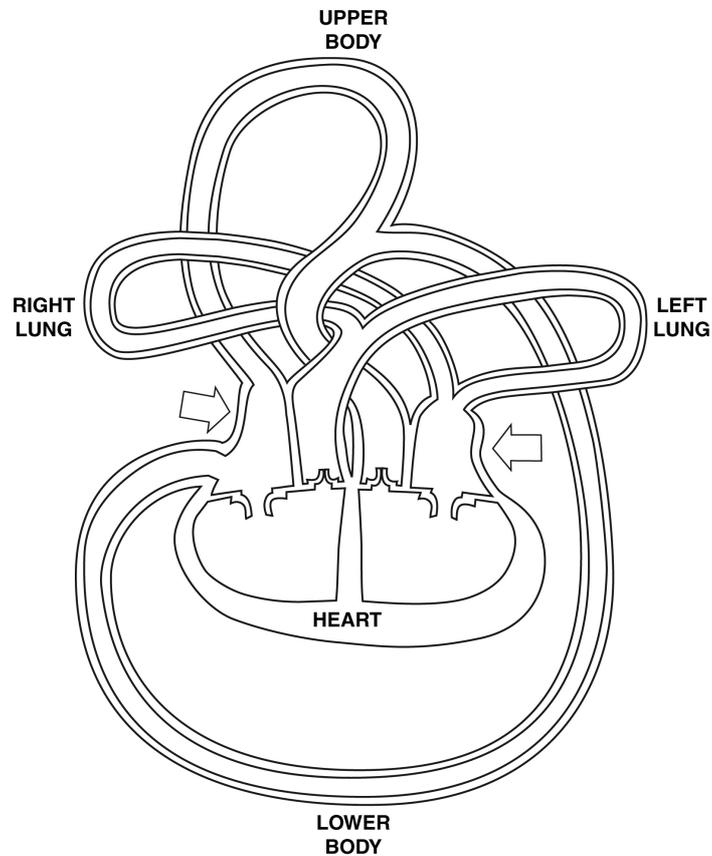


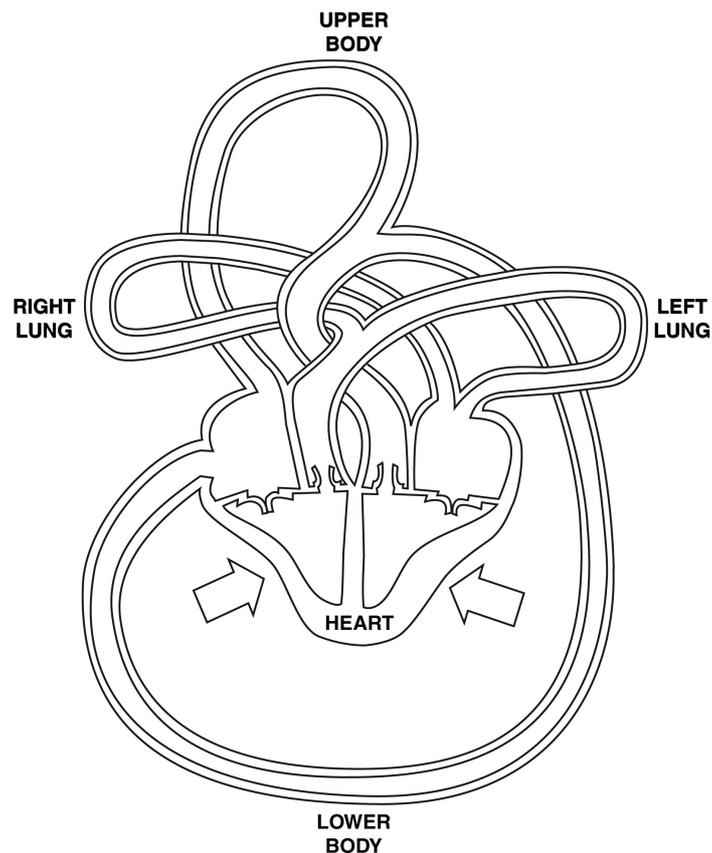
BLOOD FLOW THROUGH THE HEART

The heart is a sac made of muscle, which contains four chambers connected by valves (one-way doors). Frontal cross sections are shown in these diagrams.

(1) Diastole: Draw small arrows to trace the flow of blood when the atria contract (The atria (singular atrium) are the upper chambers):



(2) Systole: Draw small arrows to trace the flow of blood when the ventricles contract (The ventricles are the lower chambers):



(3) Memorising the names of the different parts of the heart is **not necessary**. But given the definitions, you can label each chamber of the heart, each valve, and the main arteries and veins. Colour the blood red or blue, depending on whether it is oxygenated.

The major arteries (carry blood to heart) and veins (carry blood away from heart):

- (a) The aorta is the artery that carries oxygenated blood out of the heart.
- (b) The superior vena cava carries de-oxygenated blood from the upper parts of the body into the heart.
- (c) The inferior vena cava carries de-oxygenated blood from the lower parts of the body into the heart.
- (d) Pulmonary arteries carry de-oxygenated blood from the heart to the lungs.
- (e) Pulmonary veins carry oxygenated blood from the lungs to the heart.

The valves:

- (f) The pulmonary valve lies between the right ventricle and pulmonary artery.
- (g) The tricuspid (right atrioventricular or right AV) valve lies between the right atrium and the right ventricle.
- (h) The bicuspid (mitral or left atrioventricular or left AV) valve lies between the left ventricle and left atrium.
- (f) The semilunar (aortic) valve lies between the left ventricle and the aorta.
- (f) The pulmonary valve lies between the right ventricle and pulmonary artery.

WHAT COLOUR IS YOUR BLOOD?

[Note: Students should write the answers to the questions shown in bold without help, and without previously having studied the circulatory system or the heart. Teachers can evaluate their answers as shown at the bottom of the page.]

True or false: Blood is red. Many people say red, but actually half your blood is bright red and half is bluish.

(1) Can you see any bluish blood in your veins? Look at places where your skin is thin and transparent. If you see bluish veins, tell where you see them.

(2) Did you ever see bluish blood when you cut yourself?

Blood turns bright red whenever it comes in contact with oxygen in air. Your blood travels through your lungs where it gets mixed with the air you breathe. Your blood then carries oxygen to different parts of your body.

Your body needs oxygen to grow and to function. Your muscles need oxygen to move your arms and legs. Your stomach and intestines need oxygen to digest your food. Your brain needs oxygen to think. Your bones need oxygen to grow. All the cells of your body need oxygen.

When blood gives off its oxygen to cells in different parts of your body, it turns bluish. Then it travels back to your lungs and gets more oxygen.

But what makes blood travel throughout your body? It is pumped. Your heart is a pump. It pushes blood through your arteries and veins.

How does your heart pump blood?

Your heart is like a bag made of muscles. When the muscles squeeze, the blood gets pushed out of your heart. But the heart will not pump unless it pushes the blood in only one direction, first to the lungs to get more oxygen and then to all parts of your body.

Your heart is divided into four rooms, or chambers, full of blood. It also has four special doors, or valves, that only let blood go in one direction: either in or out. Thus, when the heart muscles squeeze, the blood can go in only one direction.

How does a valve work?

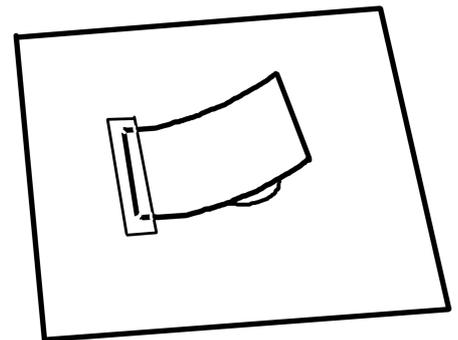
How can there be a door that will let something go in, but not out?

Make this model and find out.

Heart Valve Model

Take a sheet of paper and cut a 2 centimetre hole in the centre of it.

Cut another 5 centimetre square of paper. This is the door. Glue one side of it to the sheet so that it covers the hole, as shown. Label this side of the sheet **INSIDE.**

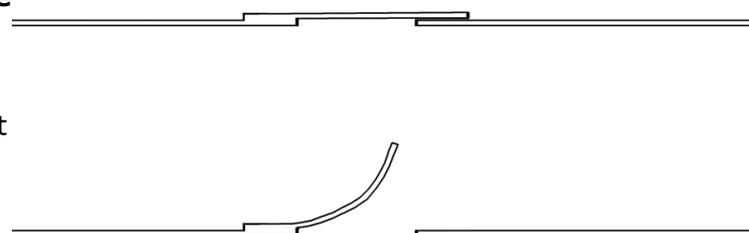


(3) Blow against the inside of the door. Does the door open?

(4) Now turn the sheet over and blow against the outside of the door. Does the door open?

(5) Does air go through the door in only one direction?

Your heart valves work just like this door, except with blood instead of air.



(6) Look at the diagrams in the handout :Blood flow through the heart". Do you see the four chambers, and the four valves?

(7) Can you imagine which way the blood would have to push to open each valve? Draw arrows to indicate which way the blood can go.

(8) Suppose you squeezed the bottom part of the heart, as indicated by the two big arrows in the bottom diagram. Where would the blood in the two bottom chambers go? Remember, the valves can let blood through in only one direction. Draw lots of small arrows to show which way the blood would go throughout the circulatory system.

(9) Now look at the top diagram. Figure out which way the blood goes when you squeeze the top part of the heart, and draw arrows throughout.

The walls of your heart are strong muscles that squeeze the blood as shown in these two diagrams. First the bottom of your heart is squeezed, then the top, then the bottom, then the top, etc. This is your heartbeat. The most powerful squeeze is the one that sends the blood out of the heart and into the body.

(10) Is the most powerful squeeze at the top or the bottom of the heart?

(11) The blood without oxygen is coloured _____, and the blood with oxygen is _____. In Diagrams 1 and 2 colour the blood in the heart, veins, and arteries, to show whether it is red or bluish at each position.

These pictures are schematic diagrams. They are not very realistic - they are drawn in a simplified way that will make it easy to see how blood circulates. Instead of showing all the veins and arteries and capillaries, simplified tubes are shown.

Is the heart really shaped like a heart? Get real hearts from chickens, goats, and other animals. What shapes are they? Try to identify the arteries and veins, the chambers, and the valves.

(12) Describe in words the entire route of blood in the circulatory system, including a description of when and how the heart beats.

(13) Could you imagine a circulatory system in which the heart only has three chambers? Try to design and draw one. Describe how it works. Would it be better or worse than the human system?

Evaluation:

- (1) Some students may not be able to see bluish veins anywhere. They should look and answer truthfully. The answer should be marked wrong only if you're sure they are impossible (eg if the student writes, "I can see blue veins on my elbows and knees"). Acceptable answers are: "I can see bluish veins on my wrists," or "I can't see bluish veins anywhere".
- (2) The only possible correct answer is NO.
- (3),(4),(5) It is important that students actually make the model, test it out and record their observations. They should submit their model so that **the teacher can test it to see if they get the same answers to these questions.** Maybe the model doesn't work the way it's supposed to - in that case the student should record their accurate observation.
- (6) It doesn't matter which number goes with which chamber, but four chambers should be found and labelled. It isn't important that the students know the names of each chamber - rather they should be able to understand the diagram, and find four chambers and four valves.
- (7),(8),(9) The arrows should be drawn correctly by analysing which way the valves will be pushed open (by analogy to the valve model). By drawing arrows pointing in the correct directions, student will demonstrate that they understand how the valves function (ie which way they let blood pass), and how the heart pumps.
- (10) This question should be answered correctly by examining the two diagrams, assuming they have been labelled with arrows correctly.
- (11) This question can be answered on the basis of the information that was given above.
- (12) The answer to this question will indicate how well the student can understand, come to conclusions, and summarise the material that has been presented. Marks for science should not be deducted for incorrect spelling or grammar, as long as you can understand the meaning.
- (13) This is a question requiring higher level thinking, assuming the students have never heard of three chambered hearts before. A variety of answers will be possible.

General Objectives:

To get practice carefully reading and answering questions without help from the teacher.

To observe carefully and record what you observe.

Specific Objectives:

To understand how and why blood circulates throughout our bodies.

To understand how a one-way valve can be made.