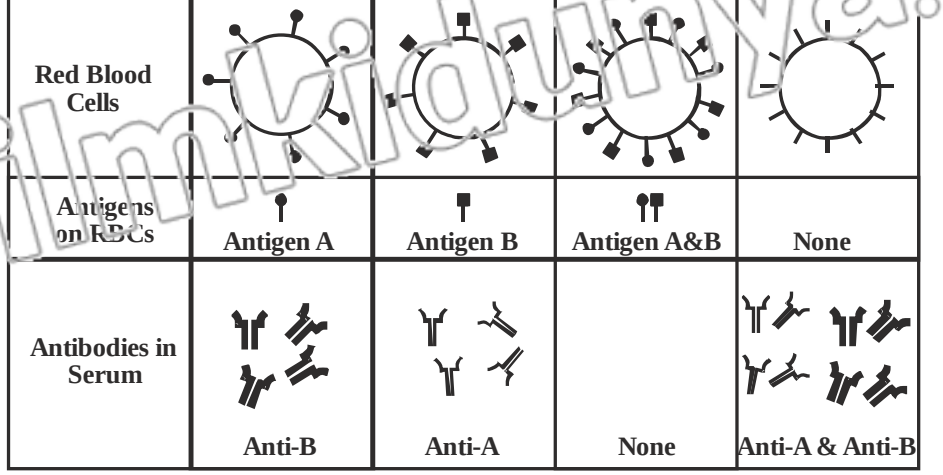


Figure: Presence and Absence of Antigens and Antibodies in ABO Blood Group System

Q.4 Describe blood transfusion in ABO blood group system. ***(A.B)***

Ans: **BLOOD TRANSFUSIONS IN ABO BLOOD GROUP SYSTEM**

Definition:

"The **process of transferring blood** or blood-based products **from one person into the circulatory system of another person** is called blood transfusion."

Advantages:

Blood transfusions **can be life-saving in some situations** such as:

- Massive blood loss due to injury
- Blood lost during surgery
- Anaemia
- Haemophilia
- Thalassaemia
- Sickle-cell disease

Caution:

A number of infectious diseases (such as AIDS, hepatitis B and hepatitis C etc) can pass from the affected blood donor to recipient. Before blood transfusion, the blood of donor is checked for the presence of germs etc.

Agglutination:

The **clumping of red blood cells in cases of mismatched blood groups** is called agglutination.

Transfusion:

Transfusion of blood is **done after confirming that no agglutination results in the blood of recipient.** If agglutination occurs, the clumped cells cannot pass through capillaries.

Compatibility:

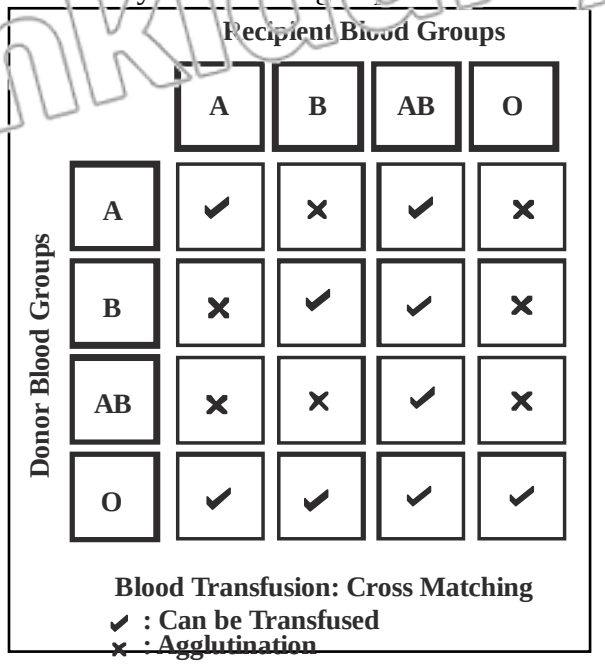
For the confirmation of no agglutination, **blood samples of donor** and **recipient are cross-matched** for compatibility. Antibodies of recipient's blood may destroy the corresponding antigen-containing RBCs of donor, or antibodies of donor's blood may destroy antigen-containing RBCs of recipient.

Universal Donors:

O blood group individuals are called universal donors because they can donate blood to the recipients of every other blood group.

Universal Recipients:

AB blood group individuals are called universal recipients because they can receive transfusions from donors of every other blood group.



Q.5 Write a note on Rh blood group system. ***(K.B)*** **Ex Q. No 8**

Ans:

Rh BLOOD GROUP SYSTEM

(+ve and –ve Blood Group Systems)

Introduction:

The **Rh blood group is also known as positive** (+ve) and **negative** (-ve) blood group system.

Discovery:

In 1930's, **Karl Landsteiner discovered Rh Blood group system.**

Rh Factors:

These **blood groups are distinct from each other on the basis of antigens** called Rh factors.

Discovery of Rh Factors:

These factors were **first discovered in Rhesus monkey**, present on the surface of RBCs.

Types of Blood groups

In this system, there are two blood groups:

i. Rh-positive Blood Group:

A **person having Rh factors** has blood group Rh-positive.

ii. Rh-negative Blood Group:

A **person without Rh factors has blood group Rh-negative**. Unlike the naturally occurring anti-A and anti-B antibodies of the ABO system, an Rh-negative person does not produce Anti-Rh antibodies unless Rh-factor enters in his/her blood.

Blood Transfusions of Rh-positive Blood Group:

Rh-positive blood group **can be transfused to Rh-positive recipient** because **recipient's blood** already has Rh-antigens and will not produce Anti-Rh antibody.

Blood Transfusions of Rh-negative Blood Group:

Rh-negative blood group **can be transfused to Rh-negative because donor's blood does not have Rh-antigen** and so the recipient's blood will not produce Anti-Rh antibody.

- If an Rh-negative person receives Rh-positive blood, he/she will produce anti-Rh antibodies against Rh-factors.
- Rh-negative blood can be transfused to an Rh-positive recipient, only if donor's blood (Rh-negative) has never been exposed to Rh-antigens, and does not contain any anti-Rh antibody.

Q.6 **Describe the structure and function of human heart in detail.** ***(K.B)***

Ex Q. No 10 (RWP 2015, LHR 2015, 2016)

Ans:

HUMAN HEART

Muscular Organ:

The heart is a **muscular organ responsible for pumping blood** through blood vessels by repeated contractions.

Cardiac Muscles:

The term 'cardiac' means **'related to the heart.** The bulk of the walls of heart chambers is made of cardiac muscles.

Location:

In human body, the heart is **situated between lungs**, in **the middle of chest cavity** (thorax), under breast bone.

STRUCTURE OF HUMAN HEART

Pericardium:

The **heart is enclosed in a** sac known as pericardium.

Pericardial Fluid:

There is a **fluid between the pericardium and heart walls,** called pericardial fluid.

Function: It **reduces friction between the pericardium** and **the heart** during heart contractions.

Cardiac Chambers:

Human heart consists of 4 chambers, like the heart of birds and other mammals.

- Two atria
- Two ventricles

Atria:

The **upper thin-walled chambers** are called left and right atria. The singular of atria is atrium.

Ventricles:

The **lower thick-walled chambers** are called left and right ventricles. The left ventricle is the largest and strongest chamber of the heart.

WORKING OF HUMAN HEART

Double Pump:

Human heart works as a double-pump. It **receives deoxygenated** (with less oxygen) **blood from body** and **pumps it to the lungs**. At the same time, **it receives oxygenated** (with more oxygen) **blood from lungs** and **pumps it to all the body.**

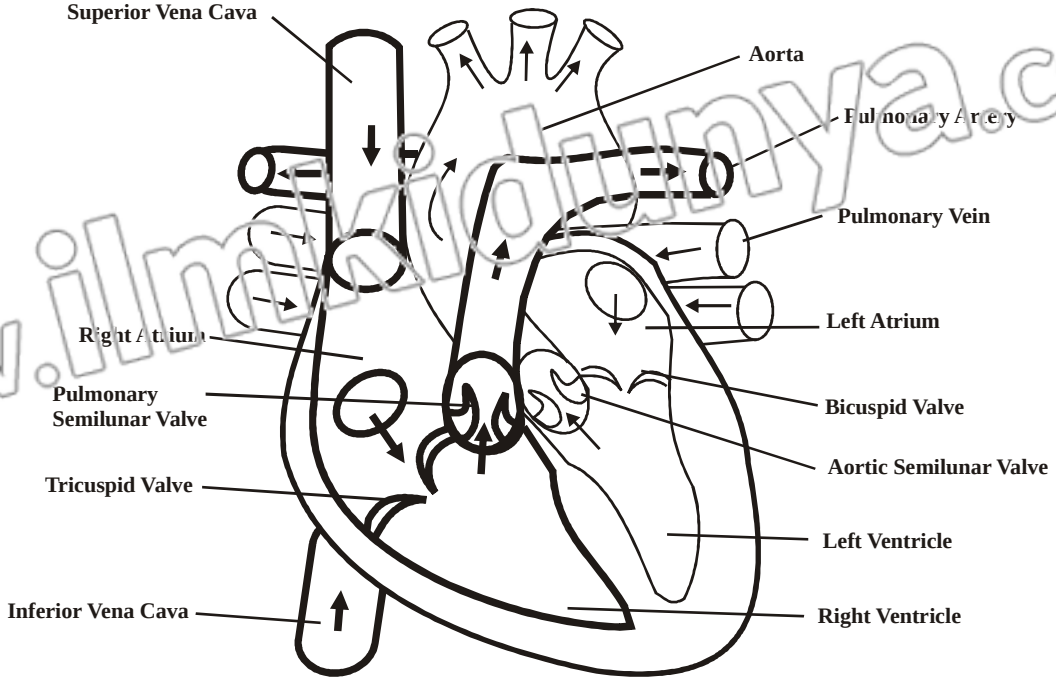


Figure: Human Heart; Structure and Blood Flow

Separation of Blood:

Inside heart chambers, the **deoxygenated and oxygenated bloods are kept separated.**

Blood to Right Atrium:

The **right atrium receives deoxygenated blood from body** via the main veins, i.e.: the superior and inferior vena cavae.

Contraction of Right Atrium:

When **the right atrium contracts, it passes the deoxygenated blood to the right ventricle.**

Tricuspid Valve:

The **opening between right atrium and right ventricle is guarded by a valve** known as tricuspid valve (because it has three flaps). Tricuspid valve prevents the backflow of blood from right ventricle to right atrium.

Contraction of Right Ventricle:

When right ventricle contracts, **the blood is passed to the pulmonary trunk**, which carries blood to the lungs.

Pulmonary Semilunar Valve:

At **the base of pulmonary trunk, pulmonary semilunar valve** is present.

Function: It **prevents the backflow of blood** from the pulmonary trunk to the right ventricle.

Blood to Left Atrium:

The **oxygenated blood from the lungs is brought by pulmonary veins** to left atrium.

Contraction of Left Atrium:

Left atrium contracts and **pumps this blood to left ventricle**.

Bicuspid Valve:

The **opening between left atrium and left ventricle is guarded by a valve** known as bicuspid valve (because it has two flaps).

Contraction of Left Ventricle:

When left ventricle contracts, it **pumps the oxygenated blood in aorta**, which carries blood to all parts of body, except lungs.

Aortic Semilunar Valve:

At the base of aorta, aortic semilunar valve is present.

Function: It **prevents the backflow of blood** from **aorta to the left ventricle**.

Simultaneous Contraction:

Both atria are filled simultaneously. They **contract together to pump the blood to both the ventricles**. Similarly, both ventricles contract simultaneously to pump blood out of the heart.

Q.7 Write a note on pulmonary and systemic circulation. ***(K.B)*** **(BWP 2015)**

Ans PULMONARY AND SYSTEMIC CIRCULATION

Deoxygenated Blood:

Right side of heart collects deoxygenated blood from body and distributes it to lungs.

Oxygenated Blood:

Left side collects oxygenated blood from lungs and distributes it to the body.

Pulmonary Circulation:

Definition:

"The pathway on which deoxygenated blood is carried from heart to lungs and in return oxygenated blood is carried from lungs to heart is called pulmonary circulation or circuit."

Proper Gaseous Exchange:

The blood in pulmonary circulation is at lower pressure than the blood in systemic circulation. It gives sufficient time to blood for gaseous exchange in lungs.

Systemic Circulation:

"The pathway on which oxygenated blood is carried from heart to body tissues and in return deoxygenated blood is carried from body tissues to heart is called systemic circulation or circuit."

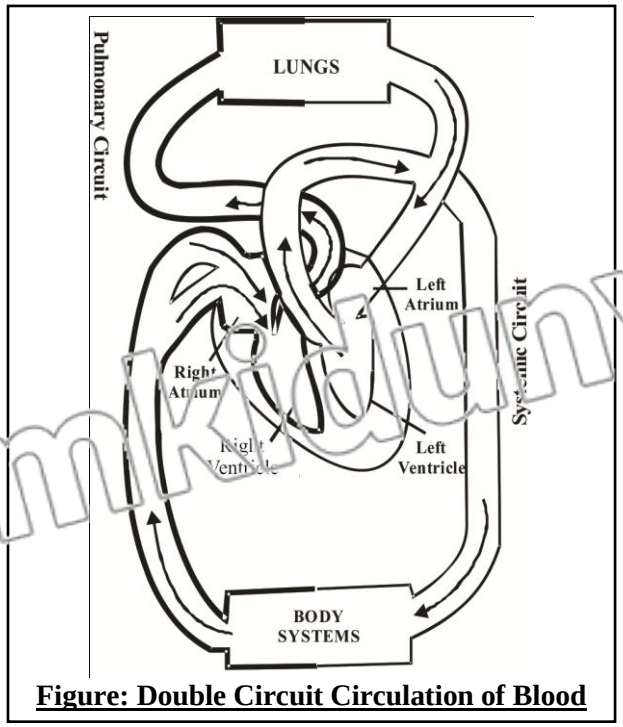


Figure: Double Circuit Circulation of Blood

Q.8 Write a note on heartbeat. ***(K.B)*** **(SWL 2014)**

Ans:

HEARTBEAT

Definition:

"The relaxation of heart chambers fills them with blood and contraction of chambers propels blood out of them. The alternating contractions and relaxations make up the cardiac cycle and one complete cardiac cycle makes one heartbeat."

Steps:

The complete cardiac cycle consists of the following steps:

i. Cardiac Diastole:

This is the **first phase in which the atria and ventricles relax** and blood is filled in atria.

ii. Atrial Systole:

Immediately after filling, **both atria contract and pump the blood towards ventricles**. This period in cardiac cycle is called atrial systole.

iii. Ventricular Systole:

Now, **both ventricles contract and pump the blood towards body and lungs.** The period of ventricular contraction is called ventricular systole.

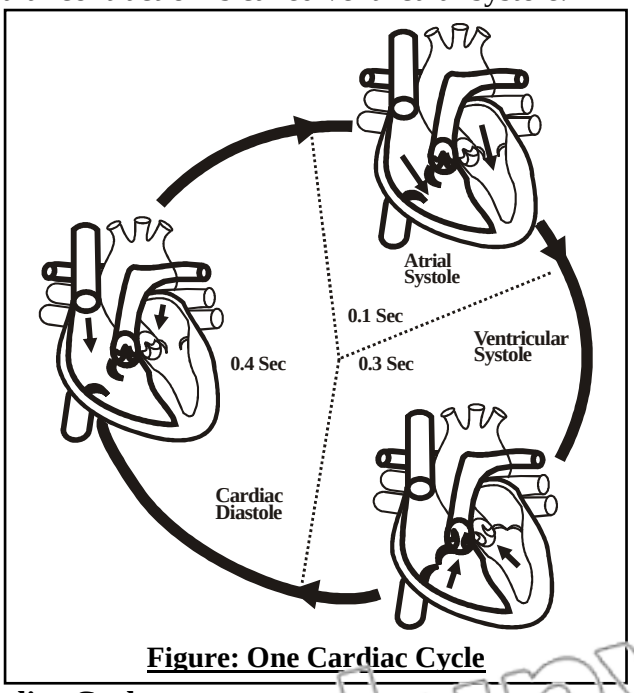


Figure: One Cardiac Cycle

Duration of Cardiac Cycle:

Total duration of one cardiac cycle is about 0.8 second, out of which

- Cardiac diastole lasts for about 0.4 second
- Atrial systole lasts for about 0.1 second
- Ventricular systole lasts for about 0.3 second

Lubb Sound:

When ventricles contract, the **tricuspid** and **bicuspid valves close and produce the sound 'Lubb'**

Dubb Sound:

When ventricles relax, **the semilunar valves close** and **produce the sound 'Dubb'.**

Hearing:

The **'Lubb-Dubb' sound can be heard with the help of a stethoscope.**

Q.9 Write a note on heart rate and pulse rate. ***(A.B)***

Ans:

HEART RATE

Definition:

"The number of times a heart beats per minute is called heart rate."

Normal Heart Rate:

At rest or during normal activities, **the heart rate is 70 times per minute in men** and **75 times per minute in women.**

Fluctuations:

The heart rate fluctuates a lot depending on factors such as:

- Activity level
- Stress level

Measurement:

Heart rate can be measured **by feeling the pulse**.

PULSE RATE

Definition:

"The rhythmic expansion and **contraction of an artery as blood is forced through it by the regular contractions of the heart is called pulse."**

Feeling of Pulse:

Pulse can be felt in the areas where an **artery is close to the skin**.

Examples:

- Wrist
- Neck
- Groin
- Top of the foot

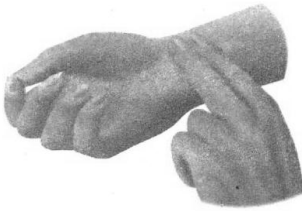


Figure: Method of taking Pulse

Measurement:

Most commonly, people measure **their pulse in their wrist.**

Q.10 Write a note on blood vessels. ***(K.B)***

BLOOD VESSELS

Introduction:

The **third part of blood circulatory system** is the blood vessels.

Function:

They **transport blood throughout the body**.

Types:

The most important blood vessels in the system are:

- Arteries
- Veins
- Capillaries

ARTERIES **(RWP 2014)**

Definition:

"The **blood vessels which carry blood away from the heart** are called arteries."

Blood Type:

In adults, **all arteries carry oxygenated blood with the exception of pulmonary arteries** that carry deoxygenated blood in them.

Structure:

The structure of arteries **is well adapted to their function**. The walls of an artery **are composed of three layers**:

- **The Outermost Layer:**
  It is **made up of connective tissue.**
- **The Middle Layer:**
  It **is made up of smooth muscles and elastic tissue.**
- **The Innermost Layer:**
  It is **made up of endothelial cells.**

Lumen:

The **hollow internal cavity in which blood flows** is called lumen.

Arterioles:

When **arteries enter body organs, they divide into smaller vessels** known as arterioles.

Capillaries:

Arterioles enter tissues and **divide into capillaries**.

CAPILLARIES

Definition:

"The **smallest blood vessels present in the tissues** are called capillaries."

Formation:

The capillaries are formed **by the division of arterioles**.

Structure:

The **walls of the capillaries are composed of only a single layer of cells** called endothelium.

Function:

The **exchange of materials between blood and tissue fluid** is carried out through capillaries.

Endothelium:

The endothelium is **so thin that molecules of digested food, oxygen, water etc. can pass through them** and enter tissue fluid. Waste products such as carbon dioxide and urea can diffuse from the tissue fluid into blood.

Size:

Capillaries **are so small that the red blood cells need to partially fold** into bullet-like shapes in order to pass through them in a single file.

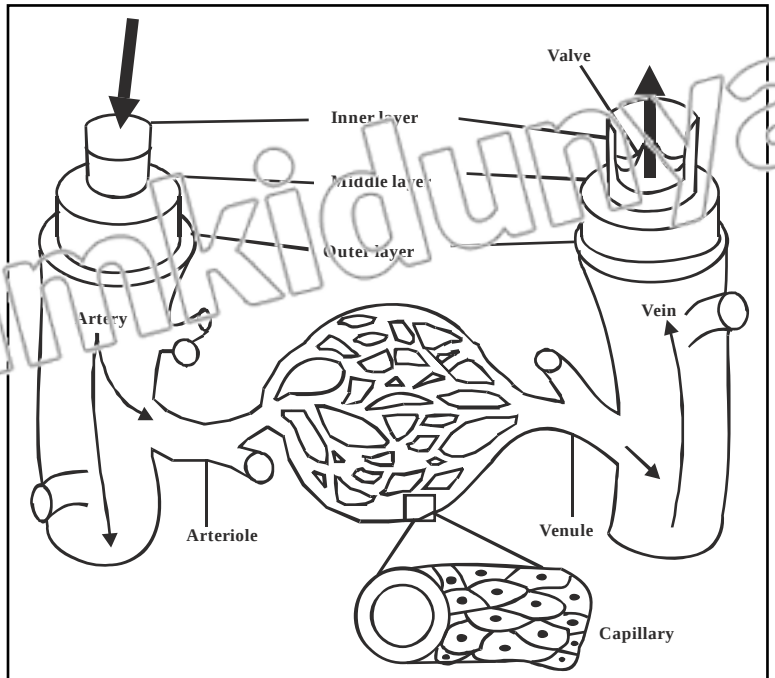


Figure: Blood Vessels

VEINS

Definition:

"The **blood vessels which carry blood towards the heart** are called veins."

Blood Type:

In adults, **all veins carry deoxygenated blood with the exception of pulmonary veins** that carry oxygenated blood in them.

Structure:

The structure of a vein **is also well-adapted to its function**. The walls of a vein **are composed of three layers** as are present in an artery wall.

Difference from Arteries:

- The middle layer of the vein has less smooth muscles and elastic tissue compared to arteries.
- The middle layer of vein is comparatively thin.
- The lumen of the veins is broader than that of arteries.
- Most veins have flaps called valves that prevent the back flow of blood.

Formation of Venules:

In a tissue, **the capillaries join to** form small venules.

Formation of Vein:

All of the **venules of an organ unite** to form a vein.

Q.11 Give a comparison of arteries, capillaries and veins. ***(K.B)***

Ans: **COMPARISON OF ARTERIES, CAPILLARIES AND VEINS**

The comparison of arteries, capillaries and veins are as follows:

Characteristics	Arteries	Capillaries	Veins
Function	Carry blood away from heart	Allow exchange of materials between blood and tissues	Carry blood towards heart
Thickness	Thick	One-cell thick	Thin
Elasticity in walls	Elastic	Non-elastic	less elastic
Muscles in walls	Thick	No muscles	Thin
Blood pressure	High BP	Medium BP	Low BP
Valves	No valves	No valves	Valves present

Q.12 Write a note on arterial system of man. ***(K.B)*** **Ex Q. No 12**

Ans: **ARTERIAL SYSTEM OF MAN**

Definition:

"The **system of arteries which carries blood from the heart to all body parts** is called the arterial system."

Pulmonary Trunk:

Large pulmonary trunk emerges from right ventricle and **divides into right and left pulmonary arteries**, which carry de-oxygenated blood to right and left lungs.

Aorta:

The **oxygenated blood leaving the left ventricle of heart is carried in a large artery,** the aorta.

Aortic Arch:

The **aorta ascends and forms an aortic arch**. The arch curves left and descends inferiorly into the body.

From the upper surface of aortic arch, three branches emerge which supply blood to:

- Head
- Shoulders
- Arms

Dorsal Aorta:

As **the aorta passes down through thorax, it becomes dorsal aorta**. It gives off many branches and the important ones are listed here:

Intercostal Arteries:

Several intercostal arteries **supply blood to ribs**.

Celiac artery and Superior Mesenteric Artery:

Supply blood to the digestive tract.

Hepatic Artery:

Supplies blood to the liver.

Renal Arteries:

A pair of renal arteries supplies blood to kidneys.

Gonadal Arteries:

These **supply blood to gonads.**

Inferior Mesenteric Artery:

Just below the gonadal arteries, is inferior mesenteric artery supplies blood to a part of large intestine and rectum.

Iliac Arteries:

The aorta **divides into two common iliac arteries**, each of which divides into an:

- Internal iliac artery
- External iliac artery

Femoral Artery:

Each external iliac artery becomes femoral artery in the upper thigh. It gives branches to the thigh, knee, shank, ankle, and foot.

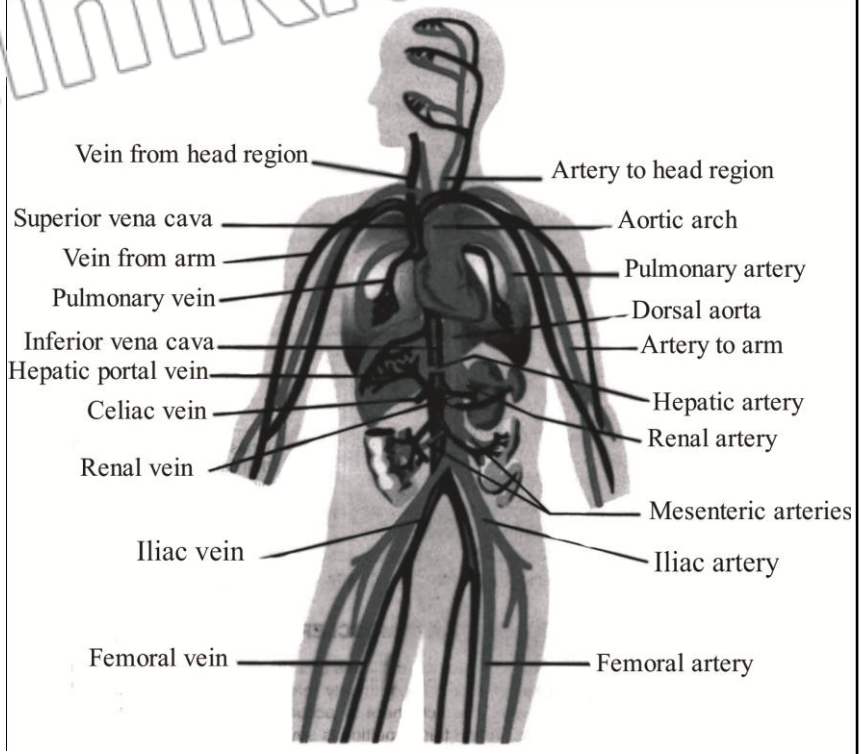


Figure: Major Arteries and Veins in Human Body

Q.13 Write a note on venous system of man. ***(K.B)*** **Ex Q. No 13** **(DGK 2014)**

Ans.

THE VENOUS SYSTEM

Definition:

"The **system of veins which carries blood from different parts of body to the heart** is called venous system."

Pulmonary Veins:

Veins from lungs, called pulmonary veins return the oxygenated blood to the left atrium of the heart.

Major Veins:

Two major veins carrying deoxygenated blood from rest of the body, empty into the right atrium. These are:

i. **Superior vena cava**
ii. **Inferior vena cava**

Formation of Superior Vena Cava:

Superior vena cava forms **when different veins join together from:**

- Head
- Shoulders
- Arms

Formation of Inferior Vena Cava:

Inferior vena cava is formed **by many veins which bring deoxygenated blood from the legs and lower region of body.**

The following veins join to form inferior vena cava:

Femoral Vein:

The veins carrying blood from the **following regions of our body join together to form femoral vein:**

- Calf
- Foot
- Knee

Common Iliac Vein:

The **femoral vein empties into the external iliac vein, which joins the internal iliac vein**, and **then both empty into the common iliac vein**. The right and left common iliac veins join to form the inferior vena cava.

Hepatic Vein:

Carries blood from liver and **empties into inferior vena cava**.

Renal Veins:

Two renal veins carry blood from kidneys and empty into inferior vena cava.

Gonadal Veins:

Two gonadal veins carry blood from gonads and empty into inferior vena cava.

Hepatic Portal Vein:

All veins coming from the following organs drain into hepatic portal vein, which carries this blood to the liver:

- Stomach
- Spleen
- Pancreas
- Intestine

Hepatic Vein:

Hepatic **carries blood from liver** and **empties into inferior vena cava**.

Thoracic Veins:

In the thoracic cavity, **inferior vena cava also receives veins from thoracic walls and ribs.**

SHORT QUESTIONS (Topic 9.2)

Q.1 Which systems perform transport in humans? ***(A.B)***

Ans:

TRANSPORT IN HUMANS

Transport of different materials in human body is performed by two systems.

- Blood circulatory system (cardiovascular system)
- Lymphatic system

Coordination:

The two systems are well coordinated and associated with each other.

Q.2 What is a closed circulatory system? ***(K.B)*** **(DGK 2014, SGD 2014)**

Ans:

CLOSED CIRCULATORY SYSTEM

Definition:

"It is a type of circulatory system in which the blood always remains in the blood vessels."

Examples:

- Humans
- Other vertebrates

Q.3 What is an open circulatory system? ***(K.B)***

Ans:

OPEN CIRCULATORY SYSTEM

Definition:

"It is a type of circulatory system in which blood does not remain in the blood vessels."

Example:

- Invertebrates like arthropods

Q.4 What are the main components of human blood circulatory system? ***(K.B)***

Ans:

MAIN COMPONENTS OF HUMAN CIRCULATORY SYSTEM

The main components of human blood circulatory system are:

- Blood
- Heart
- Blood vessels

Q.5 How is plasma separated from blood? ***(A.B)*****(LHR 2012, GRW 2014, BWP 2015, SGD 2015)**

Ans:

SEPARATION OF PLASMA FROM BLOOD

Blood is taken from an artery and an anti-coagulant (a chemical that inhibits blood clotting) is mixed in it. After about 5 minutes, plasma separates from blood cells, which settle down.

Q.6 What do you know about blood? ***(K.B)***

Ans: Page no 300.

Q.7 Write the number of RBCs in human blood. ***(K.B)***

Ans: Page no 301.

Q.8 What are the two different types of WBCs? ***(K.B)***

Ans: Page no 302.

Q.9 What are thrombocytes? Describe their function. ***(K.B)*** **(LHR 2013)**

Ans: Page no 303.

Q.10 How pus is formed? ***(U.B)*** **(SWL 2014)**

Ans:

FORMATION OF PUS

White blood cells die in the process of killing the germs. These dead cells accumulate and make the white substance called pus seen at the infection site.

Q.11 What happens in dengue fever? ***(A.B)***

Ans:

DENGUE FEVER

In dengue fever, there is a sharp decrease in the number of platelets in blood. Because of this, patients bleed from the nose, gums and under the skin.

Q.12 What is leukaemia? ***(K.B)***

Ans: Page no 304.

Q.13 Write a short note on thalassaemia. ***(K.B)*** **(GRW 2015, SGD 2015)**

Ans: Page no 304.

Q.14 What is the incidence of thalassaemia in the world? ***(K.B)***

Ans: Page no 304.

Q.15 On what date International Thalassaemia Day is celebrated? What is its aim? ***(K.B)***

Ans: Page no 304.

Q.16 What is an antigen? ***(U.B)*** **(LHR 2013, DGK 2014, SGD 2014, RWP 2015)**

Ans: Page no 304.

Q.17 What is the basis of blood group systems? ***(K.B)***

Ans: Page no 305.

Q.18 How many human blood groups systems have been studied till to date? ***(K.B)***

Ans:

NUMBER OF HUMAN BLOOD GROUPS

A total of 29 human blood group systems are now recognized by the International Society of Blood Transfusion (ISBT).

Q.19 How many blood groups are there in ABO blood group system? ***(K.B)***

Ans: Page no 305.

Q.20 Define blood transfusion. ***(K.B)***

Ans: Page no 306.

Q.21 Why the blood of donor should be checked before transfusion? ***(A.B)***

Ans: Page no 306.

Q.22 What is universal donor? ***(U.B)*** **(LHR 2014)**

Ans: Page no 307.

Q.23 Who discovered Rh blood group system and also discuss its basis of classification? ***(K.B)***

Ans: Page no 307.

Q.24 Differentiate between pericardium and pericardial fluid. ***(K.B)*** **(LHR 2015)**

Ans:

DIFFERENTIATION

The difference between pericardium and pericardial fluid are as follows:

Pericardium	Pericardial Fluid
Location	
Heart is enclosed in a sac known as pericardium.	Pericardial fluid is a fluid present between pericardium and heart walls.
Function	
It helps in protection of heart muscles.	It reduces friction between pericardium and heart, during heart contractions.

Q.25 Why heart is felt to be present on left side of our body? ***(U.B)***

Ans:

FEELING OF HEART

The heart is usually felt to be on the left side because the left chamber of the heart i.e. left ventricle is stronger and has a thicker wall. It pumps blood to all body parts.

Q.26 What is the mass and size of heart in normal adults? ***(K.B)***

Ans:

MASS AND SIZE OF HEART

Mass:

In normal adults, the mass of the heart is about 250-350 grams.

Size:

Its size is equal to a clenched fist.

Q.27 How can we say that heart works as double pump? ***(U.B)***

Ans: Page no 308.

Q.28 Why the walls of the left ventricle are the thickest one? ***(U.B)***

Ans:

WALLS OF THE LEFT VENTRICLE

The walls of the left ventricle are the thickest one.

Thickness:

These are about a half inch thick.

Significance:

They have enough force to push blood into the body. This gives an evidence that the structures of the parts of heart are adaptive to their function.

Q.29 Name and explain the valves present in heart. ***(K.B)***

Ans: Page no 309.

Q.30 Define pulmonary circulation. ***(K.B)*** **(BWP 2014, 2015, SWL 2015)**

Ans: Page no 310.

Q.31 What is systemic circulation? ***(K.B)*** **(LHR 2014, 2015)**

Ans: Page no 310.

Q.32 Justify that there is low blood pressure in pulmonary circulation. ***(U.B)***

Ans:

LOW BLOOD PRESSURE IN PULMONARY CIRCULATION

The blood in pulmonary circulation is at lower pressure than the blood in systemic circulation. It gives sufficient time to blood for gaseous exchange in lungs.

Q.33 What is meant by cardiac cycle? Define heartbeat. ***(K.B)*** **(GRW 2012, 2015, LHR 2014)**

Ans: Page no 311

Q.34 Define cardiac diastole. ***(K.B)*** **(GRW 2013, BWP 2015)**

Ans: Page no 311.

Q.35 Define systole and diastole. ***(K.B)*** **(LHR 2016, MTN 2015, FSD 2014, SGD 2014)**

Ans: Page no 311.

Q.36 How the sound of lubb dubb is produced during heart beat? ***(K.B)*** **(LHR 2016)**

Ans: Page no 311.

Q.37 What is the average human heartbeat? ***(K.B)***

Ans: Page no 310.

Q.38 Define pulse. ***(K.B)***

Ans: Page no 312.

Q.39 Write any two differences between arteries and veins. ***(K.B)*** **(LHR 2016, SGD 2015)**

Ans:

DIFFERENTIATION

The difference between arteries and veins are as follows:

Arteries	Veins
Blood Flow	
Carry blood away from heart.	Carry blood towards heart.
Nature	
Thick and elastic.	Thin and less elastic.

Q.40 What is vascular surgery? ***(A.B)***

Ans:

VASCULAR SURGERY

Definition:

"The field in surgery in which diseases of arteries and veins are managed by surgical methods is called vascular surgery."

Example:

- Thrombosis

Vascular Surgeon:

A vascular surgeon treats diseases of all parts of blood circulatory system except that of heart and brain.

Q.41 What is the contribution of Ibn-e-Nafees in the study of human blood circulatory system? ***(K.B)*** **(BWP 2015)**

Ans:

CONTRIBUTION OF IBN-E-NAFEES

Period:

1210-1286 AD

Specialty:

He was a physician.

Contribution:

He is honored to be the first scientist who described the path way of blood circulation.

Q.42 What is the contribution of William Harvey in the study of human blood circulatory system? ***(K.B)***

Ans:

CONTRIBUTION OF WILLIAM HARVEY

Period:

1578-1657 AD

Contribution:

He discovered the pumping action of heart and the pathway of blood in major arteries and veins.

Q.43 How heart muscles are supplied with blood? ***(A.B)***

Ans:

CORONARY CIRCULATION

Coronary arteries and veins are collectively called coronary circulation and it is a part of systemic circulation.

Coronary Arteries:

The blood supply to heart muscles is provided by coronary arteries, which emerge from the base of aorta.

Coronary Veins:

Heart muscles are drained by coronary veins, which empty into right atrium.

MULTIPLE CHOICE QUESTIONS (Topic 9.2)

1. The average volume of blood in adult human's body is: ***(K.B)*** **(SWL 2014)**

(A) 5 litres (B) 7 litres
(C) 8 litres (D) 10 litres

2. Percentage of plasma in blood: ***(K.B)***

(A) 35% (B) 45%
(C) 55% (D) 65%

3. Percentage of cells or cell like bodies in blood: ***(K.B)***

(A) 30% (B) 45%
(C) 25% (D) 85%

4. Percentage of water in plasma: ***(K.B)***

(A) 60-62% (B) 70-72%
(C) 80-82% (D) 90-92%

5. Blood clotting protein: ***(K.B)***

(A) Fibrinogen (B) Pepsin
(C) Pepsinogen (D) Albumin

6. When fibrinogen makes blood clot it separates from blood and the remainder is called: ***(U.B)*** **(LHR 2015)**

(A) Lymph (B) Plasma
(C) Serum (D) Pus

7. The normal PH of Human blood is: ***(K.B)*** **(LHR 2016)**

(A) 7.2 (B) 7.3
(C) 7.4 (D) 7.5

8. In the embryonic and foetal life, red blood cells are formed in: ***(K.B)*** **(LHR 2013)**

(A) Liver (B) Spleen
(C) Bone marrow (D) Both A and B

9 Average life span of erythrocytes: ***(K.B)***

(A) 100 days (B) 110 days
(C) 120 days (D) 130 days

10. Which cell play role in body's defense? ***(A.B)*** **(SGD 2015)**
(A) Erythrocytes (B) Thrombocytes
(C) Basophils (D) Leukocytes

11. The average number of leukocytes in one cubic millimeter of blood: ***(K.B)***
(A) 3000 to 40000 (B) 5000 to 6000
(C) 7000 to 8000 (D) 9000 to 10000

12. The blood cells which do not contain pigments and are colourless: ***(K.B)***
(A) Red Blood cells (B) White Blood Cells
(C) Platelets (D) All of these

13. Which one is an agranulocyte? ***(K.B)***
(A) Monocyte (B) Basophil
(C) Neutrophil (D) Eosinophil

14. Which of the following prevent blood clotting? ***(U.B)***
(A) Neutrophils (B) Eosinophils
(C) Monocytes (D) Basophils

15. The blood cells which help in blood clotting: ***(K.B)*** **(SWL 2014)**
(A) Red blood cells (B) White blood cells
(C) Platelets (D) B and T lymphocytes

16. Number of thrombocytes (platelets) in one cubic millimeter of blood is: ***(K.B)*** **(BWL 2014)**
(A) 150,000 (B) 250,000
(C) 350,000 (D) 450,000

17. Average life span of platelets: ***(A.B)***
(A) 4 to 5 days (B) 5 to 6 days
(C) 6 to 7 days (D) 7 to 8 days

18. Which blood cells are the most numerous in healthy human blood? ***(U.B)*** **(MTN 2015)**
(A) Red blood cells (B) White blood cells
(C) Platelets (D) All of these

19. Uncontrolled production of defective white blood cells: ***(U.B)***
(A) Thalassaemia (B) Leukaemia
(C) Anaemia (D) Both A and B

20. Which of the following is a genetic problem due to mutations in the gene of haemoglobin? ***(U.B)***
(A) Thalassaemia (B) Leukaemia
(C) Anaemia (D) Both A and B

21. The world celebrates the International Thalassaemia Day on: ***(K.B)***
(A) 6^{th} of May (B) 7^{th} of May
(C) 8^{th} of May (D) 9^{th} of May

22. Total number of blood group systems recognized by the International Society of Blood Transfusion: ***(K.B)***
(A) 25 (B) 27
(C) 29 (D) 31

23. A molecule that can stimulate an immune response: ***(U.B)***
(A) Antigen (B) Antibody
(C) Haemoglobin (D) Immunoglobulin

24. ABO blood group system was discovered by: ***(K.B)***
(A) Thomas B. Cooley (B) William Harvey
(C) Karl Landsteiner (D) Ibn-e-Nafees

25. Antigens are present on the surface of: ***(U.B)***
(A) Red blood cells (B) White blood cells
(C) Platelets (D) Leucocytes

26. Which blood group contains antigen A? ***(K.B)*** **(BWL 2015)**
(A) A (B) B
(C) AB (D) O

27. In persons with blood group O: ***(U.B)***
(A) Antibodies A and B are present. (B) Neither antigen A nor antigen B is present.
(C) Only Antigen A is present. (D) Both A and B

28. A person having blood group B can donate blood to: ***(U.B)***
(A) O and A (B) O and AB
(C) B and AB (D) A and B

29. A person with AB blood group can donate to: ***(U.B)*** **(SWL 2015)**
(A) A (B) B
(C) AB (D) O

30. A person having blood group O can receive blood from: ***(U.B)***
(A) A (B) B
(C) AB (D) O

31. Universal blood donors: ***(U.B)*** **(DGK 2015, LHR 2016)**
(A) Blood group A (B) Blood group B
(C) Blood group AB (D) Blood group O

32. Universal blood recipients: ***(U.B)*** **(SGD 2016)**
(A) Blood group A (B) Blood group B
(C) Blood group AB (D) Blood group O

33. Karl Landsteiner discovered the Rh-blood group system in: ***(K.B)***
(A) 1910's (B) 1920's
(C) 1930's (D) 1940's

34. What is the actual universal donor blood group? ***(U.B)***
(A) O-negative (B) O positive
(C) AB-positive (D) AB-negative

35. Which organ belongs to circulatory system? ***(K.B)*** **(GRW 2013)**
(A) Eye (B) Kidney
(C) Heart (D) Stomach

36. The largest and strongest chamber in heart is: ***(K.B)*** **(LHR 2016)**
(A) Right atrium (B) Left atrium
(C) Left ventricle (D) Right ventricle

37. The opening between right atrium and right ventricle is guarded by a valve called: ***(K.B)***
(A) Bicuspid valve (B) Tricuspid valve
(C) Pulmonary semilunar valve (D) Aortic semilunar valve

38. The type of valve present at the base of pulmonary trunk: ***(K.B)***
(A) Bicuspid valve (B) Tricuspid valve
(C) Pulmonary semilunar valve (D) Aortic semilunar valve

39. The opening between left atrium and left ventricle is guarded by a valve called: *(K.B)*
(A) Bicuspid valve (B) Tricuspid valve
(C) Pulmonary semilunar valve (D) Aortic semilunar valve

40. The alternating contraction and relaxation of heart chambers: *(K.B)*
(A) Systole (B) Diastole
(C) Cardiac cycle (D) Pulse rate

41. Average human heart beat per minute in human: *(K.B)*
(A) 60 (B) 70
(C) 80 (D) 90

42. During atrial systole: *(U.B)*
(A) Both atria contract (B) Both atria relax
(C) Both ventricles contract (D) Both ventricles relax

43. In one heart beat, diastole remains about second: *(A.B)* **(LHR 2014)**
(A) 0.4 (B) 0.6
(C) 0.7 (D) 0.8

44. "Lubb-dubb" can be heard with the help of: *(A.B)* **(LHR 2014)**
(A) Stethoscope (B) Telescope
(C) Microscope (D) Sound box

45. In normal adults, the mass of heart is: *(K.B)* **(LHR 2015, 2016)**
(A) 50 – 150g (B) 150 – 250g
(C) 250 – 350g (D) 350 – 450g

46. When does our heart takes rest? *(K.B)* **(GRW 2014)**
(A) During sleep (B) During rest
(C) During working (D) Never

47. The third part of blood circulatory system: *(U.B)*
(A) Heart (B) Blood
(C) Blood vessels (D) Capillaries

48. The blood vessels that carry blood away from heart: *(K.B)* **(SWL 2015)**
(A) Arteries (B) Veins
(C) Capillaries (D) All of these

49. The tissue layer that is common in all types of blood vessels: *(U.B)*
(A) Connective tissue (B) Elastic tissue
(C) Endothelium (D) Smooth muscles

50. In which of the following blood vessels, the blood pressure is low? *(U.B)*
(A) Arteries (B) Capillaries
(C) Veins (D) All of these

51. The blood pressure in arteries is: *(U.B)*
(A) High (B) Medium
(C) Low (D) Very low

52. Which of the following blood vessels have valves to prevent back flow of blood? *(K.B)*
(A) Arteries (B) Capillaries
(C) Veins (D) All of these

53. Through which blood vessels the materials are exchanged between the blood and the surrounding tissues? *(U.B)* **(GWL 2013)**
(A) Arteries (B) Veins
(C) Capillaries (D) All of these

54. These are smallest blood vessels: ***(U.B)*** **(SGD 2015)**
(A) Arteries (B) Capillaries
(C) Veins (D) Lymph vessels

55. Who discovered the pathway of blood circulation? ***(K.B)***
(A) Ibn-e-Nafees (B) William Harvey
(C) Karl Landsteiner (D) Louis Pasteur

56. William Harvey was born in: ***(K.B)***
(A) 1560 AD (B) 1578 AD
(C) 1590 AD (D) 1592 AD

57. William Harvey died in: ***(K.B)***
(A) 1647AD (B) 1653AD
(C) 1657AD (D) 1663AD

58. The pumping action of heart was discovered by: ***(K.B)***
(A) Ibn-e-Nafees (B) William Harvey
(C) Karl Landsteiner (D) None of these

59. As aorta passes down through thorax, it becomes: ***(K.B)***
(A) Aorta (B) Aortic arch
(C) Dorsal aorta (D) All of these

60. Intercostal arteries supply blood to: ***(K.B)***
(A) Digestive tract (B) Kidneys
(C) Liver (D) Ribs

61. Caeliac artery and superior mesenteric artery supply blood to: ***(K.B)***
(A) Digestive tract (B) Kidneys
(C) Liver (D) Ribs

62. Hepatic artery supplies blood to: ***(K.B)***
(A) Digestive tract (B) Kidneys
(C) Liver (D) Ribs

63. Renal arteries supply blood to: ***(K.B)***
(A) Digestive tract (B) Kidneys
(C) Liver (D) Ribs

64. Gonadal arteries supply blood to: ***(K.B)***
(A) Digestive tract (B) Kidneys
(C) Liver (D) Gonads

65. Each external iliac becomes femoral artery in upper thigh and gives branches to: ***(K.B)***
(A) Thigh and Knee (B) Shank
(C) Ankle and foot (D) All of these

66. Different veins from head, shoulders, and arms joined together and form: ***(K.B)***
(A) Inferior vena cava (B) Superior vena cava
(C) Hepatic portal vein (D) Femoral vein

67. Right and left common iliac veins join to form: ***(K.B)***
(A) Inferior vena cava (B) Superior vena cava
(C) Hepatic portal vein (D) Femoral vein

68. All veins coming from stomach, spleen, pancreas and intestine drain into: ***(K.B)***
(A) Renal vein (B) Hepatic vein
(C) Hepatic portal vein (D) Common iliac vein

9.3 CARDIOVASCULAR DISORDERS

LONG QUESTIONS

Q.1 Write a note on cardiovascular disorders. (A.B) (Fa. Q. No 15)

Ans.

CARDIOVASCULAR DISORDERS

Definition:

"The **diseases which involve the heart or blood vessels are collectively** called cardiovascular disorders."

- These diseases have similar causes, mechanisms, and treatments.

Risk Factors:

The risk factors that lead to cardiovascular disorders include:

- Advanced age
- Diabetes
- High blood concentration of low-density lipids e.g. cholesterol and triglycerides
- High blood pressure (Hypertension)
- Tobacco smoking
- Obesity
- Sedentary life style
- Family history

Major Cause of Non-accidental Deaths:

It has been estimated that **cardiovascular disorders are the major cause of sudden non-accidental deaths** in developed as well as developing countries.

ATHEROSCLEROSIS

Introduction:

It is a **chronic disease**. It is commonly **referred to as 'narrowing'** of the arteries.

Causes:

It characterized by the accumulation of the following in the lumen of the arteries:

- **Fatty materials**
- **Cholesterol**
- **Fibrin**

Prime Contributor:

The **accumulation of cholesterol** is the prime contributor to atherosclerosis.

Severe Condition:

When this condition is severe, **arteries can no longer expand** and **contract properly** and **blood moves through them with difficulty.**

Atherosclerotic Plaques:

The **accumulation of cholesterol results in the formation of multiple deposits** called plaques within arteries.

Thrombus:

The **plaques can form blood clots** called thrombus within arteries.

Embolus:

If a **thrombus dislodges** and **becomes free-floating**, it is called an embolus.

ARTERIOSCLEROSIS

Introduction:

Arteriosclerosis **is a general term describing any hardening of arteries.**

Cause:

It occurs **when calcium is deposited in the walls of arteries**. It can happen when atherosclerosis is severe.

MYOCARDIAL INFARCTION

Meaning:

The term myocardial infarction is derived from:

- Myocardium **means the heart muscle**
- **Infarction means tissue death**

Common Name:

It is more commonly known as **heart attack**.

Causes:

It occurs when:

- There **is blood clot in coronary arteries**
- Blood **supply to a part of the heart is interrupted** and **leads to the death of heart muscles**

Medical Emergency:

It is a medical emergency, and a **leading cause of death for men** and **women** all over the world.

Silent Myocardial Infarctions:

Approximately one fourth of all myocardial infarctions are silent i.e., without chest pain or other symptoms. A **silent heart attack is more common in the elderly, in patients with diabetes mellitus** and **after heart transplantation.**

Symptoms:

- **Severe chest pain** is the most common symptom.
- **Sensation of tightness,** pressure, or squeezing in chest.
- **Pain radiates** most often to left arm.
- Pain may **also radiate to the lower jaw**, neck, right arm and back
- **Loss of consciousness**
- **Sudden death may occur**

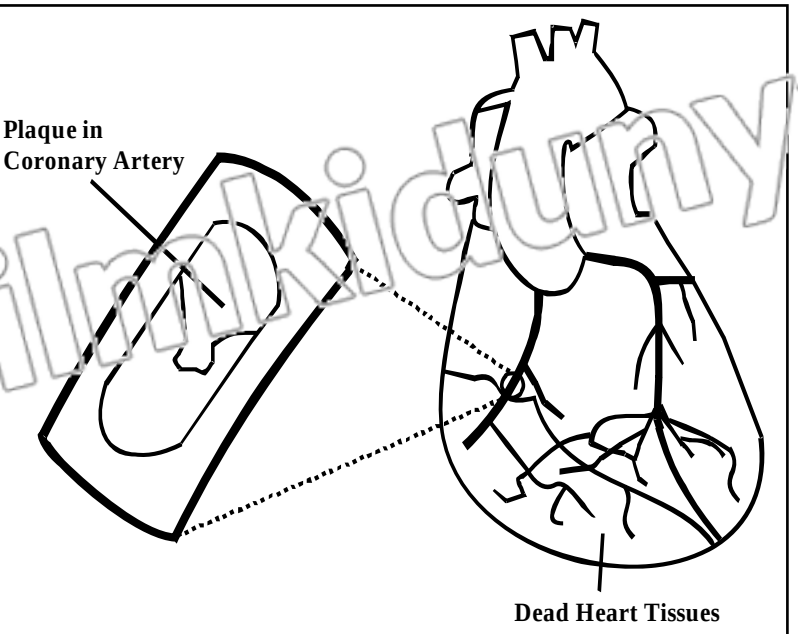


Figure: Atherosclerosis and resulting Myocardial Infarction

Treatment:

The patients of myocardial infarction are treated **in the following** ways:

Immediate Treatment:

Immediate treatment for a suspected acute myocardial infarction includes:

- **Oxygen supply**
- **Aspirin**
- **Sublingual tablet of glyceryl trinitrate**
- **Surgical methods** (Angioplasty or bypass surgery)

Angioplasty:

The **mechanical widening of a narrowed** or totally **obstructed blood vessel** is called angioplasty. Most cases of myocardial infarction are treated by angioplasty.

Bypass Surgery:

It is a surgery in **which arteries or veins from elsewhere in a patient's body are grafted** into the coronary arteries to improve blood supply to heart muscles.

World Heart Day:

World Heart Day is held on 28th September every year throughout the world. Its objective is to help people better understand their personal risks of cardiovascular disorders.

ANGINA PECTORIS

Meaning:

Angina pectoris means **chest pain**.

Symptoms:

The pain may occur **in heart and often in left arm and shoulder.**

Severity:

It is **not as severe as heart attack.**

Warning Sign of Heart Attack:

Angina pectoris is a warning sign that blood supply to heart muscles is not sufficient but shortage is not enough to cause tissue death.

Q.2 What is coronary circulation?

CORONARY CIRCULATION

Definition:

"Coronary arteries and **veins are collectively called coronary circulation** and it is a part of systemic circulation."

Need:

Even though the **heart chambers are continually bathed with blood**, this does not nourish heart muscles.

Coronary Arteries:

The **blood supply to the heart muscles is provided by coronary arteries** which emerge from the base of aorta.

Coronary Veins:

Heart muscles are drained by coronary veins which empty into right atrium.

SHORT QUESTIONS (Topic 9.3)

Q.1 Define Plaque. ***(K.B)***

Ans: Page No. 326

Q.2 What is thrombus? ***(K.B)***

Ans: Page No. 326

Q.3 Define the Embolus. ***(K.B)***

Ans: Page No. 326

Q.4 Write causes of cardiovascular disorders. ***(A.B)*** **(LHR 2015)**

Ans: Page No. 326

Q.5 What is difference between atherosclerosis and arteriosclerosis? ***(A.B)***

Ans:

DIFFERENTIATION

The difference between atherosclerosis and arteriosclerosis is as follows:

Atherosclerosis	Arteriosclerosis
• It is commonly referred to as a "narrowing" of arteries. • It is a chronic disease in which there is accumulation of fatty materials, cholesterol, or fibrin in arteries.	• It is a general term describing any hardening of arteries. • It occurs when calcium is deposited in the walls of arteries.

Q.6 What is a silent heart attack? ***(U.B)***

Ans: Page No. 327

Q.7 Define myocardial infarction. ***(K.B)*** **(LHR 2015, SWL 2014, FSD 2015)**

Ans: Page no 327.

Q.8 What is the treatment of myocardial infarction? **(LHR-G1-15)**

Ans:

Treatment of Myocardial infraction

There are two major treatments of myocardial infarction.

- Immediate treatment includes oxygen supply, aspirin and sub-lingual tablet of glyceryl trinitrate.
- Most cases of myocardial infarction are treated with angioplasty.

Q.9 What is angioplasty and bypass surgery? ***(A.B)*** **(LHR 2013)**

Ans: Page no 328.

Q.10 What is angina pectoris? ***(K.B)*** **(GRW 2014)**

Ans: Page no 328.

Q.11 What percentage of our population is diabetic? ***(K.B)***

Ans: **DIABETIC POPULATION**

About 10% of our population is diabetic.

Q.12 What is the ratio of obese population in Pakistan? ***(K.B)***

Ans: **OBESE POPULATION**

According to World Health Organization, in Pakistan, 1 in 7 urban adults is obese.

Q.9 What is the percentage of adult deaths by cardiovascular disorders in Pakistan? ***(K.B)***

Ans: **DEATHS BY CARDIOVASCULAR DISORDERS**

According to the survey of Federal Bureau of Statistics of Pakistan, cardiovascular disorders were reported as the cause of 12% of the adult deaths in Pakistan.

Q.10 What is the most common cause of cardiovascular disorders in Pakistan? ***(A.B)***

Ans: **CAUSE OF CARDIOVASCULAR DISORDERS**

The most common cause of cardiovascular disorders in Pakistan is hypertension (blood pressure higher than normal)

Hypertensive Patients:

There are over 12 million hypertensive patients in Pakistan.

MULTIPLE CHOICE QUESTIONS (Topic 9.3)

1. How many patients are suffering from Hypertension in Pakistan?
(A) 10 million (B) 20 million
(C) 9 million (D) Over 12 million

2. Atherosclerosis is commonly referred to as a: ***(K.B)***
(A) Widening of arteries (B) Narrowing of arteries
(C) Hardening of arteries (D) Closure of arteries

3. If a thrombus dislodges and becomes free floating, it is called: ***(K.B)***
(A) Plaques (B) Stone
(C) Embolus (D) Tumor

4. Arteriosclerosis is a general term describing: ***(K.B)***
(A) Widening of arteries (B) Narrowing of arteries
(C) Hardening of arteries (D) Bursting of arteries

5. The death of the heart tissue is called:
(A) Atherosclerosis (B) Artheriosclerosis
(C) Myocardial infarction (D) Thalassaemia

6. Atherosclerosis is a chronic disease in which there is accumulation of:
(A) Fatty material (B) Cholesterol
(C) Fibrin (D) All of these

7. Heart attack may be caused by blood clot in: ***(A.B)***
(A) Heart muscles (B) Heart chambers
(C) Coronary arteries (D) Veins

8. The most common symptom of myocardial infarction is: ***(K.B)***
(A) Pain in left arm (B) Pain in neck
(C) Pain in right arm (D) Severe chest pain

9. Angina pectoris means: ***(K.B)***
(A) Chest pain (B) Tissue death
(C) Heart attack (D) Silent death

10. World Heart Day is held on: ***(K.B)*** **(RWP 2015)**
(A) 28th August (B) 28th September
(C) 28th October (D) 28th November

ANSWER KEYS

MULTIPLE CHOICE QUESTIONS

9.1 TRANSPORT IN PLANTS

1	B	**5**	C	**9**	A	**13**	A	**17**	B
2	C	**6**	A	**10**	D	**14**	A	**18**	B
3	D	**7**	D	**11**	A	**15**	D	**19**	B
4	D	**8**	D	12	C	**16**	B	**20**	A

9.2 TRANSPORT IN HUMANS

1	A	**11**	C	**21**	C	**31**	D	**41**	B	**51**	A	**61**	A
2	C	**12**	B	**22**	C	**32**	C	**42**	A	**52**	C	**62**	C
3	B	**13**	A	**23**	A	**33**	C	**43**	A	**53**	C	**63**	B
4	D	**14**	D	**24**	C	**34**	A	**44**	A	**54**	B	**64**	D
5	A	**15**	C	**25**	A	**35**	C	**45**	C	**55**	A	**65**	D
6	C	**16**	B	**26**	A	**36**	C	**46**	D	**56**	B	**66**	B
7	C	**17**	D	**27**	D	**37**	B	**47**	C	**57**	C	**67**	A
8	D	**18**	A	**28**	C	**38**	C	**48**	A	**58**	B	**68**	C
9	C	**19**	B	**29**	C	**39**	A	**49**	C	**59**	C		
10	D	**20**	A	**30**	D	**40**	C	**50**	C	**60**	D		

9.3 CARDIOVASCULAR DISORDERS

1	D	**6**	D
2	B	**7**	C
3	C	**8**	D
4	C	9	A
5	C	10	B

REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. In most plants, food is transported in the form of: *(K.B)*

(a) Glucose (b) Sucrose

(c) Starch (d) Proteins

2. Stomata close when guard cells: *(U.B)*

(a) Lose water (b) Gain chloride ions

(c) Become turgid (d) Gain potassium ions

3. Trace the pathway of water from soil through the plant to atmosphere: *(K.B)*

(a) Endodermis, cortex, epidermis, xylem, intercellular spaces in mesophyll, stomata

(b) Epidermis, endodermis, phloem, cortex of leaf, intercellular spaces of mesophyll, stomata

(c) Root hairs, epidermis, cortex, xylem, endodermis, intercellular spaces in mesophyll, stomata

(d) Root hairs, cortex, endodermis, xylem, intercellular spaces in mesophyll, stomata

4. When fibrinogen makes blood clot, it separates from blood and the remainder is called: *(U.B)*

(a) Plasma (b) Lymph

(c) Serum (d) Pus

5. What is correct about human red blood cells? *(U.B)*

(a) Have limited life span (b) Are capable of phagocytosis

(c) Produce antibodies (d) Are multinucleate

6. Which of the following tissue layer is found in all blood vessels? *(U.B)*

(a) Smooth muscle (b) Endothelium

(c) Skeletal muscle (d) Connective tissue

7. When do the atria contract? *(K.B)*

(a) Before diastole (b) After systole

(c) During diastole (d) During systole

8. Which of the following contains deoxygenated blood in an adult human? *(U.B)*

(a) Left atrium (b) Pulmonary artery

(c) Pulmonary vein (d) All of the above

9. Which of the following chambers has the thickest walls in human heart? *(K.B)*

(a) Right atrium (b) Left atrium

(c) Left ventricle (d) Right ventricle

10. Which of these statements is correct about circulatory system? *(U.B)*

(a) It transports hormones

(b) Capillaries have thicker walls than veins

(c) Systemic circulation carries blood to and from the lungs

(d) All are true

11. Exchange of materials between blood and surrounding tissues occurs in: *(K.B)*
(a) Arteries (b) Veins
(c) Capillaries (d) All of the above

12. Which of the following is a type of leukocytes? *(K.B)*
(a) Lymphocyte (b) Eosinophil
(c) Monocyte (d) All of the above

13. Which of the following is a function of human blood? *(A.B)*
(a) It regulates body temperature (b) It transports wastes
(c) It provides defense (d) All of the above

14. Valves to prevent the backflow of blood are found in: *(K.B)*
(a) Arteries (b) Veins
(c) Capillaries (d) All of the above

15. Plasma is made up of water and: *(K.B)*
(a) Metabolites and wastes (b) Salts and ions
(c) Proteins (d) All of the above

16. Which of these are responsible for blood clotting? *(A.B)*
(a) Platelets (b) Erythrocytes
(c) Neutrophils (d) Basophils

17. Find the correct path of blood circulation: *(K.B)*
(a) Left atrium, left ventricle, lungs, right atrium, right ventricle, body
(b) Right atrium, right ventricle, lungs, left atrium, left ventricle, body
(c) Left atrium, left ventricle, right atrium, right ventricle, lungs, body
(d) Right atrium, lungs, right ventricle, left atrium, body, left ventricle

18. A patient with blood group A can be given the blood of donor who has: *(U.B)*
(a) Blood group A or AB (b) Blood group A or O
(c) Blood group A only (d) Blood group O only

19. The death of heart tissue is called: *(K.B)*
(a) Atherosclerosis (b) Arteriosclerosis
(c) Myocardial infarction (d) Thalassaemia

20. What happens when a mismatched blood is injected in a recipient? *(A.B)*
(a) Antibodies of recipient's blood destroy donor's RBCs
(b) Antibodies of donor's blood breakdown recipient's RBCs
(c) Both of these can happen
(d) None of these happen and such transfusion can be safe

ANSWERS KEY

1	b	2	a	3	d	4	c	5	a
6	b	7	d	8	b	9	c	10	a
11	c	12	d	13	d	14	b	15	d
16	a	17	b	18	b	19	c	20	c

UNDERSTANDING THE CONCEPTS

1. How would you relate the internal structure of root with the uptake of water and salts? *(U.B)*

Ans: See the LQ.1 of **(Topic 9.1)**

2. Define transpiration and relate it with cell surface and with stomatal opening and closing. *(U.B)*

Ans: See the LQ.2 of **(Topic 9.1)**

3. How do different factors affect the rate of transpiration? *(A.B)*

Ans: See the LQ.4 of **(Topic 9.1)**

4. Transpiration is a necessary evil. Give comments. *(K.B)*

Ans: See the LQ.5 of **(Topic 9.1)**

5. Explain the movement of water in terms of transpirational pull. *(K.B)*

Ans: See the LQ.6 of **(Topic 9.1)**

6. Describe the theory of pressure flow mechanism to explain the translocation of food in plants. *(K.B)*

Ans: See the LQ.7 of **(Topic 9.1)**

7. List the functions of the components of blood. *(A.B)*

Ans: See the LQ.1 of **(Topic 9.2)**

8. How do we classify blood groups in terms of ABO and Rh blood group systems? *(K.B)*

Ans: See the LQ.3 and 5 of **(Topic 9.2)**

9. State the signs and symptoms, causes and treatments of leukemia and thalassaemia. *(K.B)*

Ans: See the LQ.2 of **(Topic 9.2)**

10. What four chambers make the human heart and how does blood flow through these chambers? *(K.B)*

Ans: See the LQ.6 of **(Topic 9.2)**

11. Compare the structure and function of an artery, a vein, and a capillary. *(K.B)*

Ans: **COMPARISON AMONG ARTERIES, VEINS AND CAPILLARIES**

CHARACTERISTICS	ARTERIES	VEINS	CAPILLARIES
Function	Carry blood away from the heart	Carry blood towards the heart	Allow exchange of materials
Thickness	Thick	Thin	One-cell thick
Elasticity	Elastic	Less elastic	Non elastic
Muscles	Thick	Thin	None
Blood pressure	High	Low	Medium
Valves	Absent	Present	Absent
Type of blood	Oxygenated, (exception: Pulmonary artery)	De-oxygenated (exception: Pulmonary vein)	Can carry both as they connect arterioles & venules

12. Draw diagrams which can illustrate the origins, locations, and target areas of the main arteries in human blood circulatory system. *(K.B)*

Ans: See the figure of LQ.12 of **(Topic 9.2)**

13. Draw diagrams which illustrate the areas and locations of the main veins in human blood circulatory system. ***(K.B)***

Ans: See the figure of LQ.12 of **(Topic 9.2)**

14. How would you differentiate between atherosclerosis and arteriosclerosis? ***(K.B)***

Ans:

DIFFERENTIATION

The differences between atherosclerosis and arteriosclerosis are as follows:

Feature	Atherosclerosis	Arteriosclerosis
Main pathology	Narrowing of arteries	Hardening of arteries
Cause	Deposits *on* the artery walls	Deposits *in* the artery walls
Agents	Cholesterol, fibrin, dead cells	Calcium deposits
Plaques/deposits	Deposits form atherosclerotic plaques	Deposits usually do not form plaques
Thrombus formation	Accumulated plaques give rise to atherosclerotic masses called thrombi which can partially or completely occlude an artery lumen.	No characteristic thrombus formation, but lumen obliteration may be present.
Relationship with each other	It involves arteriosclerosis in advanced stages.	It is a form of atherosclerosis in advanced stage.

15. State the causes, treatments and prevention of myocardial infarction. ***(A.B)***

Ans: See the LQ.1 of **(Topic 9.3)**

SHORT QUESTIONS

1. What are lenticels and where are they found in plant body? ***(K.B)***

Ans:

LENTICELS

Introduction:

A lenticel is an airy aggregation of cells within the structural surfaces of the stems, roots, and other parts of vascular plants, especially woody plants.

Function:

It functions as a pore, providing a medium for the direct exchange of gasses between the internal tissues and atmosphere

Location:

These special openings are found on the stems of some vascular plants, where they allow gaseous exchange.

2. What is the role of potassium ions in the opening of stomata? ***(A.B)***

Ans:

ROLE OF POTASSIUM IONS IN OPENING OF STOMATA

Recent studies have shown that stomata actually open and close due to the movement of potassium ions in and out of guard cells.

Blue Light:

Blue wavelengths of daylight open stomata by allowing K^+ to flow into the guard cells from the surrounding epidermal cells. Water passively flows these ions into guard cells, and stomata open as their turgidity increases.

3. Define the cohesion-tension theory ***(K.B)***

Ans:

COHESION-TENSION THEORY

According to this theory, the mechanism by which water (along with dissolved materials) is carried upward through the xylem is transpirational-pull. Transpiration creates a pressure difference that pulls water and salts up from the roots.

4. What do you mean by sources and sinks according to the pressure-flow mechanism? ***(K.B)***

Ans. **SOURCES AND SINKS**

Sources:

Sources are exporting organs such as:

- A mature leaf
- A storage organ

Sinks:

Sinks are areas of active metabolism or storage, such as:

- Roots
- Tubers
- Developing fruits and leaves
- Growing regions

Storage Organ:

A storage organ is capable of storing food and exporting stored materials. The root of beet is a sink in first growing season. It becomes source in the next growing season, when sugars are utilized in the growing of new shoots.

5. What are the two main types of white blood cells? How do they differ? ***(K.B)***

Ans: **TYPES OF WHITE BLOOD CELLS**

The following are the two main types of white blood cells:

- Granulocytes
- Agranulocytes

DIFFERENTIATION BETWEEN GRANULOCYTES AND AGRANULOCYTES

Feature	Granulocytes	Agranulocytes
Cell features	Granular cytoplasm	Clear cytoplasm
Cytoplasmic granules	Present, visible on staining	Absent
Formation	Red bone-marrow	Lymphoid tissue
Nucleus	Multi-lobed	Single
Types	Eosinophils, basophils, neutrophils	Monocytes, Lymphocytes
Functions	**Eosinophils:** Kill parasites Break inflammatory substances **Basophils:** Prevent blood clotting **Neutrophils:** Destroy small particles by phagocytosis	**Monocytes:** Produce macrophages which engulf germs **Lymphocytes:** Produce antibodies and kill germs

6. You see pus at the site of an infection on your skin. How is it formed? ***(U.B)***

Ans: **FORMATION OF PUS**

White blood cells die in the process of killing the germs. These dead cells accumulate and make the white substance called pus seen at the infection site.

7. What role does the pericardial fluid play? ***(A.B)***

Ans: **ROLE OF PERICARDIAL FLUID**

Definition:

"The fluid between the pericardium and heart walls is called pericardial fluid."

Function:

The presence of this fluid reduces friction between the pericardium and the heart walls during heart contractions

8. Define the terms systole and diastole. ***(K.B)***

Ans: **SYSTOLE AND DIASTOLE**

Systole:

The period of rhythmic contraction of the heart is called systole. It is of two types:

i. Atrial Systole:

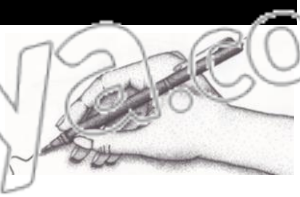
The phase in which both atria contract and pump the blood towards ventricles

ii. Ventricular Systole:

The phase in which both ventricles contract and pump the blood towards body and lungs. The phase in which the atria and ventricles relax and blood is filled in atria is called diastole.

KIPS ASSIGNMENT

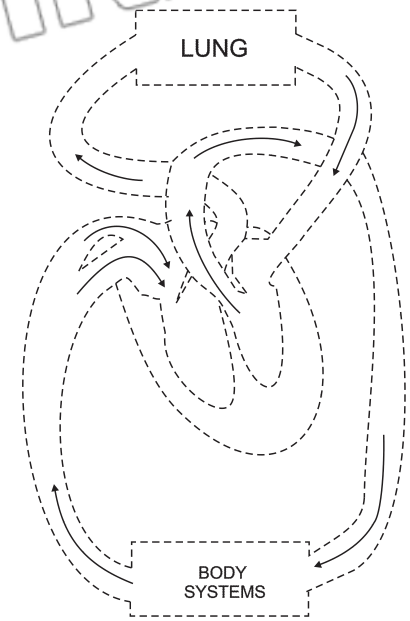
LET'S DRAW & LABEL



(A) Double Circuit Circulation of Blood

Instructions:

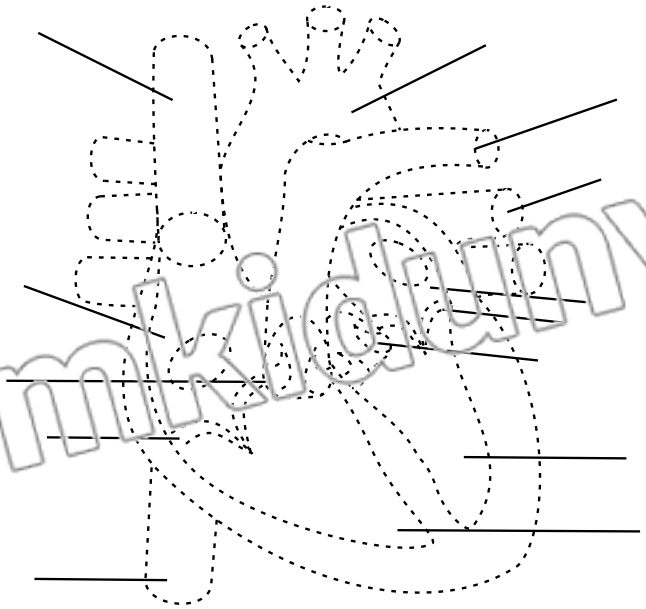
- Trace the patterns and marks the labels



(B) Human Heart

Instructions:

- Trace the patterns and marks the labels



CUT HERE

SELF TEST

Time: 40 min **Marks: 30**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. **(5×1=5)**

1. Percentage of water in plasma: ***(K.B)***

(A) 60-62% **(B)** 70-72%

(C) 80-82% **(D)** 90-92%

2. Which blood cells are the most numerous in healthy human blood? ***(U.B)***

(A) Red Blood cells **(B)** White Blood Cells

(C) Platelets **(D)** Thrombocytes

3. The type of valve present at the base of pulmonary trunk: ***(K.B)***

(A) Bicuspid valve **(B)** Tricuspid valve

(C) Pulmonary semilunar valve **(D)** Aortic semilunar valve

4. Through which blood vessels the materials are exchanged between the blood and the surrounding tissues? ***(K.B)***

(A) Arteries **(B)** Veins

(C) Capillaries **(D)** All of these

5. Hepatic artery supplies blood to: ***(K.B)***

(A) Digestive tract **(B)** Kidneys

(C) Liver **(D)** Ribs

Q.2 Give short answers to following questions. **(5×3=15)**

1. Define stomatal transpiration. ***(K.B)***

2. Which systems perform transport in humans? ***(K.B)***

3. How pus is formed? ***(A.B)***

4. What is the basis of blood group systems? ***(K.B)***

5. What is angina pectoris? ***(K.B)***

Q.3 Answer the following Questions in detail. **(6+4=10)**

(a) Draw a labeled diagram of human heart. ***(K.B)*** **(6)**

(b) Describe cohesion tension theory. ***(K.B)*** **(4)**

Note:

Parents or guardians can conduct this test in their supervision in order to check the skill of students.