

Date: _____

Name: _____

Hydraulics and Pneumatics in the Body

This activity was created by Zoe.

Hydraulic and pneumatic systems convert fluid pressure to mechanical motion, and are used in many everyday machines and objects. Did you know that the human body makes use of these systems too? Between the lungs and heart, can you figure out which one is which type of system?

DEFINITIONS

HYDRAULIC SYSTEMS use liquid substances to transmit power. Liquid substances can include water-based fluids, petroleum-based or mineral-based fluids, as well as synthetic fluids. Some examples of hydraulic systems are various kinds of lifts (for example, jacks and lifts for cars, wheelchair lifts, amusement park rides, moving theatre stages, elevators, etc.), hydraulic brakes (for example, in cars or mountain bikes), construction gear (cranes, dump trucks), dishwashers, and dentist and barber chairs.

PNEUMATIC SYSTEMS use easily compressible gas such as air or pure gas to transmit power. Some examples of pneumatic systems are air brakes used by buses, tampers used to pack down dirt/gravel, nail guns, dentist's chairs, and precision drills used by dentists.

LUNGS

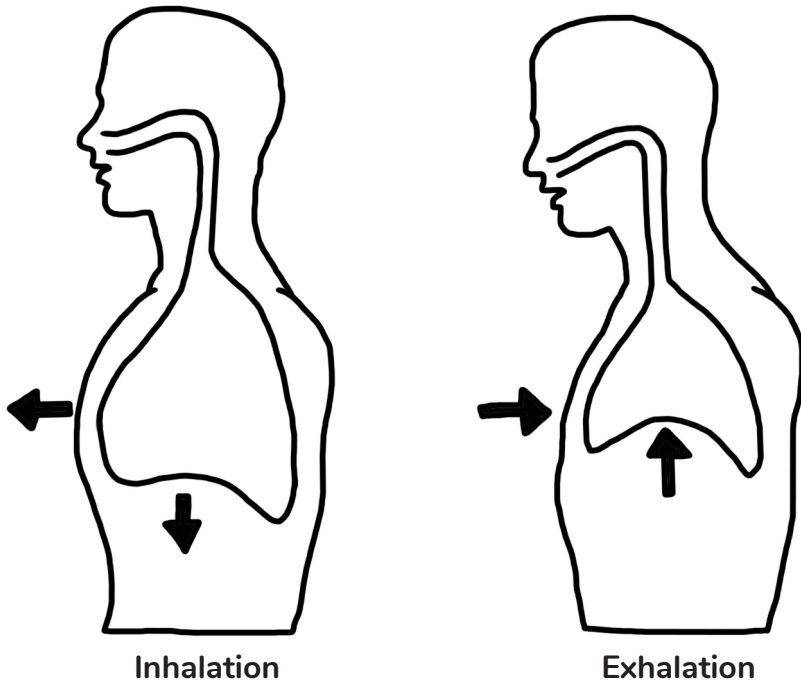
The way you breathe has everything to do with differences in pressure between the inside of your lung and the outside air.

To **inhale**, your chest muscles contract to pull the chest cavity more open, which increases the volume inside the lung. This expansion decreases the pressure of air inside the lungs, causing fresh air to rush in.

To **exhale**, your chest muscles relax and your lungs spring back, decreasing the volume of your lungs. This increases the pressure of air, causing air to rush back out.

- Draw arrows to represent how fluid air flows in and out of our lungs as we breathe in and out.

- Draw dots inside of the lungs to represent air molecules (and air pressure) inside the lungs during inhalation and exhalation. (Hint: Gases fill their container. When air molecules are closer together, pressure is higher. When air molecules are further apart, pressure is lower.)



Is this a pneumatic or a hydraulic system?

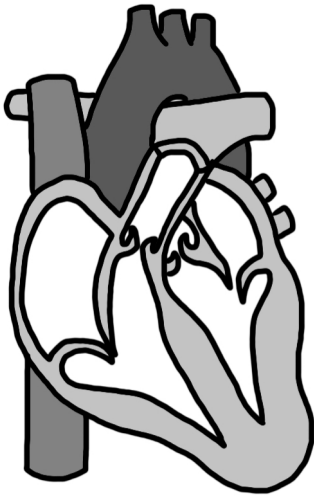
PNEUMATIC

HYDRAULIC

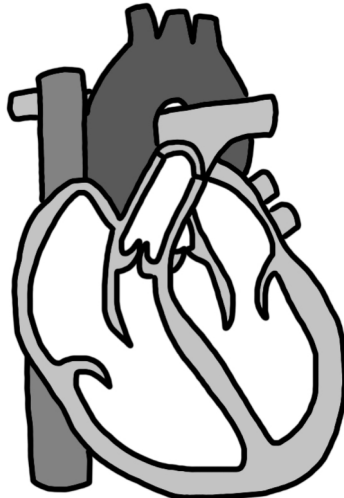
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HEART



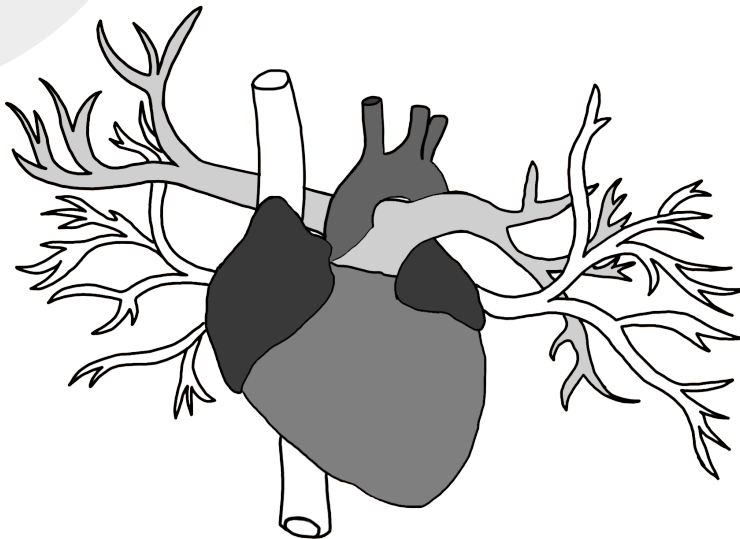
Systole



Diastole

Is this a pneumatic or a hydraulic system?

PNEUMATIC HYDRAULIC



Note: veins are coloured white, and arteries are grey (light grey or medium grey)

Your heart is a very strong muscle, and its contractions force blood to move due to pressure.

In **systole**, your heart contracts to pump blood out. The contraction causes a higher pressure in the heart chambers, forcing blood out into your blood vessels.

In **diastole**, your heart relaxes between beats to refill with blood. A relaxed heart has lower pressure inside its chambers.

- Draw arrows to represent how fluid flows through the heart during systole and diastole.

- Draw dots inside the heart chambers to represent the blood molecules (and pressure) in the heart during systole and diastole. (Hint: more blood in one area results in higher pressure).

BLOOD VESSELS

The pumping of your heart affects the pressure of blood inside your vessels. Vessels are built differently to withstand pressure.

Arteries receive blood from the heart after it contracts during systole. They carry the blood from the heart to the rest of your body. They withstand a lot of pressure, and are thicker and made up of smoother muscle fibers and elastic tissue.

Veins carry blood back to your heart to fill it during diastole. They don't have as much force acting on them as arteries do, so they don't need to be as thick.

- Draw dots to represent the pressure in the veins and arteries. (Hint: draw more dots to represent high pressure, and fewer dots to represent low pressure).