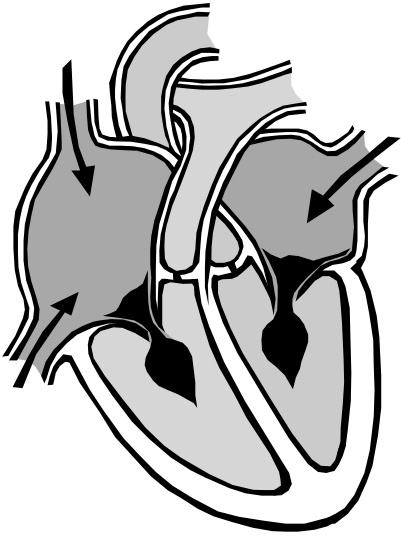
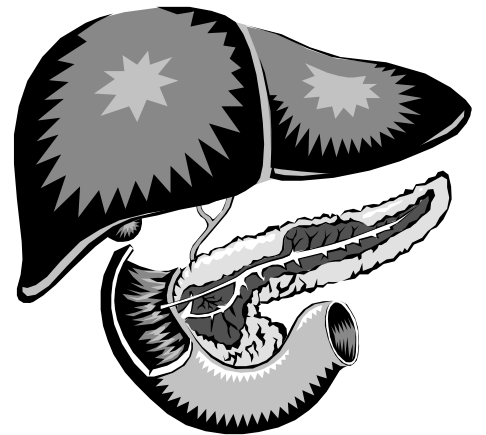




The incredible Journey



Name: _____



YOUR BODY'S TRANSPORT SYSTEM

The cells in your toes need food, water and oxygen and have to get rid of waste products just like any other cell in your body. However, they are more than a metre away from your digestive system. A transport system is needed to deliver the food and oxygen. Your blood system does this job.

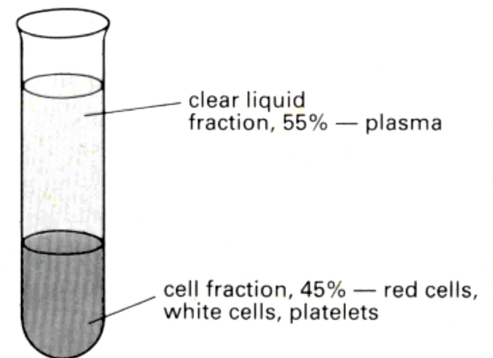
The blood system consists of blood vessels of different sizes and a muscular heart which contracts rhythmically to pump blood through the blood vessels. The blood system is often called the circulatory system.

BLOOD

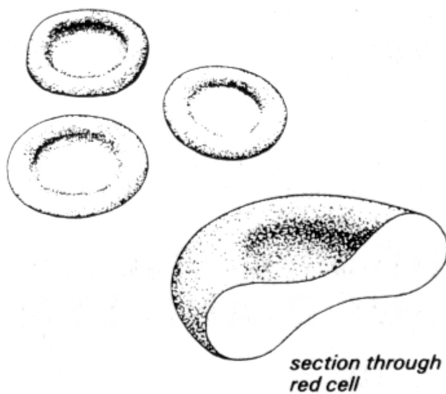
The circulatory system is concerned with transporting materials and maintaining the circulation of fluids within the body.

THE COMPOSITION OF BLOOD

If a sample of mammalian blood is taken and spun in a centrifuge it will separate into two fractions. Plasma makes up about 55 per cent of the volume of blood. It is a watery solution in which are suspended red and white blood cells and small particles called platelets.



RED BLOOD CELLS



Red blood cells. Red blood cells are 7-8 μm in diameter and 1-2 μm thick.

Human red blood cells contain no nuclei. For this reason they cannot survive more than three months. There are about five million red blood cells in every 1 ml of blood (a tiny drop). They are made in the red bone marrow, stay in the blood for about three months and are destroyed in the liver or the spleen. In humans, every second, about one million old red blood cells are replaced by new ones. Red cells contain the pigment haemoglobin. Haemoglobin contains iron, which combines readily with oxygen to form a bright red unstable compound called oxyhaemoglobin. Where the oxygen concentration is low the molecule breaks down to release free oxygen. In this way red blood cells can pick up oxygen molecules in the lungs and transport them round the body to the cells in the tissues.

WHITE BLOOD CELLS

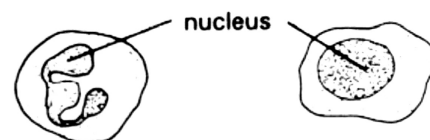
White blood cells are of several different types. They all contain a nucleus. There are between four and twelve thousand in every 1 mL of blood. Most white blood cells are made in the bone marrow or lymph nodes. They are 600 to 1000 times less numerous than red cells but most are much larger.

There are several types of white blood cells; two important types are phagocytes and lymphocytes.

Phagocytes can actively move about by

flowing their cytoplasm and can move from the blood into the tissue fluid. They surround and ingest bacteria, foreign bodies and dead cells, and collect at areas of infection or injury.

WHITE BLOOD CELLS (LEUCOCYTES)



White blood cells. White blood cells vary in size up to 26 μm in diameter.

PLATELETS

Blood platelets are fragments of cells made in the bone marrow. They are very small, about 3µm in size, and play an important role in helping the blood to clot.

PLASMA

Plasma is a sticky, straw-coloured liquid. It is made up of about 90 per cent water plus various other substances carried in solution. These include digested food products such as sugars and amino acids, excretory products such as carbon dioxide and urea, hormones, and large protein molecules such as antibodies. Dissolved inorganic minerals make the plasma slightly salty.

THE FUNCTIONS OF BLOOD

Transport system The table below shows how the blood carries various substances to every cell in the body.

Blood clotting This complex mechanism repairs damage to blood vessels and seals wounds to prevent loss of blood.

Defence against disease The various types of white blood cells help to fight infection in the body. Antibodies provide immunity against further attack.

MATERIALS TRANSPORTED IN THE BLOOD				
TRANSPORT OF	FROM	TO	CARRIED BY	PURPOSE
Oxygen	Lungs	Body cells	Red blood cells	Respiration
Carbon dioxide	Body cells	Lungs	Red blood cells and plasma	Excretion
Digested foods	Digestive organs and liver	Body cells	Plasma	Growth and cell metabolism
Urea and other waste nitrogenous material	Liver and body cells	Kidneys	Plasma	Excretion
Hormones	Ductless glands	Body	Plasma	Regulation of body activities
Heat	Muscles, liver	All tissues including skin	Whole blood	Regulation of body temperature

Question

1. What is blood, and what does it do?

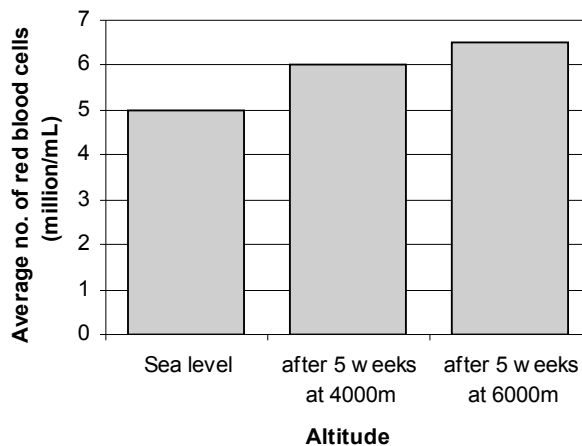
2.State the differences between red blood cells, white blood cells and blood platelets.

PROBLEM SOLVING

The number of red cells in the blood varies slightly from person to person. However, people who live high up in mountains have a higher average red cell count than people who live at sea level. Scientists infer that since there is less oxygen available at higher altitudes the body makes more red blood cells so that the blood can carry oxygen more efficiently.

In an experiment, some people who lived at sea level were taken to an experimental station 4000 m above sea level where they stayed for 5 weeks. They then went to another station 6000 m above sea level for 5 weeks.

The bar graph shows the results of this experiment.

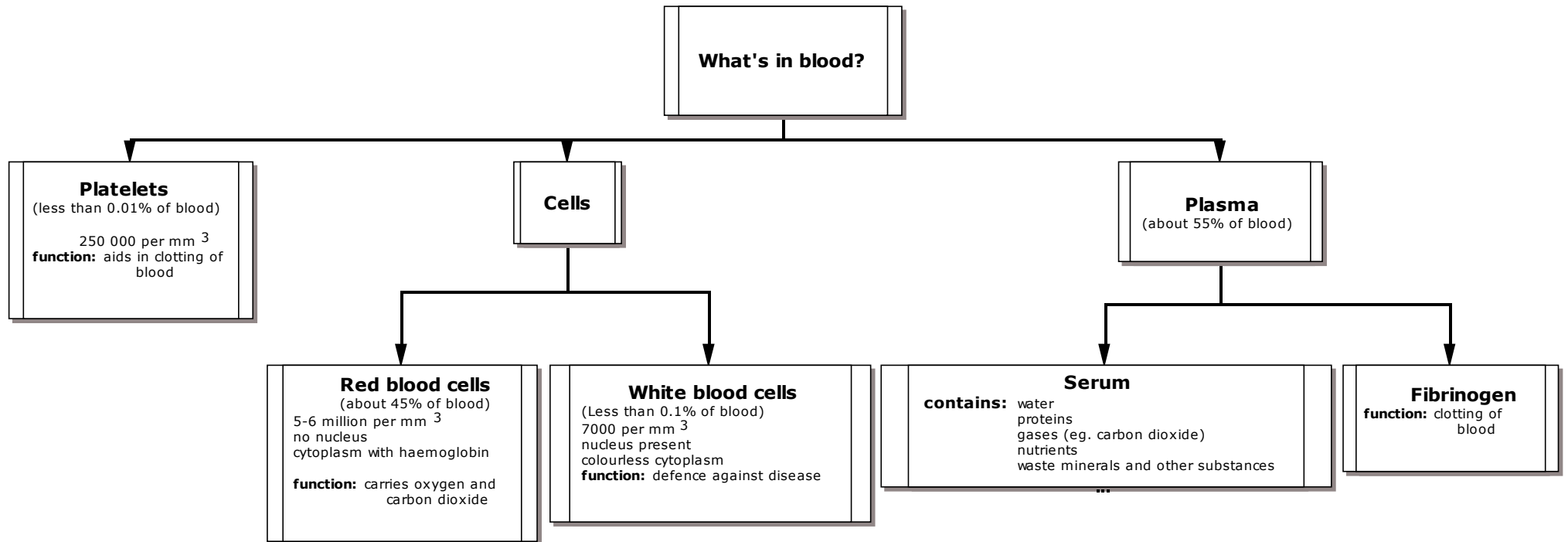


1. What was the percentage change in the average number of red blood cells after 5 weeks at 4000 m?

2. By what percentage did the red cell count increase between sea level and 6000 m?

3. Predict what would happen to the red cell counts when the people returned to sea level. Explain why.

4. Some athletes, particularly long-distance runners, train for a number of weeks at high altitudes before important events such as the Olympic Games. Why do they do this?



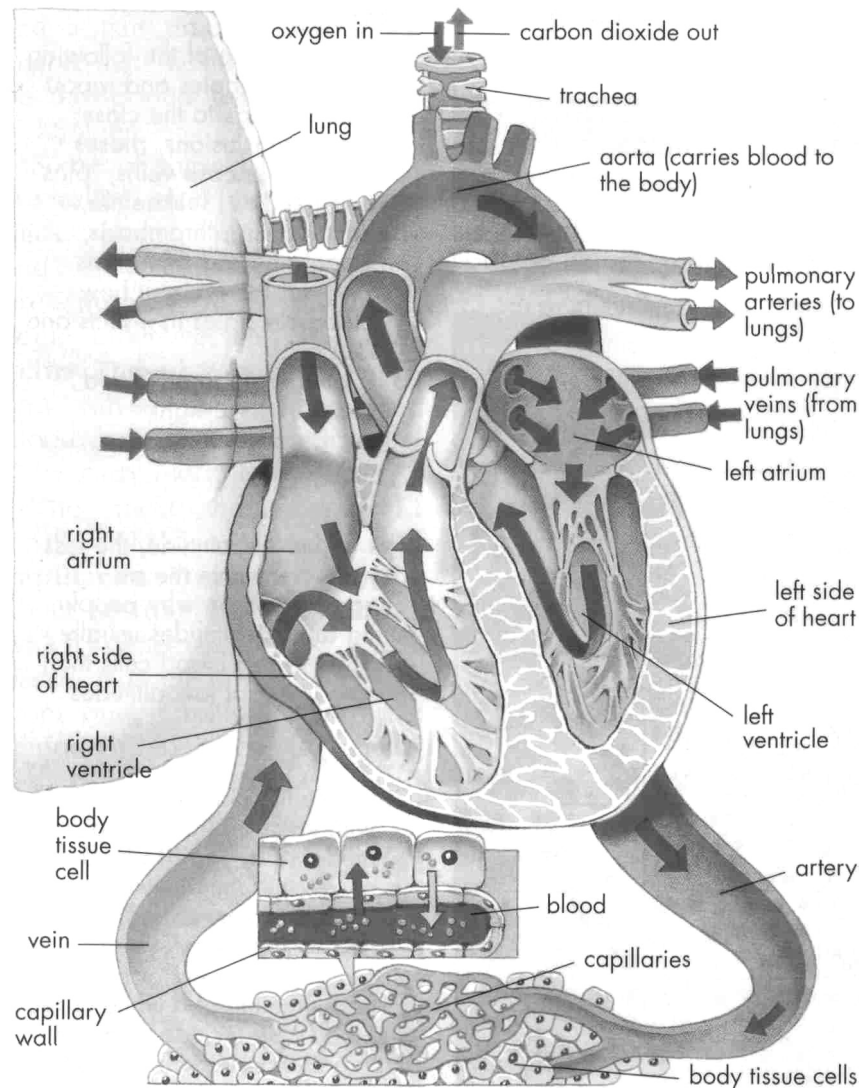
Circulatory System

The circulatory system constantly carries blood in a cycle around an animal's body. This system supplies every cell with oxygen and the nutrients it needs to survive, and takes away the waste products.

The blood flows through tubes called blood vessels and is kept moving by the pumping action of the heart.

Parts and Functions of the Circulatory System

- **Heart** — The heart is a hollow muscular pump which forces blood around the body. An atrium is a chamber that admits blood to the heart and a ventricle expels blood from the heart.



The movement of blood through the heart, as seen from the front of your body

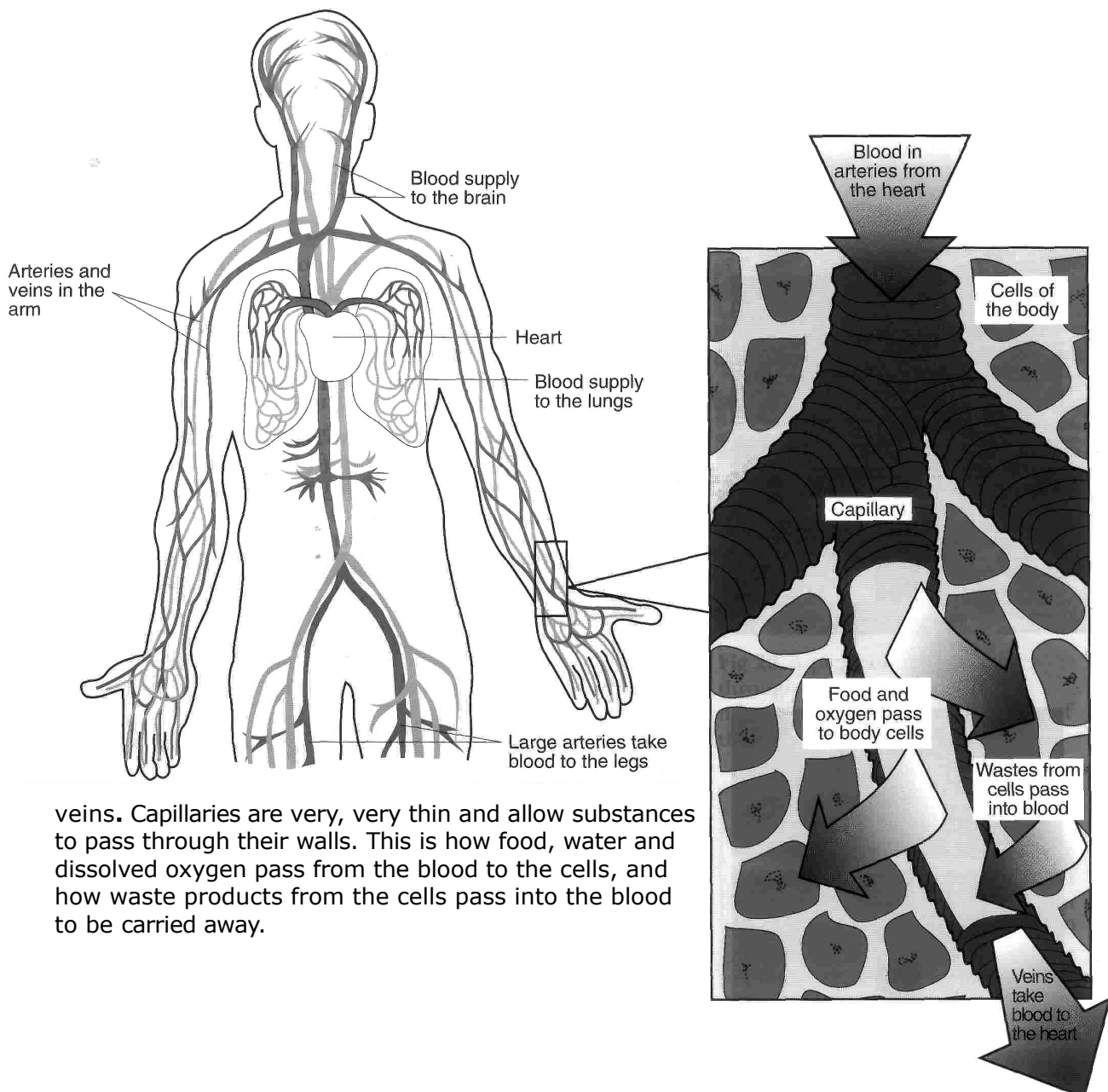
Blood from the lungs flows into the heart via the **pulmonary vein**, and out to the body via the **aorta**. Blood from the body flows back into the heart via the **vena cava**, and then out to the lungs via the **pulmonary artery**.

The heart is an organ that pumps blood through the body. It is driven by muscles. Blood leaves the heart through arteries. Used blood returns to the heart in veins. The heart is actually a double pump. One pump pushes the blood through the lungs. Here, the blood receives oxygen. It then returns to the heart, where it is pumped around the body.

Copy and complete

1. The _____ is an organ which pumps blood through the human body.
2. The heart is driven by _____.
3. Blood is pumped through the _____ where it picks up oxygen. It then returns to the heart, where it is pumped again, this time around the body and head.
4. Blood leaves the heart in tubes called _____.
5. Blood returns used up to the heart, in tubes called _____.
6. The top half of the heart is called the _____.
7. The bottom half of the heart is called the _____.

Blood vessels — The blood vessels that carry blood *away* from the heart are called **arteries**. Those that carry the blood back *towards* the heart are called **veins**. The large arteries and veins connected to the heart form numerous branches and become narrower. Microscopic vessels called capillaries connect the narrowest arteries and



veins. Capillaries are very, very thin and allow substances to pass through their walls. This is how food, water and dissolved oxygen pass from the blood to the cells, and how waste products from the cells pass into the blood to be carried away.

Experiment: Measuring Friction

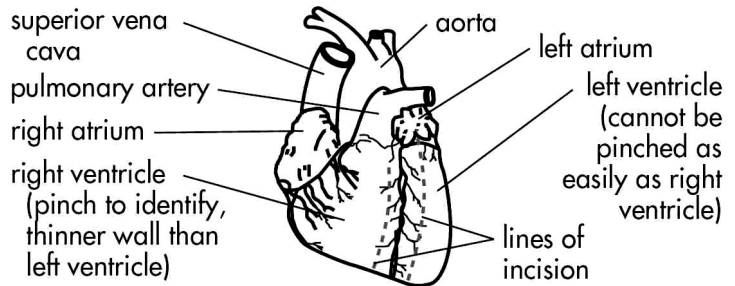
AIM: To dissect a sheep's heart to identify its main features. Sheep have similar hearts to humans.

MATERIALS

- Sheep's heart
- Dissection implements (dissecting board, forceps, tweezers, scalpel, scissors)
- Antiseptic solution
- Paper towelling

METHOD

Follow the figure to dissect a sheep's heart.



RESULTS AND DISCUSSION

Identify the four chambers and the major blood vessels. Identify valves inside the heart.

1. Draw a diagram of your dissected sheep's heart and write a description of each structure you identify.
2. Suggest why one side of the heart has thicker walls than the other side. What is the function of the valves in the heart?

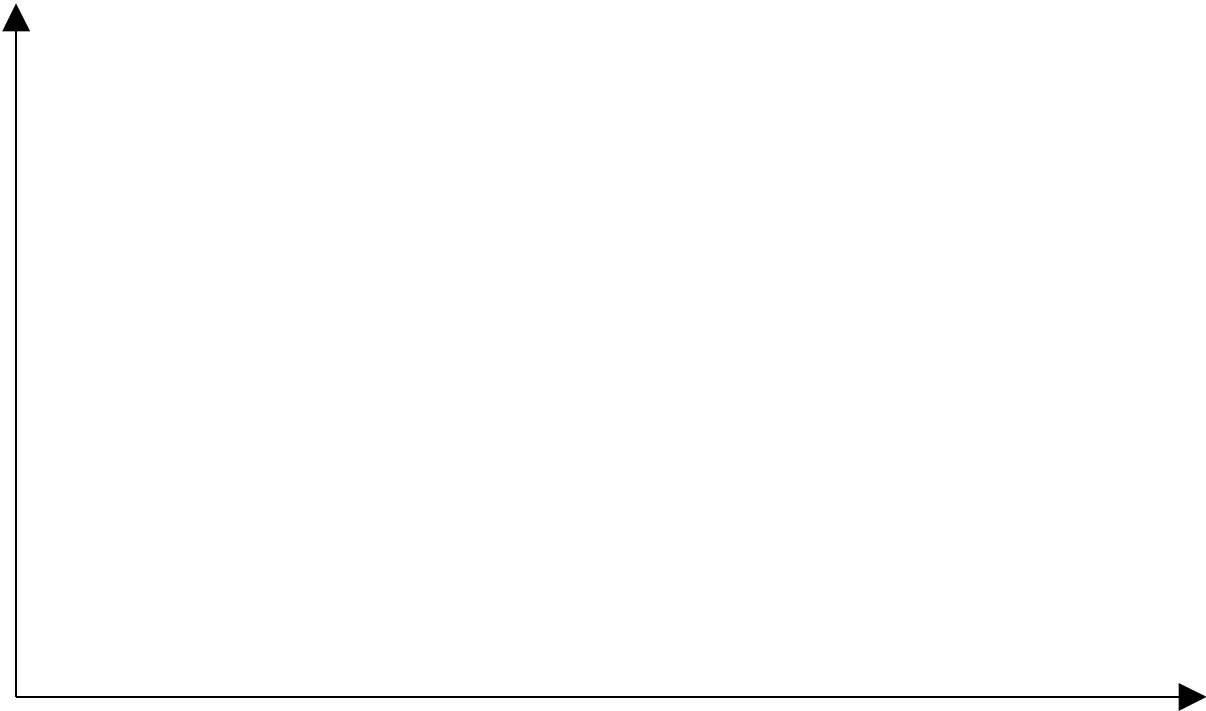
Question

1. How many pumping chambers are there in a human heart? _____
2. From which side of the heart, and which chamber, is blood pumped:
 - a To the lungs? _____
 - b To the rest of the body? _____
3. What is a pulse? Why can you feel it in arteries and not in veins?

4. You can feel the pumping action of the heart in your arteries. This is a pulse. Find the pulse in your wrist. Count the beats in 1 minute:
 - c When you are sitting down
 - d When you walking on the spot for 1 minute
 - e When you run on the spot for 1 minute.

Activity	Sitting	Walking on the spot	Running on the spot
Trail 1			
Trail 2			
Trail 3			
Average			

Graph the time it takes for your pulse to return to normal.

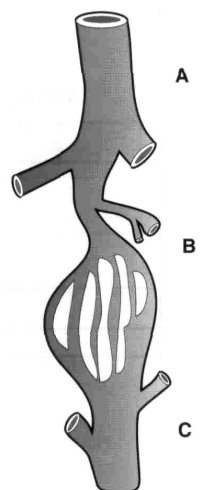


5. Complete the following sentences.

- a. Arteries have thicker, more muscular walls than _____.
- b. Blood is pumped to the rest of the body by the _____.
- c. _____ is carried to body cells by red blood cells.
- d. Food and oxygen pass out of the tiny _____ and into the cells in your body.

6. Blood contains different types of cells suspended in a liquid called plasma. What is the job of the plasma and each of the types of blood cells?

7. The figure is a simplified diagram of part of the blood system. Which of the structures are (a) veins, (b) arteries and (c) capillaries? In which direction does the blood flow?

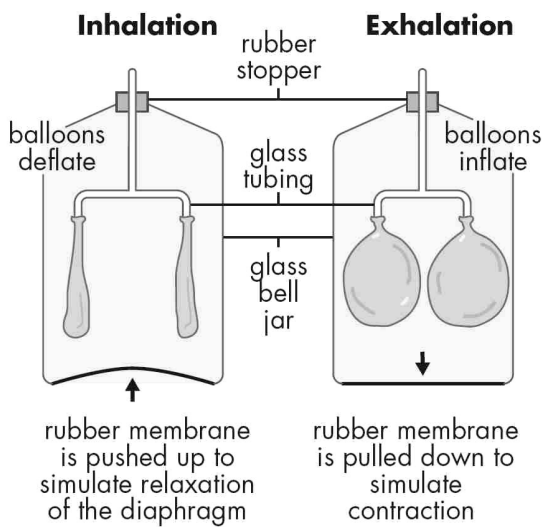


8. Why do your pulse and breathing rates increase after exercising?

9. An adult heart pumps about 5 litres of blood each minute. How much will it pump in one day?

Respiratory System

The lungs are the organs at the centre of the respiratory system. They bring air and blood close together so that oxygen and carbon dioxide can move from one to the other through a thin, moist membrane. Breathing is the forced movement of air into and out of the lung. When the carbon dioxide levels in the brain decrease the diaphragm muscles pull down and so increase the volume of the lungs, so air rushes in. The diaphragm then contracts and the air is forced out. The term breathing refers to the inhaling and exhaling of air, while respiration refers to the chemical reaction that takes place in all body cells, using oxygen and simple sugars and releasing carbon dioxide, water and energy.



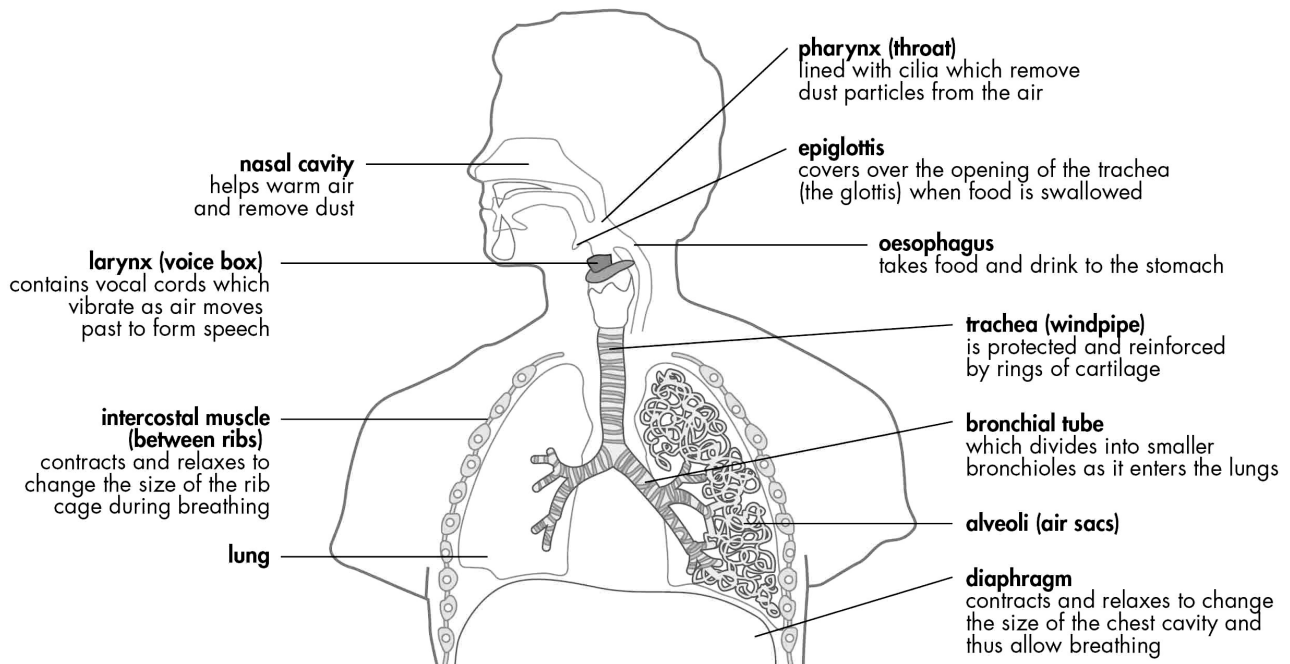
Component	Inhaled air (%)	Exhaled air (%)
Oxygen	21	16
Carbon dioxide	0.03	4
Nitrogen	79	79
Water vapour	Variable	Saturated

Composition of air

Model lungs. The diagrams show a model for how the diaphragm functions in breathing, but they do not give a full explanation of breathing. How could the model be improved?

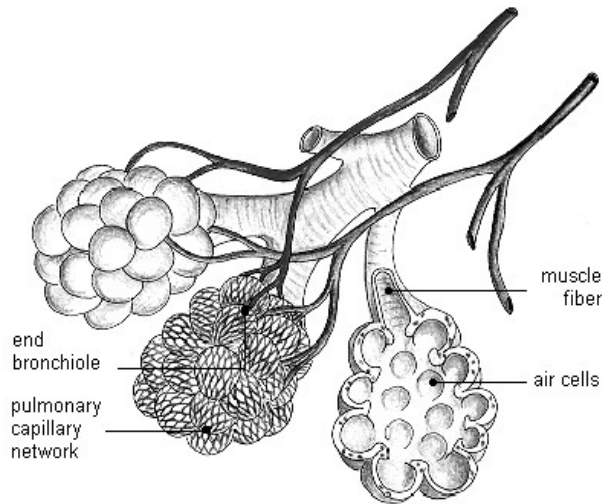
Parts and Function of the Respiratory System

- Lungs** — Lungs are the organs that most vertebrates use to exchange gases. Oxygen and carbon dioxide exchange occurs through a very thin membrane.



- **Trachea** — The passageway leading from the nose to the lungs. The trachea is reinforced by rings of cartilage and lined by cilia that move dust and other particles back out of the airways.
- **Bronchus** — The passageway leading from the trachea to the lung. The bronchi divide into very small branches called bronchioles that go to every alveolus.
- **Alveolus** — A tiny air-filled sac from which gas exchange between blood and air takes place across a thin membrane

air cells



1. Explain the difference between breathing and respiration.

2. Why is it important that you breathe faster when exercising?

3. Draw a flow chart to summarise the steps in inhaling and exhaling.

