


# GRADE 8 SCIENCE

## UNIT 3: FLUIDS & VISCOSITY



Chapter 9: *Forces influence the motion and properties of fluids.*

# FORCE

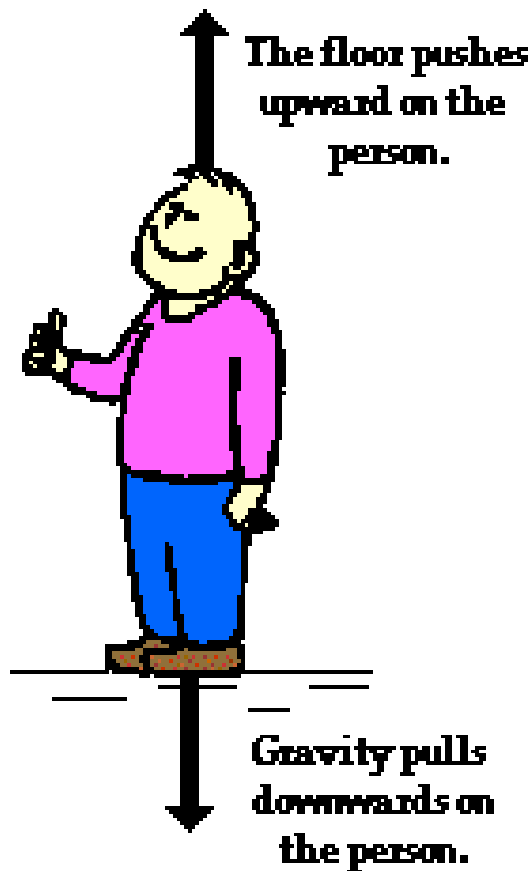
- Anything that causes a change in the motion of an object.
- A push or pull.



# BALANCED FORCES ARE...

- Equal in strength
- Opposite in direction
- No movement

The forces on the person are balanced.



# UNBALANCED FORCES ARE...

- Unequal in strength
- Cause a change in speed or direction



# MASS VS. WEIGHT

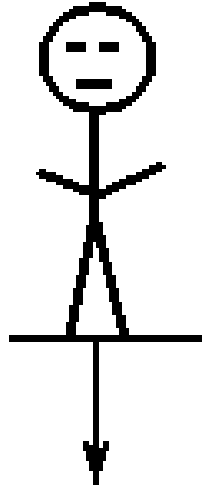
## Mass

- Stays the same anywhere in the universe
- Kilograms (kg)

## Weight

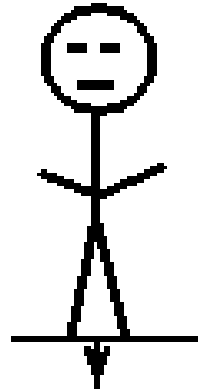
- A measure of the push or pull acting on an object.
- Newton (N) ●

Earth



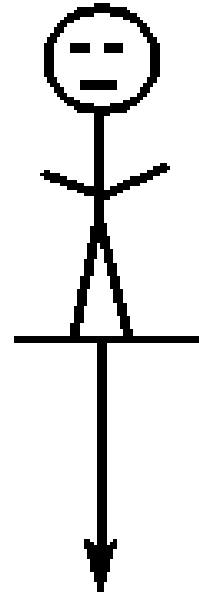
Mass = 63.5 kg  
Weight = 623 N  
(140 lbs)

Moon



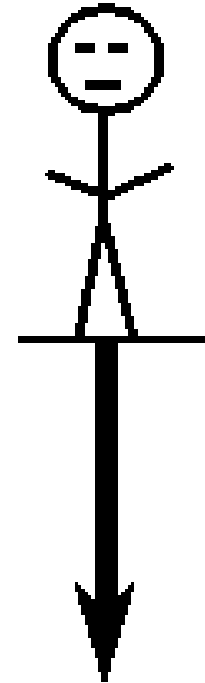
Mass = 63.5 kg  
Weight = 103 N  
(23 lbs)

Jupiter



Mass = 63.5 kg  
Weight = 1582 N  
(355 lbs)

Sun



Mass = 63.5 kg  
Weight = 17418 N  
(3914 lbs)



# BUOYANCY

- The upward force on an object submerged in or floating on fluids.
- An object that floats has neutral buoyancy.



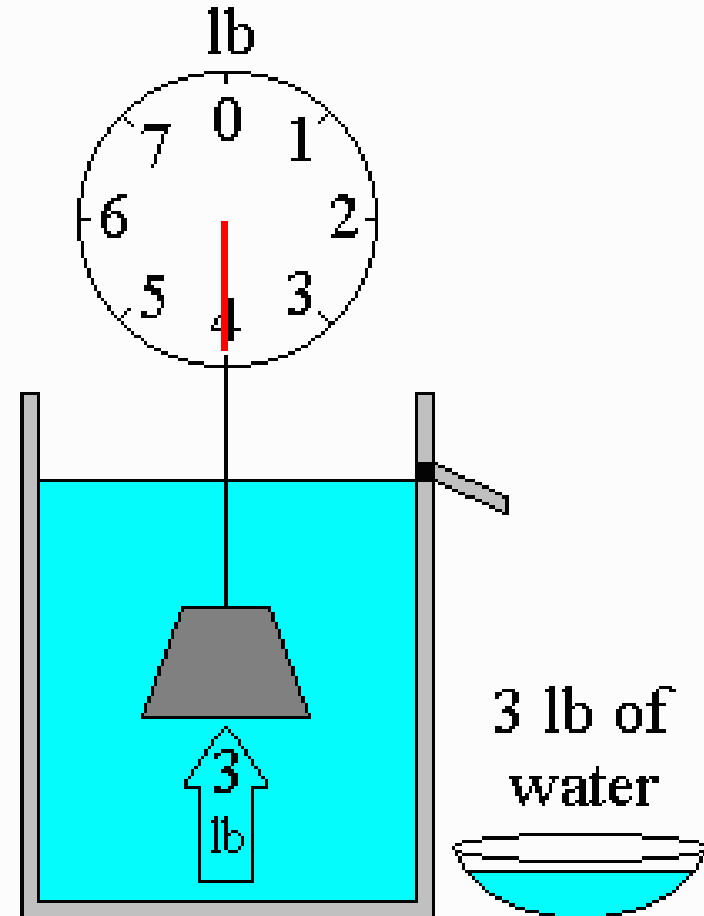
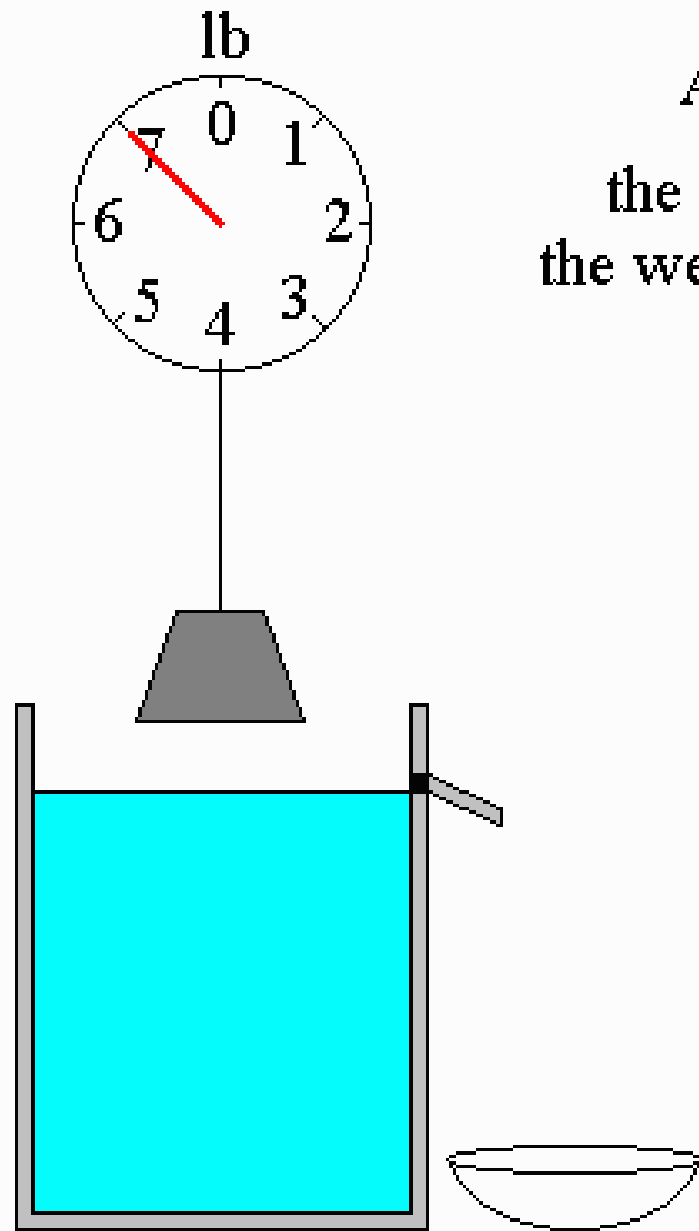
- The amount of buoyant force that would push up against the object immersed in the fluid equals the force of gravity or the weight of the fluid that the object displaces.



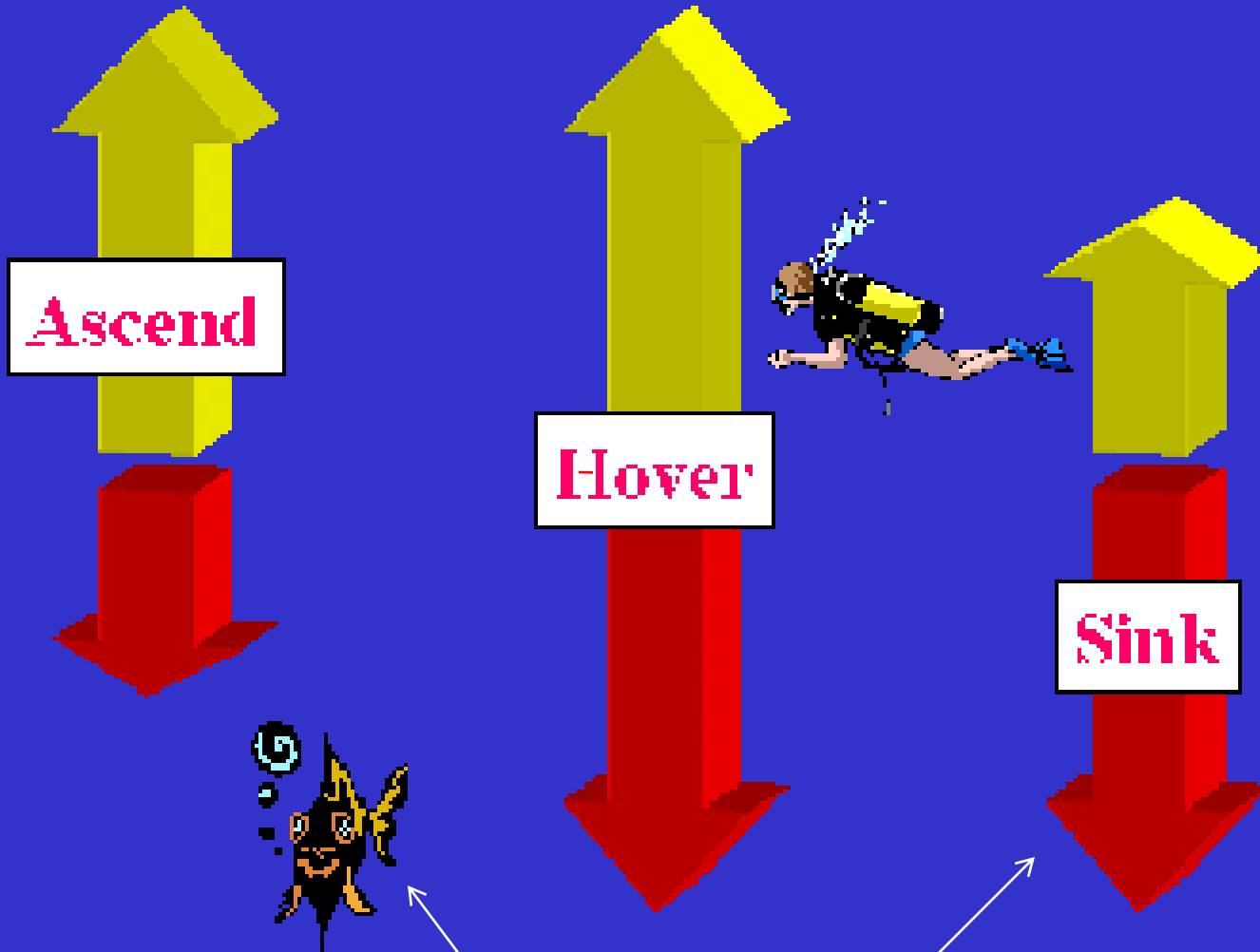


# Archimedes' Principle

the buoyant force is equal to  
the weight of the displaced water



balanced



unbalanced

# DENSITY & BUOYANCY

- If the density of the immersed object is greater than the density of the fluid, it will **SINK**.



# WHICH WILL FLOAT? WHY?

1. Wooden boat vs. water logged stick
2. Metal block vs. metal boat
3. A sealed empty water bottle vs. full water bottle



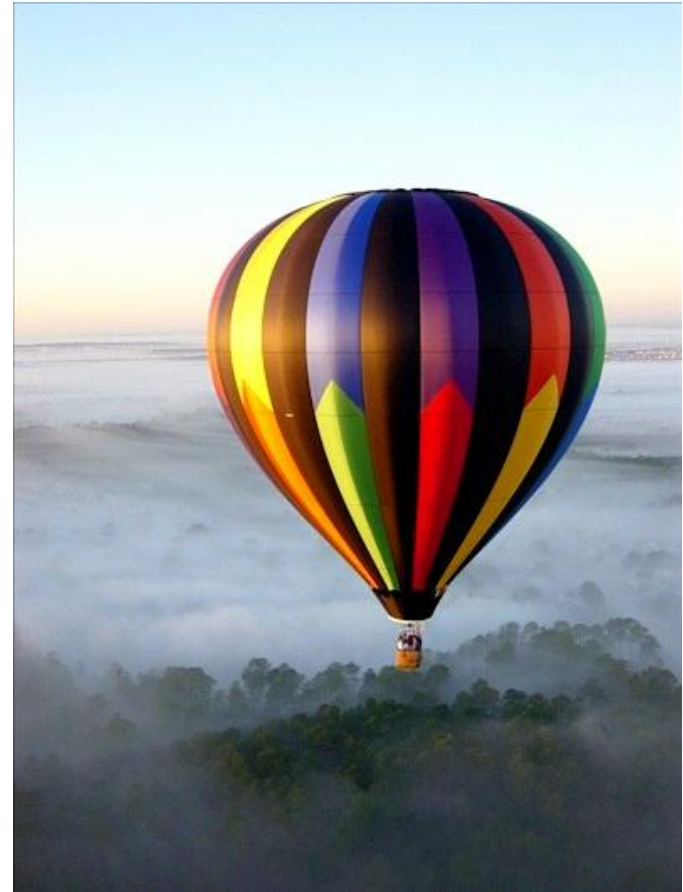
# AVERAGE DENSITY

- The total mass of all substances that make up an object divided by the total volume.



# TECHNOLOGIES DEVELOPED

- Personal floatation devices
- Submarines
- Hot air balloons



# PRESSURE

- The force acting on a certain area of surface.

*The larger the force, the greater the pressure.*

*The smaller the area, the greater the pressure.*



# CALCULATING PRESSURE

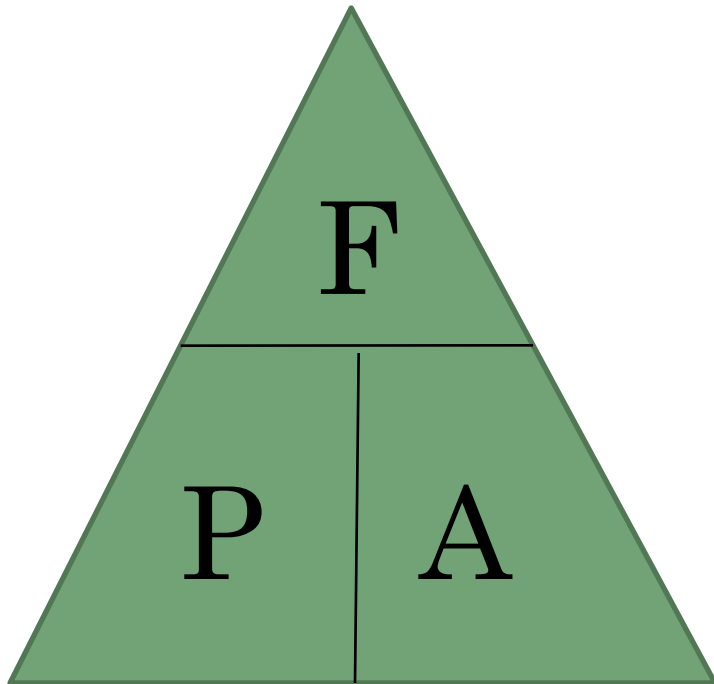
- The unit for pressure is the **Pascal (Pa)**
- You can determine pressure if you know the force and the area.





# Formula:

$$\text{Pressure (P)} = \frac{\text{Force (F)}}{\text{Area (A)}}$$



# SAMPLE PROBLEMS

1. An aquarium is filled with water that weighs 10 000N. If the base of the aquarium has an area of  $1.6 \text{ m}^2$ , what **pressure** does the water exert on its base?



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

$$P = \frac{10\,000\text{N}}{1.6\text{m}^2}$$

$$P = 6250\text{ Pa}$$



2. If the atmospheric pressure is  $101\,200\text{ Pa}$  and you are holding your hand, the atmosphere is exerting a force on your hand. If the area of your palm is  $0.006\text{m}^2$ , calculate the **force** on your hand.



$$F = P \times A$$

$$F = 101\,200 \text{ Pa} \times 0.006 \text{ m}^2$$

$$F = 607 \text{ N}$$



3. The weight of water in a glass is 4.9 N. If the water is exerting a pressure of 1700 Pa on the bottom of the glass, what is the **area** of the bottom of the glass?



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

$$A = \frac{4.9 \text{ N}}{1700 \text{ Pa}}$$

$$A = 0.0029 \text{ m}^2$$





Assignment: Complete  
the practice problems on  
pages 351-353





# DETERMINE WHY...

1. A person wearing snowshoes can walk across a section of deep, soft snow without sinking



2. The nozzle on a garden hose can be used to create a faster or slower flow of water.



# ATMOSPHERIC PRESSURE

- The pressure exerted by the layers of air surrounding the Earth that are held by the Earth's gravity. (~ 160 km above the Earth)



# PASCAL'S LAW



# PASCAL'S LAW

- Pressure applied to a enclosed fluid is transmitted with equal force throughout the entire container
- Basis for hydraulic and pneumatic devices.



# HYDRAULICS

- The study of pressure in liquids.
- Hydraulic systems: devices that transmit applied force through a liquid to move something else.





- Hydraulic systems use liquids because they are **incompressible** (they cannot be squeezed into a smaller volume).
- The liquid must be enclosed in a tube or pipe.






- The pressure produced will exert in all directions equally.
- This pressure will cause motion at the other end of the hydraulic system.



# PNEUMATIC SYSTEMS

- A **gas** is used to exert a force on the gas in an enclosed space.
  - Compressors are necessary as gases can be compressed. They build up air pressure.
- 



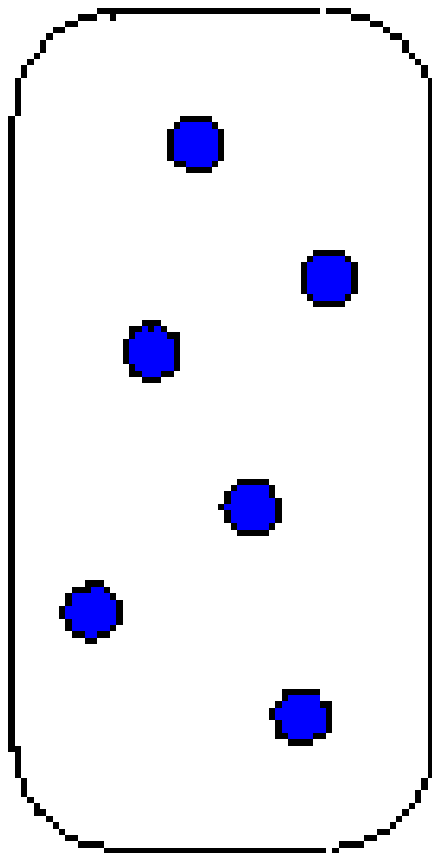
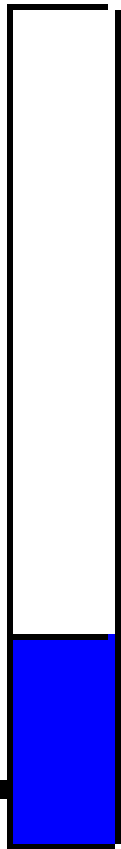
# PRESSURE & VOLUME

- Increasing pressure of a fluid will decrease volume by the same amount.

*\*\*known as Boyle's Law*

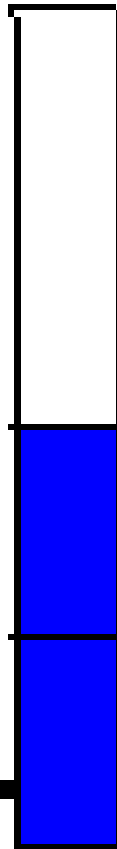


pressure

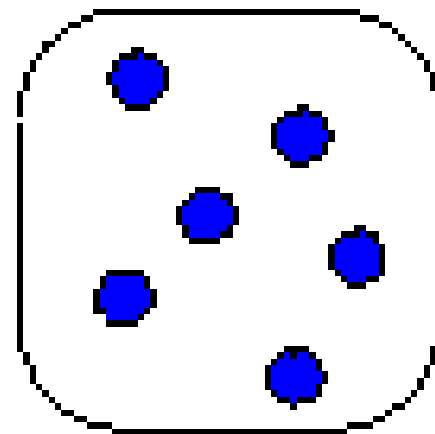


$$V = V_1$$

pressure



more collisions



$$V = V_1 / 2$$



# TEMPERATURE & VOLUME

- Increasing temperature will increase the volume of a fluid.



# TEMPERATURE & PRESSURE

- Increasing temperature of a fluid will increase the pressure.



Why does this symbol  
appear on aerosol cans?

