
BLOOD AND HEART PRACTICE TEST

This assignment consists of several practice questions that should prepare you for your heart and blood “quest”, which is taking place on Thursday, January 18th (Day 1, Period 1). If you have difficulty with any of this material, check your notes, the class website, or ask for help. The answers will be posted online.

1. If you know the **pressure** that something applies and its **surface area**, you can calculate the **force** it generates.

- a. Write the mathematical formula that allows you to do this.

$$P = \frac{F}{A}$$

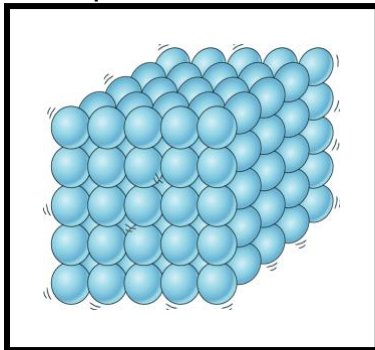
- b. Specify the **units of measurement** for each quantity.

Pressure is measured in **Pascals (Pa)**, surface area is measured in **square metres (m²)**, and force is measured in **Newtons (N)**.

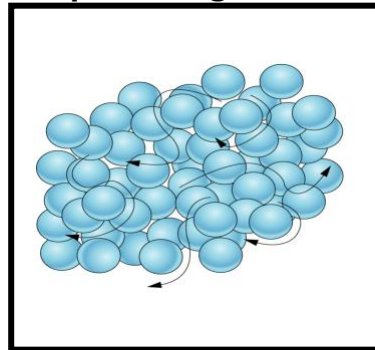
- c. A snowshoe has a surface area of 0.25 m². When you take a step, you are generating a force of 200 N. How much pressure has this snowshoe generated?

$$P = \frac{200 \text{ N}}{0.25 \text{ m}^2} = 800 \text{ Pa}$$

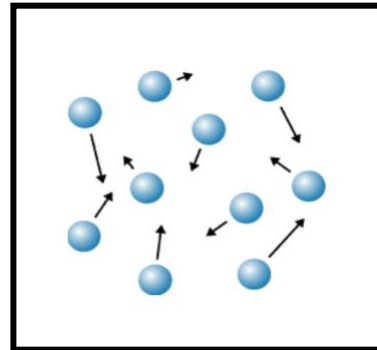
2. Draw the particle model for **solids**, **liquids**, and **gases**.



Solids



Liquids

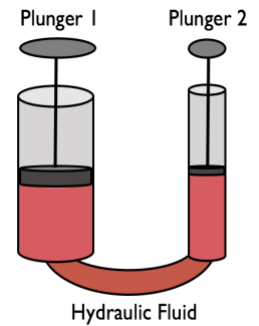


Gases

3. The figure on the right shows a system involving a non-compressible fluid between two connected pistons. Which plunger is easier to push down? Explain why.

HINT: Use the formula you wrote for question 1!

Plunger 2 is easier to push down because it has a smaller surface area. This is just like how it's easier to push a thumbtack into a board (the pin has a very small area) compared to pushing a chalkboard eraser into the board.



4. A healthy blood pressure for an adolescent is approximately 120/80. The first number represents **systolic** pressure (when the heart muscles “contract”), while the second number represents the **diastolic** pressure (when the heart “reloads”).

5. Use your understanding the circulatory system to explain how carbon monoxide can be dangerous.

Carbon monoxide bonds to the hemoglobin in red blood cells. This blocks oxygen from bonding to our red blood cells, so they are unable to pick up and transport oxygen. People can suffocate as a result. This is why it's dangerous to leave a car idling in a poorly ventilated garage for a long time, because cars emit carbon monoxide.

6. Give definitions for each of the following terms:

- a. **Erythropoietin** This is the hormone that triggers red blood cell growth. It is produced naturally, but can also be injected artificially. This is called blood doping.
- b. **Hemoglobin** This is the protein in red blood cells that oxygen bonds to. Each hemoglobin can carry 4 oxygen molecules. You can suffer from carbon monoxide poisoning if carbon monoxide bonds to hemoglobin since it blocks oxygen from bonding.
- c. **Hypertension** This is another word for high blood pressure. This means that your blood is having a relatively difficult time circulating properly.
- d. **Phagocytosis** This is how a white blood cell destroys a pathogen. Its cytoplasm (outer membrane) encircles the pathogen, engulfs it, and digests it.

7. Explain the difference between **pulmonary circulation** and **systemic circulation**.

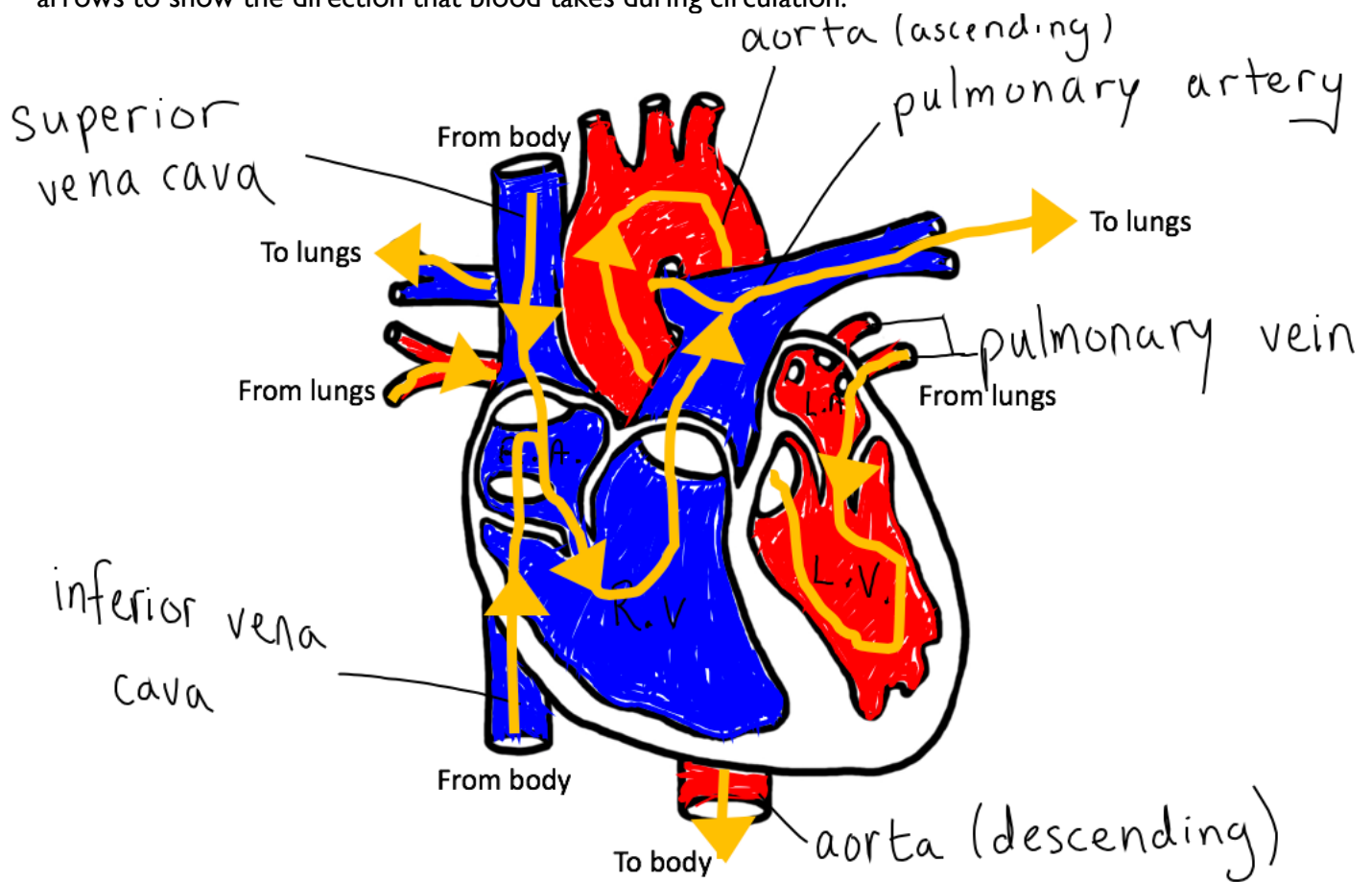
Pulmonary circulation refers to blood travelling from the heart, to the lungs, and back to the heart. This is how the blood becomes oxygenated. More specifically:

Right ventricle → Pulmonary artery → Lungs → Pulmonary veins → Heart

Systemic circulation refers to blood travelling from the heart to every point in the body (except the lungs). This is how the blood distributes this oxygen throughout the body. More specifically:

Left ventricle → Aorta → Capillaries → Pulmonary veins → Heart

8. Label all 4 heart chambers, as well as the blood vessels that lead in and out of each one on the diagram below. Colour them red and blue to indicate whether or not the blood is oxygenated or deoxygenated. Then, draw arrows to show the direction that blood takes during circulation.



9. Which of the heart's chambers is surrounded by the most muscle, and why?
 The left ventricle is surrounded by the most muscle. This is so that when it contracts (squeezes), it can pump blood to every part of the body.
10. Why does the heart have so many tiny blood vessels on itself? What would happen if these vessels became obstructed?
 The heart is the most important muscle, so it needs oxygen more than anything else. The many blood vessels on the heart's surface feed it oxygen. If insufficient amounts of oxygen are feeding the cardiac muscle, for whatever reason, it could lead to cardiac arrest (heart attack). If insufficient amounts of oxygen reach the brain, it could lead to a stroke.
11. Arteries always carry oxygenated blood, except for the pulmonary arteries. Veins always carry deoxygenated blood, except for the pulmonary veins.

