Respiration and Circulation

EXERCISES [PAGES 180 - 181]

Exercises | Q 1.01 | Page 180

Choose the correct alternative.

The muscular structure that separates the thoracic and abdominal cavity is _____.

1. pleura
2. **diaphragm**
3. trachea
4. epithelium

Solution: The muscular structure that separates the thoracic and abdominal cavity is **diaphragm**.

Exercises | Q 1.02 | Page 180

Choose the correct alternative.

What is the minimum number of the plasma membrane that oxygen has to diffuse across to pass from air in the alveolus to haemoglobin inside a RBC?

1. Two
2. Three
3. Four
4. **Five**

Solution: Five

Exercises | Q 1.03 | Page 180

Choose the correct alternative.

_____ is a sound-producing organ.

1. **Larynx**
2. Pharynx
3. Tonsils
4. Trachea

Solution: Larynx is a sound-producing organ.

Exercises | Q 1.04 | Page 180

Choose the correct alternative.

The maximum volume of gas that is inhaled during breathing in addition to T.V is _____.

1. residual volume
2. **I.R.V.**
3. G.R.V.
4. Vital capacity

Solution: The maximum volume of gas that is inhaled during breathing in addition to T.V is **I.R.V.**.

Exercises | Q 1.05 | Page 180

Choose the correct alternative.

_____ muscles contract when the external intercostal muscles contract.

1. Internal abdominal
2. Jaw
3. Muscles in bronchial walls
4. **Diaphragm**

Solution: Diaphragm muscles contract when the external intercostal muscles contract.

Exercises | Q 1.06 | Page 180

Choose the correct alternative.

Movement of cytoplasm in unicellular organisms is called _____.

1. diffusion
2. **cyclosis**
3. circulation
4. thrombosis

Solution: Movement of cytoplasm in unicellular organisms is called **cyclosis**.

Exercises | Q 1.07 | Page 180

Choose the correct alternative.

Which of the following animals do not have closed circulation?

1. Earthworm
2. Rabbit
3. **Butterfly**
4. Shark

Solution: Butterfly

Exercises | Q 1.08 | Page 180

Choose the correct alternative.

Diapedesis can be seen in _____ cell.

1. RBC
2. **WBC**
3. Platelet
4. Neuron

Solution: Diapedesis can be seen in **WBC** cell.

Exercises | Q 1.09 | Page 180

Choose the correct alternative.

Pacemaker of heart is _____.

1. **SA node**
2. AV node
3. His bundle
4. Purkinje fibers

Solution: Pacemaker of heart is **SA node**.

Exercises | Q 1.1 | Page 180

Choose the correct alternative.

Which of the following is without a nucleus?

1. **Red blood corpuscle**
2. Neutrophil
3. Basophil
4. Lymphocyte

Solution: Red blood corpuscle

Exercises | Q 1.11 | Page 180

Choose the correct alternative.

Cockroach shows which kind of circulatory system?

1. **Open**
2. Closed
3. Lymphatic
4. Double

Solution: Open

Exercises | Q 1.12 | Page 180

Choose the correct alternative.

Diapedesis can be seen in _____ cell.

1. RBC
2. **WBC**
3. Platelet
4. Neuron

Solution: Diapedesis can be seen in **WBC** cell.

Exercises | Q 1.13 | Page 180

Choose the correct alternative.

Opening of inferior vena cava is guarded by _____.

1. bicuspid valve
2. tricuspid valve
3. **Eustachian valve**
4. Thebesian valve

Solution: Opening of inferior vena cava is guarded by **Eustachian valve**.

Exercises | Q 1.14 | Page 180

Choose the correct alternative.

_____ wave in ECG represent atrial depolarization.

1. **P**
2. QRS complex

3. Q
4. T

Solution: P wave in ECG represent atrial depolarization.

Exercises | Q 1.15 | Page 180

Choose the correct alternative.

The fluid seen in the intercellular spaces in human is _____

1. blood
2. lymph
3. **interstitial fluid**
4. water

Solution: The fluid seen in the intercellular spaces in humans is **interstitial fluid.**

Exercises | Q 2 | Page 180

Match the Respiratory surface to the organism in which it is found.

Respiratory surface	Organism
Plasma membrane	Insect
Lungs	Salamander
External gills	Bird
Internal gills	Amoeba
Trachea	Fish

Solution:

Respiratory surface	Organism
Plasma membrane	Amoeba
Lungs	Bird
External gills	Salamander
Internal gills	Fish
Trachea	Insect

Exercises | Q 3.1 | Page 180

Very short answer question.

Why does trachea have ‘C’ shaped rings of cartilage?

Solution:

The trachea has ‘C’ shaped rings of cartilage as they prevent the trachea from collapsing.

Exercises | Q 3.2 | Page 180

Very short answer question.

Why is respiration in insect called direct respiration?

Solution:

In insects, the respiratory system is independent of its circulatory system as blood does not play a direct role in oxygen transport but the tracheal tubes directly transport oxygen to the entire body. Therefore, respiration in the insect is called direct respiration.

Exercises | Q 3.3 | Page 180

Very short answer question.

Why is a gas exchange very rapid at the alveolar level?

Solution:

Alveoli are lined by layer of simple squamous epithelial epithelium. This thin, single layer of epithelium allows the rapid exchange of gases in alveolar region.

Exercises | Q 3.4 | Page 180

Very short answer question.

Name the organ which prevents the following the entry of food into the trachea while eating.

Solution:

Epiglottis

Exercises | Q 4.1 | Page 181

Short answer question.

Why is it advantageous to breathe through the nose than through the mouth?

Solution:

i. Nose filters and warms the inhaled air. Hair in the nose prevents the entry of microbes, dust, and other impurities which may harm the lungs.

ii. Mouth lacks any such structures for filtering and warming the air that is inhaled during inspiration. Hence, it is advantageous to breathe through the nose than through the mouth.

Exercises | Q 4.2 | Page 181

Short answer question.

Identify the incorrect statement and correct it,

a. A respiratory surface area should have a large surface area.

b. A respiratory surface area should be kept dry.

c. A respiratory surface area should be thin, maybe 1mm or less.

Solution:

b. A respiratory surface should be kept dry.

Correct statement – A respiratory surface should be moist in order to facilitate the exchange of gases.

Exercises | Q 4.3 | Page 181

Short answer question.

Given below is the characteristic of some modified respiratory movement. Identify them.

Spasmodic contraction of muscles of expiration and forceful expulsion of air through nose and mouth.

Solution:

Sneezing

Exercises | Q 4.3 | Page 181

Short answer question.

Given below is the characteristic of some modified respiratory movement. Identify them.

An inspiration followed by many short convulsive expirations accompanied by facial expression.

Solution:

Crying

Exercises | Q 4.4 | Page 181

Short answer question.

Write a note on blood plasma.

Solution:

Human blood consists of plasma and blood corpuscles or blood cells

Plasma: It is a straw-coloured, slightly alkaline, viscous fluid. It constitutes 55% of the blood.

Plasma consists of water, proteins (albumin, globulin, properdin, prothrombin, fibrinogen), inorganic salts

(Na, K, Mg, Ca, Fe, Mn and Cl^-, HCO_3^-, and PO_4^{3-})

food (glucose, amino acids, fatty acids, triglycerides), wastes (urea, uric acid and creatinine), regulators (hormones, enzymes, vitamins), anticoagulants (heparin), cholesterol and antibodies, dissolved gases (O_2, CO_2, N_2) Plasma contains 90% water, 7-8% proteins, inorganic salts – 1% and other substances 1-2%.

Blood Corpuscles: It constitutes 44% of the blood. Blood corpuscles are of three types as given below:

1. RBC (Red Blood Corpuscles) or Erythrocytes:

1. Erythrocytes are the most abundant cells in the human body.

2. They are circular, biconcave and enucleated (in camel and llama they are nucleated).

3. The red colour or RBCs is due to an oxygen-carrying pigment, the haemoglobin, in their cytoplasm.

4. In males, the RBC count is about 5.1–5.8 million/mm^3 (per µL) and in females about 4.3–5.2 million/mm^3.

5. The average life span of RBCs is 120 days.

6. The process of formation of RBCs is called erythropoiesis.

7. RBCs are produced from haemocytoblasts/reticulocytes.

8. The erythropoeitic organ of the foetus is the liver and spleen and in the adult, it is mainly the red bone marrow.

9. Vitamin B_{12}, folic acid and heme protein are required for the production of RBCs. The old and worn-out RBCs are destroyed in the liver and spleen (graveyard of RBCs).

10. Polycythemia is the condition in which the number of RBCs increase and erythrocytopenia is a decrease in number of RBCs.

11. The hormone erythropoietin produced by the kidney cells stimulates the bone marrow for the production of RBCs.

12. Mature erythrocyte is devoid of nucleus, mitochondria or other membrane bound cell organelles. Its cytoplasm (stroma) is rich in haemoglobin and O_2 carrying proteinaceous pigment that gives red colour to the RBCs and blood. It also contains an enzyme, carbonic anhydrase.

13. Erythrocytes are responsible for the transport of respiratory gases O_2 and CO_2, maintaining pH and viscosity of blood. They also contribute in the process of blood clotting.

14. The ratio of the volume of RBCs to the total blood volume of blood is hematocrit. It is different for men and women.

2. WBC (White Blood Corpuscles) or Leucocytes:

1a. Leucocytes are colorless, nucleated and amoeboid cells larger than RBCs.

2. These are colorless, irregular nucleated cells and show polymorphism (exist in variable forms)

3. Due to their amoeboid movement, they can move out of the capillary walls by a process called diapedesis.

4. A normal adult has on average, 5000-11000 WBCs per mm3 of blood.

5. Decrease in the number of WBCs (<4000) is called leucopenia (common in HIV, AIDS, and TB patients or those exposed to radiations, shock, etc.). Temporary increase in the number of WBCs is called as leucocytosis. It is due to infection. It also occurs during pregnancy and in newborn babies. An uncontrolled increase in the number of

WBCs is a type of blood cancer called leukemia. WBCs are mainly concerned with defense mechanisms i.e. protection.

3. Blood Platelets or Thrombocytes:

1. Thrombocytes are cellular fragments formed from the large cells called megakaryocytes.

2. These are produced in the bone marrow. They are very small, oval shaped cell fragments without a nucleus.

3. Normal count of thrombocytes in human blood is about 2.5 – 4.5 lakh / mm^3 of blood. If the number of thrombocytes decreases than normal, the condition is called thrombocytopenia. This condition causes internal bleeding (hemorrhage).

4. Platelets secrete platelet factors which are essential in blood clotting. They also seal the ruptured blood vessels by the formation of platelet plug/ thrombus. They secrete serotonin a local vasoconstrictor.

5. **Functions of Blood:** Blood perform various functions like transport, homeostasis and protection.

Exercises | Q 4.5 | Page 181

Short answer question.

Explain blood clotting in short.

Solution:

1. Clotting or coagulation is the process of converting liquid blood into a solid form. This process may be initiated by contact of blood with any foreign surface (intrinsic process) or with damaged tissue (extrinsic process).
2. Intrinsic and extrinsic processes involve the interaction of various substances called clotting factors by a stepwise or cascade mechanism.
3. There are in all twelve clotting factors numbered as I to XIII (factor VI is not in active use). Interaction of these factors occurs in a cascade manner leading to the formation of the enzyme thrombin.
4. Thromboplastin helps in the formation of enzyme prothrombinase. This enzyme inactivates heparin and it also converts inactive prothrombin into its active thrombin.
5. Thrombin converts soluble blood protein fibrinogen into insoluble fibrin. Fibrin forms a mesh in which platelets and other blood cells are trapped to form the clot.

Exercises | Q 4.6 | Page 181

Short answer question.

Describe pericardium.

Solution:

The heart is enclosed in a membranous sac called the pericardium. The pericardium is formed of two main layers - outer fibrous and inner serous pericardium. Serous pericardium is soft, moist, and elastic. It is formed of squamous epithelium and is further divisible into two layers as a parietal and visceral layer. Parietal and visceral layers of serous pericardium are separated by a pericardial space. This space is filled with pericardial fluid (about 50ml) which acts as a shock absorber and protects the heart from mechanical injuries. It also keeps the heart moist and acts as a lubricant.

Exercises | Q 4.7 | Page 181

Short answer question.

Describe valves of human heart.

Solution:

Both the atria open into ventricles of their respective sides by atrioventricular apertures. The atrio-ventricular apertures are guarded by cuspid valves.

i. Cuspid valves:
These are bicuspid and tricuspid valves. The bicuspid valve also known as the mitral valve is present in the left atrio-ventricular aperture. Tricuspid valve is present in the right AV aperture.

ii. Eustachian valve:
It is present on the opening of the post-caval vein (inferior vena cava).

iii. Thebesian valve:
It guards the opening of the coronary sinus into the right atrium.

iv. Semilunar valves:
These three valves guard the opening between the right ventricle and pulmonary artery and left ventricle and aorta.

Exercises | Q 4.8 | Page 181

Short answer question.

What is the role of papillary muscles and chordae tendinae in the human heart?

Solution:

The bicuspid and tricuspid valves are connected to chordae tendineae which in turn are connected to the papillary muscles present on the ventricular wall. Chordae tendineae and papillary muscles regulate the opening and closing of valves.

Exercises | Q 4.9 | Page 181

Short answer question.

Explain in brief the factors affecting blood pressure..

Solution:

The factors affecting blood pressure are:

1. Cardiac output:
The normal cardiac output is 5 litres/min. An increase in cardiac output increases systolic pressure.

2. Peripheral resistance:
It depends upon the diameter of blood vessels. A decrease in the diameter of arterioles and capillaries under the effect of vasoconstrictors like vasopressin or ADH cause increase in peripheral resistance and thereby increase in blood pressure.

3. Blood volume:
Blood loss in accidents decreases blood volume, and thus the blood pressure.

4. Viscosity of blood:
Blood pressure is directly proportional to the viscosity of blood.

5. Age:
Blood pressure increases with age due to the increase in inelasticity of blood vessels.

6. Venous return:
The amount of blood brought to the heart via the veins per unit time is called the venous return. It is directly proportional to blood pressure.

7. Length of blood vessel:
Blood pressure is also directly proportional to the total length of the blood vessel. Blood pressure can also be affected by vasoconstriction or vasodilation.

8. Gender:
Females have slightly lower BP than males before the age of menopause. However, the risk of high B. P. increases in the females after menopause sets in.

Exercises | Q 5.1 | Page 181

Give scientific reason.

Closed circulation is more efficient than open circulation.

Solution:

1. In open circulation, blood is not enclosed in blood vessels but pumped directly into the cavity called haemocoel whereas, in the closed type of circulation, blood flows within the blood vessels and does not come in direct contact with cells and body tissues.

2. Therefore, in closed blood circulation blood flows under high pressure and allows the blood to pass faster and achieve a high level of distribution within the body.

Thus, closed circulation is more efficient than open circulation.

Exercises | Q 5.2 | Page 181

Give scientific reason.

Human heart is called as myogenic and autorhythmic.

Solution:

1. The human heart is capable of generating a cardiac contraction independent of the nervous system. It can generate its own rhythm due to the presence of nodal tissues.
2. The nodal tissue SA node (Sinoatrial node) is capable of generating the wave on contraction and making the pace of contraction.

Thus, human heart is myogenic and autorhythmic.

Exercises | Q 5.3 | Page 181

Give scientific reason.

Person who has undergone a heart transplant needs lifetime supply of immunosuppressants.

Solution:

a. Immunosuppressants are the drugs that reduce the level of immune activity and the risk of rejection of foreign bodies such as transplant organs.

b. After transplantation, there is a risk of graft rejection as the body may recognize the transplanted organ/tissue as foreign and may trigger an immune response thereby damaging the transplanted organ.
Therefore, the heart recipient has to rely upon lifetime supply of immunosuppressants.

Exercises | Q 5.4 | Page 181

Give scientific reason.

Arteries are thicker than veins.

Solution:

i. Arteries carry oxygenated blood away from the heart to the body.

ii. The blood pumped out by the heart is under high pressure and to withstand this pressure arteries are thick-walled.

iii. Veins carry deoxygenated blood from the body back to the heart.

iv. They are thin-walled as the blood that flows through veins is under low pressure. Hence, arteries are thicker than veins.

Exercises | Q 5.5 | Page 181

Give scientific reason.

Left ventricle is thick than all other chambers of heart.

Solution:

i. The thickness of the myocardium of the four chambers varies according to the functions of each chamber.

ii. The thin-walled atria deliver blood into adjacent respective ventricles.

iii. As compared to the right ventricle, the left ventricle pumps blood at great distances to all other parts of the body at higher pressure, and resistance to blood flow is larger. Therefore, the left ventricle is thick as it requires strength to withstand the high pressure.

Exercises | Q 6.1 | Page 181

Distinguish between open and closed circulation.

Solution:

Open circulation	Closed circulation
1. In open circulation, blood is circulated through the body cavities (haemocoels).	1. In closed circulation, blood circulates the blood vessels and does not come in direct contact with cells and body tissues.
2. The blood flows with low pressure.	2. The blood flows with high pressure.
3. Exchange of material takes place directly between blood and cells or tissues of the body.	3. Exchange of material between blood and body tissues is through intermediate fluid called lymph.
4. It usually does not contain any respiratory pigment like haemoglobin so it does not transport respiratory gases	4. It contains respiratory pigments like haemoglobin for transportation of respiratory gases.
e.g. Arthropods and molluscs	e.g. All vertebrates, higher molluscs and annelids