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The Human Body: Circular System

We'll cover the following key points:

- The Circulatory System and its Parts
- Heart: Structure and Function
- Blood and Blood vessels
- Keeping your heart healthy



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Learning Outcomes

By the end of this chapter, students will be able to:

- Understand the basic concept of the human circulatory system and its role in the body.
- Identify the key components of the circulatory system, such as the heart, blood, and blood vessels.
- Learn how the circulatory system transports oxygen, nutrients, and waste throughout the body.
- Explore the importance of a healthy lifestyle, including exercise and diet, to maintain a strong and efficient circulatory system.

Guidelines for Teachers

The teacher can start the chapter by introducing the human circulatory system with a diagram of the heart and blood vessels, encouraging students to observe their own pulse or heartbeat. Discussions can focus on the function of the heart, the role of blood, and how blood vessels connect different parts of the body. The teacher can also emphasize the importance of a balanced diet, regular exercise, and clean habits to keep the circulatory system healthy, helping students understand the critical role it plays in overall well-being.



Warm Up

Write 'Yes' or 'No' for each of the following:

1. Blood flows through blood vessels in our body.
2. Blood keeps our body cool.
3. Blood carries only oxygen to different parts of the body.
4. Heart pumps blood through the body.
5. Arteries carry oxygen-rich blood away from the heart.

Fun Fact

The circulatory system is like a superhighway inside your body, with blood traveling nearly 60,000 miles of blood vessels—that's enough to circle the Earth twice! Your heart pumps around 2,000 gallons of blood every day, working tirelessly to deliver oxygen and nutrients. Amazingly, blood takes just 20 seconds to make a complete loop through your body. Red blood cells are the couriers, making 250,000 trips during their 120-day lifespan. And, laughter can improve circulation by 20%, making it literally good for your heart!

The Circulatory System and Its Parts

The Circulatory System

The human body can be compared to a very complex machine. There are several organs and organ systems within our body. The digestive system and the respiratory system, the excretory system are some of the system are responsible for the effective functioning of our body. The circulatory system delivers things to different parts of our body. This can be compared to a delivery truck that transports packages. But, unlike these trucks, our circulatory system carries oxygen, nutrients, and cell wastes through blood to different parts of our body. There is a need to constantly move these things around our body and therefore our circulatory system can never take a break.

Parts of the Circulatory System

The circulatory system consists of three main parts:

- ✦ **The heart**—A multi chambered, muscular organ that pumps blood throughout the body.
- ✦ **Blood**—A tissue that comprises of plasma, red and white blood cells and platelets.
- ✦ **Blood vessels**—It comprises of arteries, veins and capillaries.



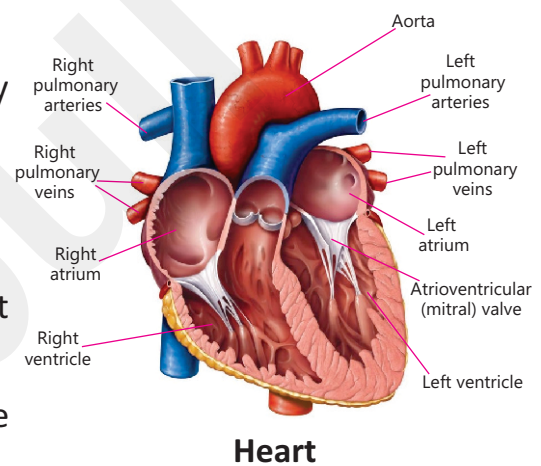
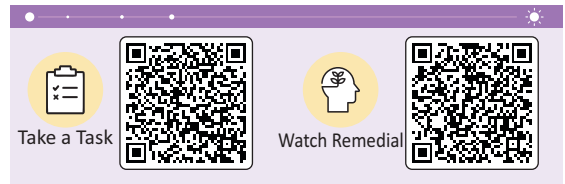
Heart: Structure and Function

The human heart is a muscular organ roughly triangular in shape made up of a type of muscle known as **cardiac muscle**. The size of our heart is about the same as our 'clenched fist' and is located in between the lungs, right in the center and above the diaphragm in the ribcage. The narrow end of the roughly triangular heart is pointed to the left side giving a feeling of the heart being on the left side.

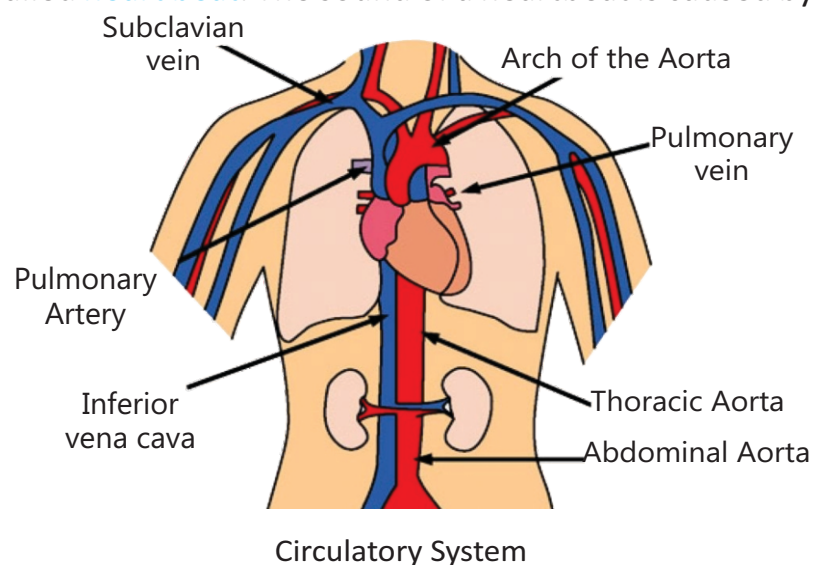
The heart has four compartments called 'chambers' inside it. The upper two chambers of the heart are called **atria** (singular atrium) or **auricles**, and the lower two chambers of the heart are called **ventricles**. These pumps the blood out of the heart. The left and right sides of the heart are separated by a partition called the **septum**.

The functioning of the heart can be summarized as follows:

- ✦ Oxygen-poor blood (shown as blue) from the body arrives in the heart to collect oxygen.
- ✦ The heart then sends this blood to the lungs to collect oxygen.
- ✦ This oxygen-rich blood (shown as red) is now brought back again to the heart.
- ✦ The heart now passes this oxygen-rich blood to be distributed to all the body parts.



The heart pumps blood by regular contraction and relaxation of the auricles and ventricles. The contraction and relaxation of the auricles and ventricles take place alternately. One complete contraction and relaxation of the heart is called **heart beat**. The sound of a heartbeat is caused by the opening and closing of the heart valves, as they pump blood. We can feel the heartbeat of a person by feeling the underside of the wrist, at the neck and also in the temples. This is called feeling the **pulse**. The heart of a normal healthy person beats about 60 to 100 times per minute under normal conditions. But, the rate of heart beat can increase during special physical exercise to more than 100 per minute.



Tabulation of your heart beat

Materials Required: Lab note book, pen/pencil, skipping rope, hula hoop, a timer etc.

Preparation: Practice finding your pulse. Use the first two fingers of one hand to feel your radial pulse on the opposite wrist. You should find your radial pulse on the "thumb side" of your wrist, just below the base of your hand. Practice finding your pulse until you can do it quickly.

Procedure:

- ♦ Measure your resting heart rate. You can do this by counting your pulse rate for 10 seconds and then multiplying it by 6. This will give you your heart rate per minute.
- ♦ Choose which exercise you want to do first. Before starting it, make sure you have been resting for a few minutes, so that your heart is at its resting heart rate.
- ♦ Perform the first exercise (say skipping) for 15 minutes and quickly count your pulse rate. Record your findings.
- ♦ Relax and bring your heart beat to normal before moving on to the next exercise.
- ♦ Perform the next exercise (say jumping jack) for 15 minutes and quickly count your pulse.
- ♦ You can do this for at least 5 different exercises and record your findings in a tabular form in the format given below:

Observation:

Exercise	Heart rate/minute (before exercise)	Heart rate/minute (after exercise)

Write 'T' for true and 'F' for false statements.

1. The heart is made up of cardiac muscles.
2. Septum is situated between the left and right chambers.
3. A normal healthy person's heart beats about 50-60 times per minute.
4. Exercise decreases the rate of heart beat.

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Blood and Blood Vessels

Blood

Blood is the fluid that is the main agent of transportation in our body. It flows inside the blood vessels. It consists of a fluid part known as **plasma** and solid parts known as **RBC**, **WBC** and **platelets**. Let us understand their functions:

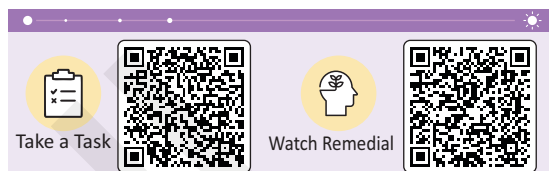
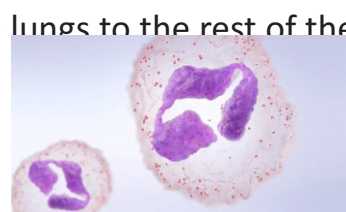
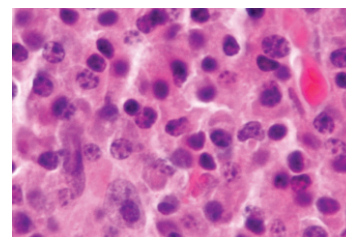
Plasma - This is the liquid component of the blood in which the blood cells (RBC, WBC and platelets) are suspended. It transports nutrients to the cells and also carries wastes from the cells.



Red blood cells - These carry oxygen from the lungs to the rest of the body. It also carries carbon dioxide from the rest of the body to the lungs.

White blood cells - These help to fight infections and to help build the immune system.

Platelets - These help in blood clotting whenever there is an injury.



Did you know ?

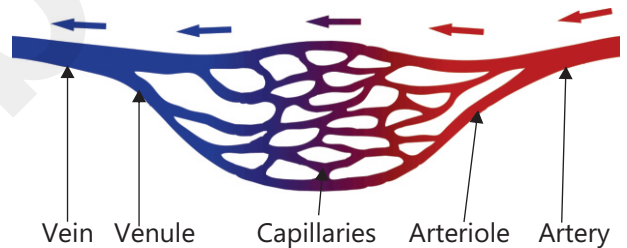
Not all blood is red: While humans have red coloured blood, other organisms have blood of varying colours. Crustaceans (spiders, squid, octopuses, etc.) have blue blood. Some types of worms and leeches have green blood. Some species of marine worms have violet blood. Insects, including beetles and butterflies, have colorless or pale-yellowish blood. The colour of blood is determined by the type of respiratory pigment used to transport oxygen via the circulatory system to cells. The respiratory pigment in humans is a protein called hemoglobin found in red blood cells.

Blood Vessels

Blood vessels are a fine network of hollow tubes that transport blood throughout the body. They form an intricate network within the body so that blood along with nutrients and other substances may be transported throughout the body. There are three main types of blood vessels. They are arteries, veins and capillaries.



- **Arteries** – These are blood vessels that carry blood away from the heart. They have thick strong walls. Small arteries are called **arterioles**. **Aorta** is the largest artery in our body. Other important arteries are **Pulmonary artery** (carries blood to the lungs) and **Carotid artery** (carries blood to the brain).
- **Veins** – These blood vessels carry blood back from the tissues to the heart. They have thinner walls than arteries. Veins branch into small **venules**. Veins have valves to prevent the back flow of blood into the body parts. The largest vein is called the **vena cava**. There are two sections of vena cava. The **Superior vena cava** returns blood from upper part of the body such as head, neck, chest, etc. whereas the **Inferior vena cava** returns blood from the lower parts of the body back to the heart.
- **Capillaries** – They are the smallest type of blood vessels in our body. They connect the smallest arteries to the smallest veins.



Keeping Your Heart Healthy

- Remember that our heart is a very active muscle working for us non stop day and night. If we want

CHECK 'N' MATE

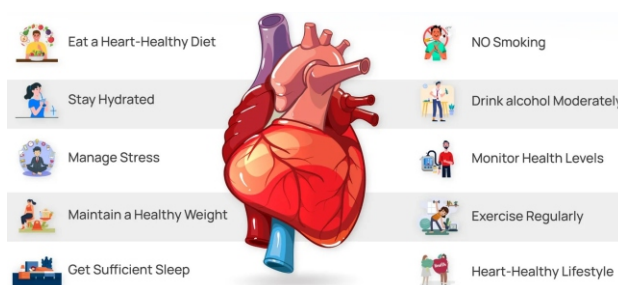
Critical Thinking

Fill in the blanks with correct words.

1. _____ (Red/White) blood cells carry oxygen from the lungs to the rest of the body.
2. Platelets help in blood _____ (purifying/clotting).
3. _____ (Arteries/Veins) carry blood back from the tissues to the heart.
4. Capillaries are the _____ (smallest/biggest) type of blood vessels.

it to be strong, we need to give it its share of regular exercise. Skipping, dancing, or playing games like tennis and basketball are very good for our heart. We must give it at least half an hour of rigorous exercise everyday.

- A healthy breakfast is the key to a healthy heart.
- We must eat a variety of healthy foods and avoid foods high in unhealthy fats, such as saturated fats and trans fats (reading food labels can help us figure out if our favorite snacks contain these unhealthy ingredients).
- We must not forget to include a generous amount of fruits and vegetables in our daily diet along with whole grains.
- We must choose and prepare food with less salt. We always tend to consume more sodium (salt) than our body needs.
- Consuming omega 3 fats is good for our heart and brain.
- We must try and spend less time sitting still. Taking a break while watching TV, playing computer games or doing our homework is a good idea. We must get up from our seat and take a stroll around if our work demands us to sit for long hours.
- Taking the stairs instead of an elevator is another good option to keep our heart healthy.
- We should drink lots of water every day rather than fizzy drinks or sugary fruit juices.



In a Nutshell

- ✦ The circulatory system is the main transporting system in our body.
- ✦ It consists of the heart, blood and the blood vessels.
- ✦ The heart is a muscular organ made up of cardiac muscles which is responsible for pumping blood throughout our body.
- ✦ Blood is the fluid agent of transportation in our body that comprises plasma, RBCs, WBCs and platelets.
- ✦ Blood vessels are hollow tubes that transport blood throughout the body. They are of three types.
- ✦ Arteries- These carry blood away from the heart to different body parts.
- ✦ Veins – These carry blood back to the heart from different body parts.
- ✦ Capillaries – These are the smallest connections between arteries and veins.

Blood	: Sticky red liquid that carries oxygen, water and nutrients to all parts of the body
Blood vessels	: Thin tubes that carry blood to different parts of the body
Circulatory system	: Organ system that helps in the transportation of essential substances inside the body



EXERCISE

That turn curiosity into confidence—let's begin!



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A. Objective Type Questions.

- The beating sound of the heart comes from :
 - The heart skipping beats ☐
 - Blood going in the wrong direction ☐
 - Heart valve's opening and closing as they pump blood ☐
 - Your imagination ☐
- The wall that separates left and right side of the heart is called.

a. Auricles	<input type="checkbox"/>	b. Septum	<input type="checkbox"/>
c. Ventricles	<input type="checkbox"/>	d. The great wall	<input type="checkbox"/>
- You can keep your heart healthy by :

a. Exercising regularly	<input type="checkbox"/>	b. Consuming omega 3 fats	<input type="checkbox"/>
c. Reducing your salt intake	<input type="checkbox"/>	d. All of the above	<input type="checkbox"/>
- What is the main function of RBC in the blood?
 - To help in clotting of blood. ☐
 - To fight infections and help to build the immune system. ☐
 - To transport oxygen to the body's cells and carry away carbon dioxide from the cells. ☐
 - To transport carbon dioxide to the body's cells and carry away oxygen from the cells. ☐

5. Which of the following may be compared to soldiers of our body?

a. Capillaries

☐

b. Lungs

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c. RBC

☐

d. WBC

☐

6. Which blood vessels carry blood away from the heart?

a. Arteries

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b. Veins

☐

c. Capillaries

☐

d. All of the above

☐

7. Which of the following is not a part of the circulatory system?

a. Veins

☐

b. Stomach

☐

c. Heart

☐

d. Arteries

☐

B. Fill in the blanks.

1. The heart is made of special muscles known as _____ muscles.

2. _____ are the smallest type of blood vessels that connect the arteries to the veins.

3. The _____ artery carries blood to the lungs.

4. The circulatory system consists of the _____ , _____ and _____ .

5. _____ is the largest artery in our body.

6. The upper two chambers of the heart are called _____ and the lower two chambers are called _____ .

7. The fluid part of the blood is called _____ .

C. Very Short Answer Questions.

Give one word answer.

1. Blood vessels that carry blood away from the heart _____ .

2. This returns blood from the lower part of the back to the heart _____ .

3. The respiratory pigment found in red blood cells _____ .

4. These help to fight infection and to build up the immune system _____ .

5. This is the main agent of transportation in our body _____ .

6. One complete contraction and relaxation of the heart _____ .

7. The heart sends the blood here to collect oxygen _____ .

D. Short Answer Questions.

1. Describe in brief the circulatory system.

2. Enlist the three main parts of the circulatory system.
3. List three ways by which we can keep our heart healthy.
4. WBCs are called the 'soldiers of our body'. Explain.
5. What would happen if there were no platelets in our blood?



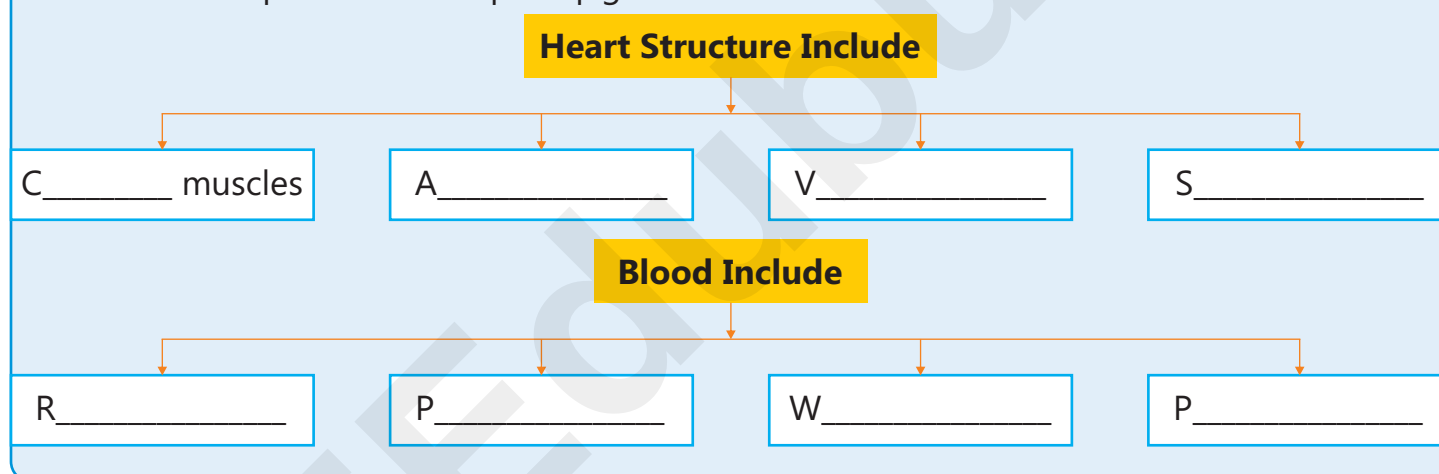
E. Long Answer Questions.

1. What is blood ? Explain the components of blood along with their functions.
2. What are the different types of blood vessels? Explain their functions.
3. With the help of a neat labelled diagram, explain the structure of the human heart. Also explain its functioning.

Time to Recall

Remembering and Analysing

Recall and complete the concept map given below.



Time to Apply

Applying and Creating

An interesting way to think about the circulatory system is to compare it to the transportation network of a city. The heart can be thought of as the central hub that powers the system, much like a central station or power plant in a city. Blood vessels can be compared to the roads, highways, and subways that transport goods and people across the city. Taking hints from the examples above, can you draw comparisons and state the following:

The central station or hub of the city (that powers everything) - _____

The roads connecting different parts of the city - _____

The highways that transport goods quickly to distant locations - _____

The traffic signals controlling the flow of transport - _____



Time to Discuss

Pondering and Communicating

How do different organs work together to make the circulatory system function properly?

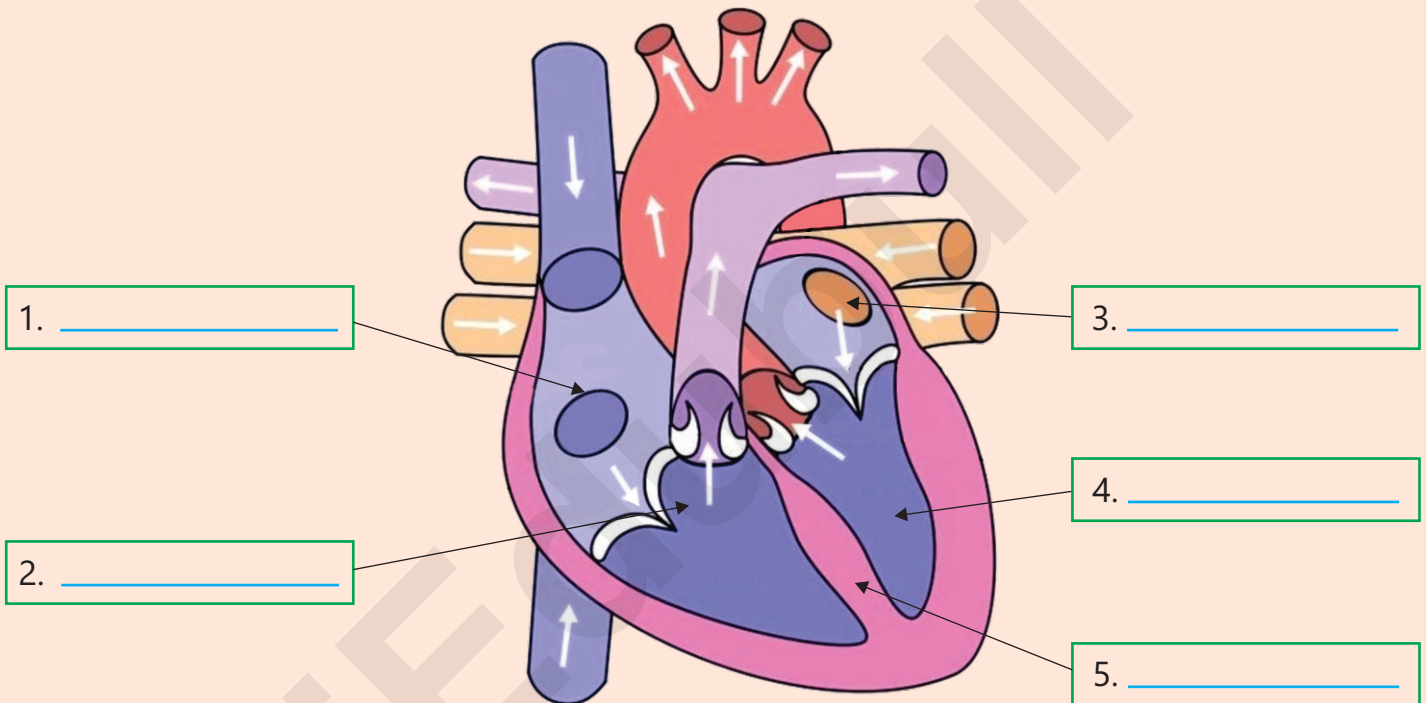


Time to Observe

Observing, Critical Thinking, Analysing

Observe the structure of the heart and label it correctly. The names are given in the box for your help.

Septum Right auricle Left ventricle
Right ventricle Left auricle



Time to Create

Creating and Collaborating

Make a simple model of circulatory system using thermocol. You may cut out shapes of the circulatory systems from thermocol by pasting pictures of these systems on thermocol first.