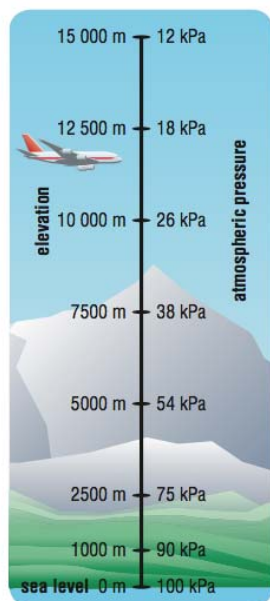


Grade 8 Science

Fluids

Class 13

Atmospheric Pressure



- Atmospheric Pressure – the force the atmosphere exerts on a unit of surface area
- Atmospheric pressure decreases the higher you ascend because there is less air
- Air pressure applies force in all directions

Water Pressure



- Water pressure increases as you descend since there is more water above
- Deep-sea divers require greater protection than scuba divers
- Submarines have special hulls to withstand water pressure

Pascal's Law

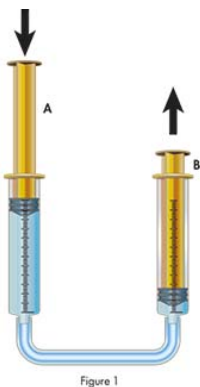


Figure 1

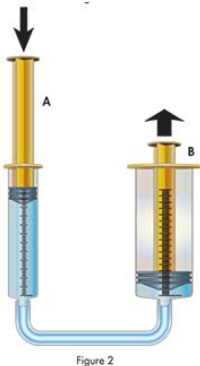
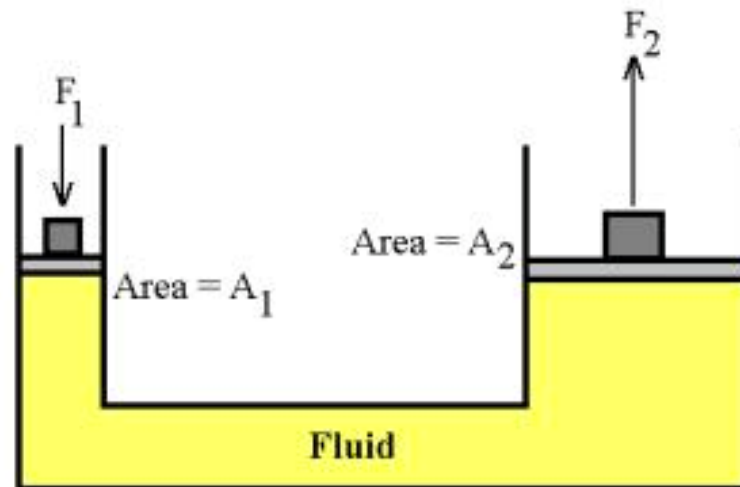
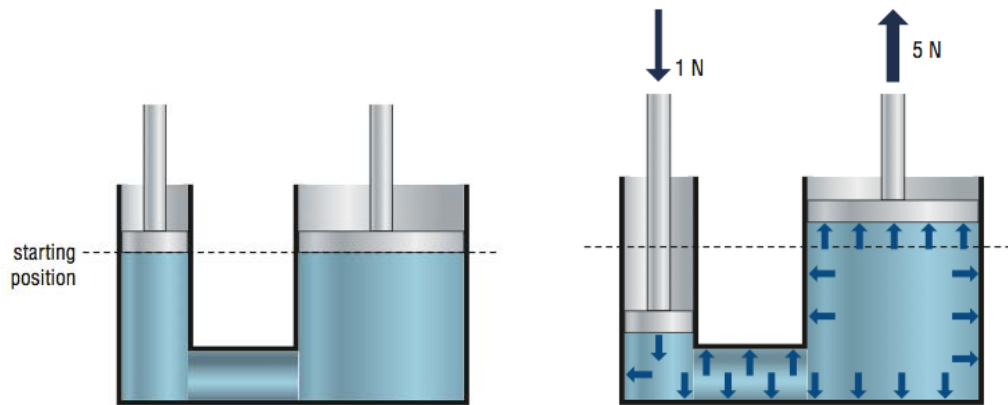


Figure 2

- A force applied to a fluid is distributed equally through all parts of the fluid
- Plunger in the small syringe moves farther than the plunger in the large syringe
- Plunger in the small syringe is easier to move than the plunger in the large syringe

- The distance moved by the large piston is always smaller than the distance moved by the small one
- The force of the large piston is 5X the force of the small piston because the area is 5X larger



$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$



Checkpoint



A hydraulic system is used to lift a 2000kg vehicle in an auto garage. If the vehicle sits on a piston with an area of 0.5m^2 and a force is applied to a piston of area 0.03m^2 , what is the minimum force that must be applied to lift the vehicle?



Checkpoint



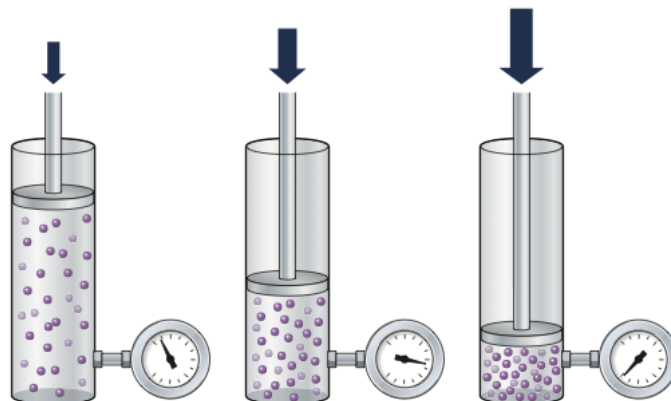
A barber raises his customer's chair by applying a force of 150N to a hydraulic piston of area 0.01m^2 . If the chair is attached to a piston of area 0.1m^2 , how massive a customer can the chair raise? Assume the chair itself has a mass of 5kg.

- Pascal's Law is used in hydraulic brakes and to lift heavy equipment
- Liquids cannot be compressed so the force applied is immediately transferred to all other parts
- Gases are compressible so pneumatic systems are used for a cushioning effect



Pressure and Volume

- Boyle's Law
 - As pressure increases, volume decreases
 - As volume increases, pressure decreases



Temperature and Pressure

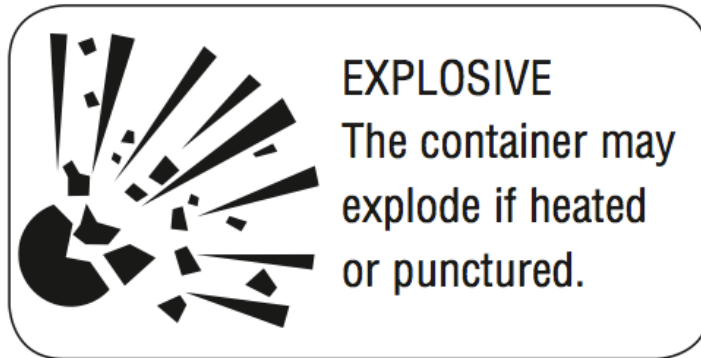
- Gay-Lussac's Law
 - As pressure increases, temperature increases
 - As pressure decreases, temperature decreases
 - Occurs due to the collisions of air particles with the container



Temperature and Volume

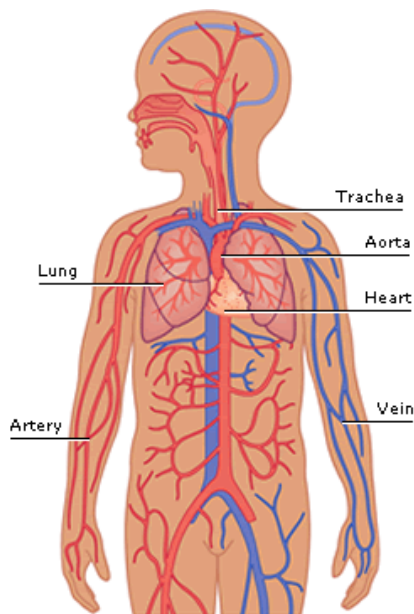
- Charles' Law
 - As temperature increases, volume increases
 - As temperature decreases, volume decreases
 - Due to particles moving faster and farther apart during high temperature causing the fluid to expand





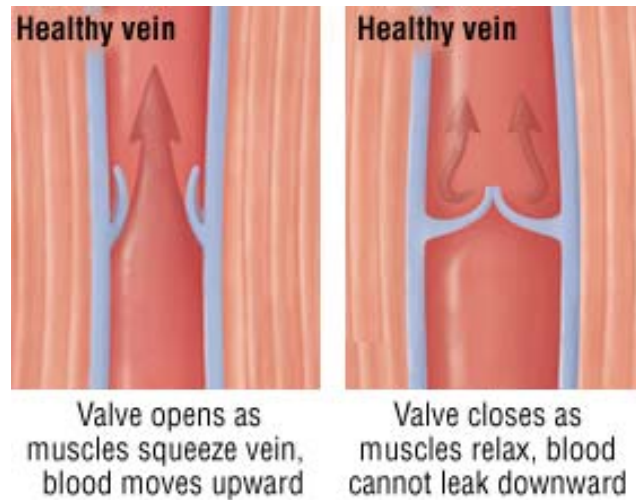
- Aerosol cans and other containers of compressed gases are dangerous when heated
- Temperature causes increased pressure inside the can which can cause an explosion

Valves



- Circulatory system is a closed hydraulic system
- The heart acts as a pump to push blood through arteries and veins
 - Blood pressure is highest in the aorta, which have thick muscular walls to withstand pressure
 - Blood pressure is lowest in the veins, which have thin walls

- Veins have valves that prevent blood from pooling due to gravity
- Valves – devices that control the movement of fluid through a hollow tube or pipe



- When valves do not close completely, blood pools in the veins – varicose veins
- Commonly occurs in older women and pregnant women



- The internal combustion engine in cars relies on valves to allow fuel to enter the chambers
- Exhaust gases use valves to escape at the correct time and direction

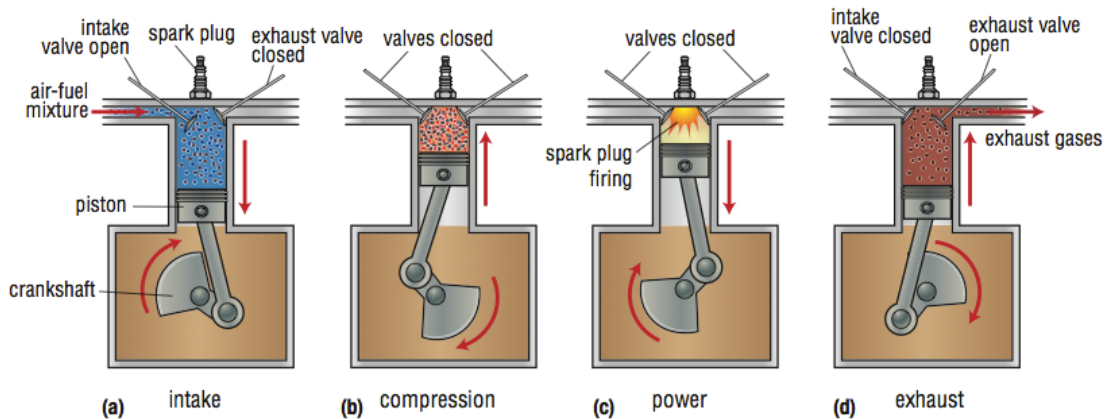


Figure 5 (a) Air and fuel enter in past the open intake valve. (b) Valves are closed to allow compression of the air-fuel mixture. (c) Valves remain closed during combustion so no fuel or gases escape. The explosion pushes the piston down. (d) Exhaust valve opens to allow gases to escape.

The Power of Fluids

- Hydraulic rams are similar to syringes
- Composed of a piston inside a cylinder, which is connected by pipes to a reservoir of hydraulic fluid

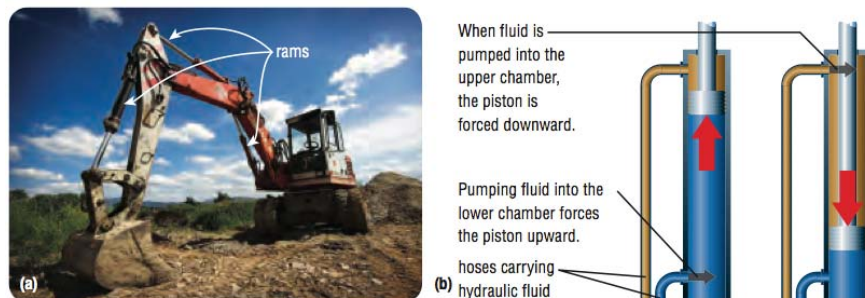
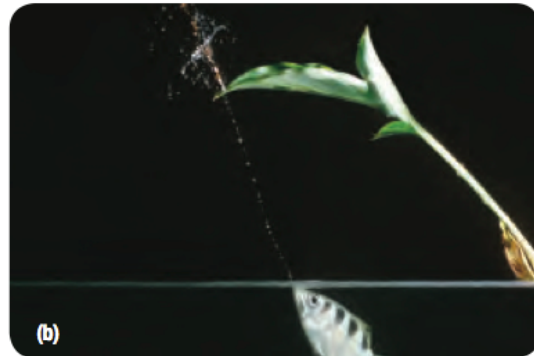


Figure 1 (a) Hydraulic rams allow this single worker to do the work of many people. (b) The rams work by forcing fluid into either side of the piston, allowing powerful and precise movement in both directions.



- Water from a fire hydrant already has some pressure
- Pumping unit and nozzle design increase the water pressure to project water over large distances
- The archer fish uses hydraulic power to shoot insects off plants

- Hovercrafts draw in air from the atmosphere and drive it under intense pressure below the craft
- Kneeling buses use forced air to raise and lower the bus allowing people to enter and exit
- Automobile hoists use a compressed air with hydraulic fluid to move the piston upward

