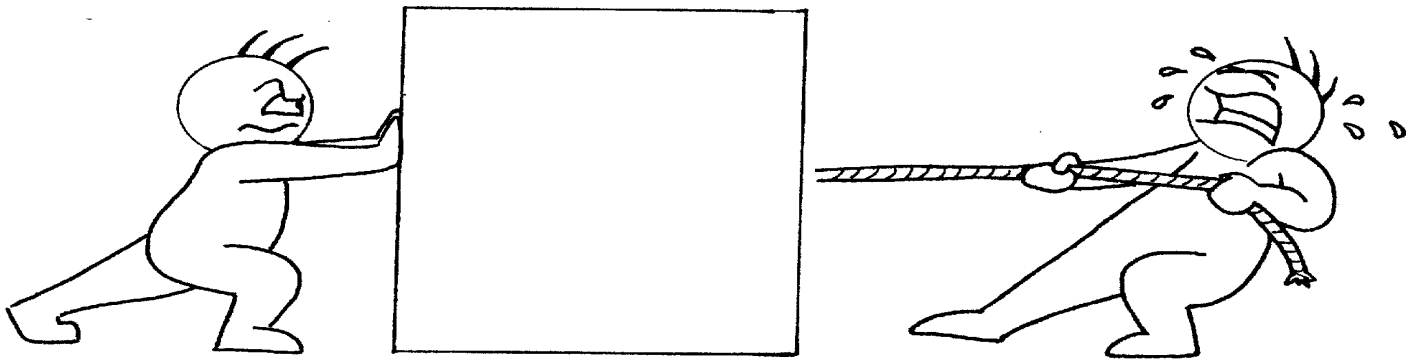
# Science 8

## Unit 2:

## *Topic 5: What is a Force?*

# What is a Force ?

- A **force** is a push or pull exerted on an object. It is measure in Newtons

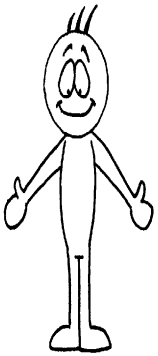


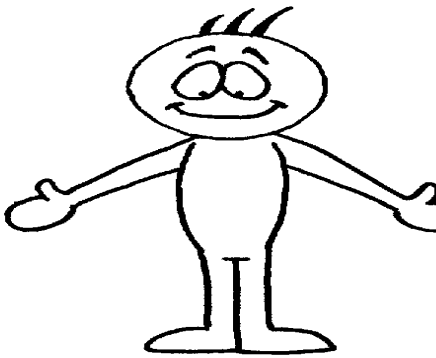
- Who is pushing?  Who is pulling?



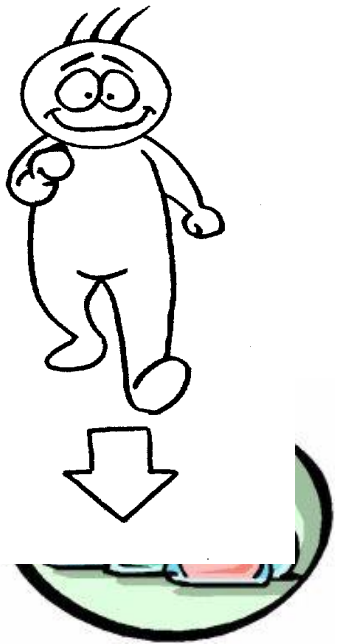
Forces may cause a change in an object in two ways:

- 1. the objects shape





- 2. the objects motion



# How are Weight and Mass different?

Mass is a measurement of the amount of matter something contains. Measured in kg

Weight is the measurement of the pull of gravity on an object. Also called the force of gravity. Measures in Newtons

Mass is measured by using a balance scale.

Weight is measured on a spring scale.

The Mass of an object doesn't change when an objec location changes. Weight, on the other hand does with location

Mrs. Mini Me weighs 100 Newtons on Earth. During a recent galactic holiday she traveled to several different planets. Wishing to maintain her weight, she was careful not to overeat. Each day as she weighed herself she was astonished to discover her amazing weight gain. Can you explain what happened?


**Earth**

Mass: 10kg

**Jupiter**

Mass: 10kg

**Mars**

Mass: 10kg

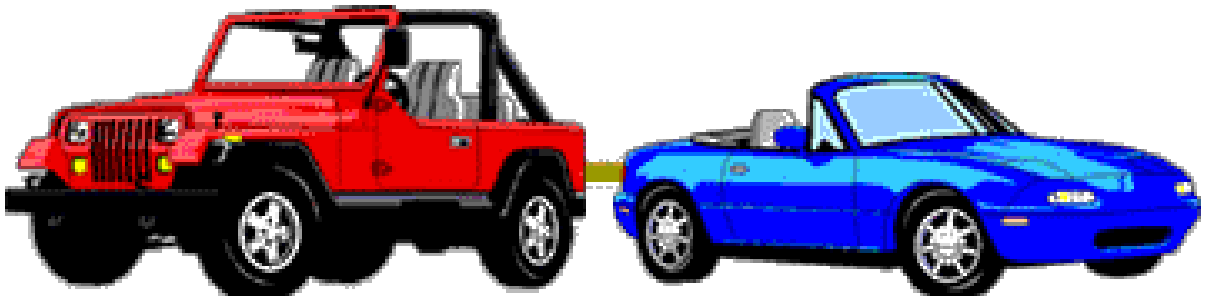
Check it out:

- http://www.exploratorium.edu/ronh/weight/
- Or Web file: Calculating weight



# Forces may change an objects motion

- First we need to understand that more than one force may act upon an object at the same time.  Even it is sitting still!



Forces occur in pairs and can be either balanced or unbalanced



# Balanced Forces

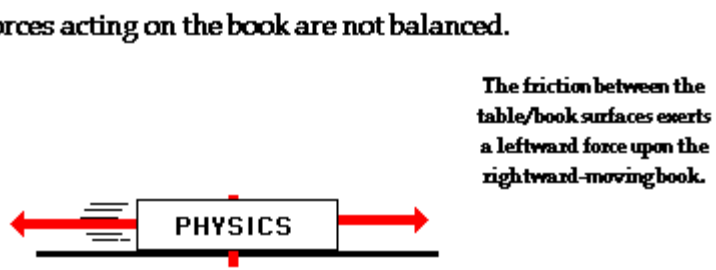
- **Balanced forces** do not cause a change in motion. They are equal in size and opposite in direction.



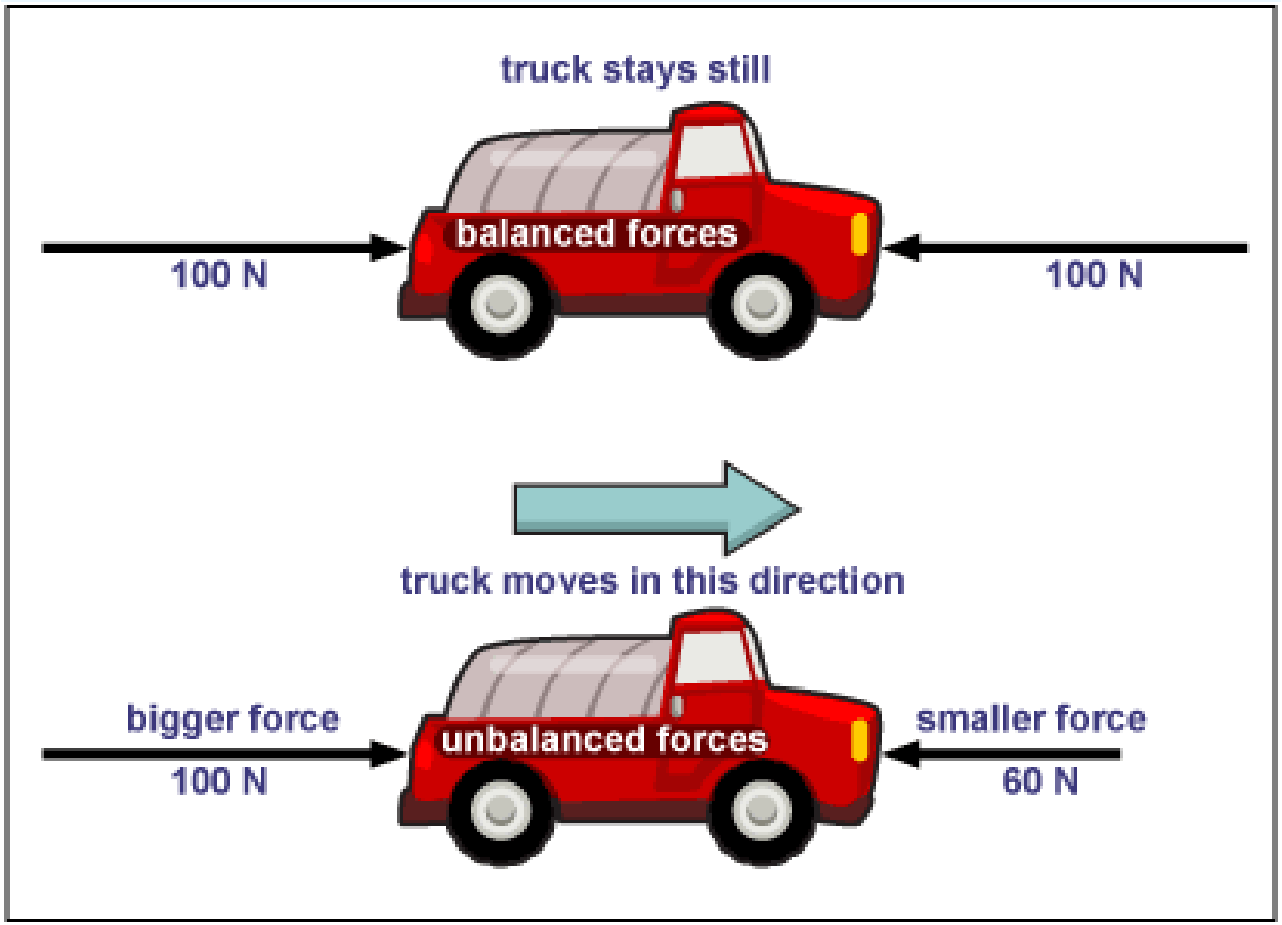

# UNBALANCED FORCES

- **unbalanced forces** always cause a change in motion. They are not equal and opposite.

- When two unbalanced forces are exerted in opposite directions, their combined force is equal to the difference between the two forces and is exerted in the direction of the larger force







truck stays still
balanced forces
100 N
100 N
truck moves in this direction
bigger force
100 N
unbalanced forces
smaller force
60 N



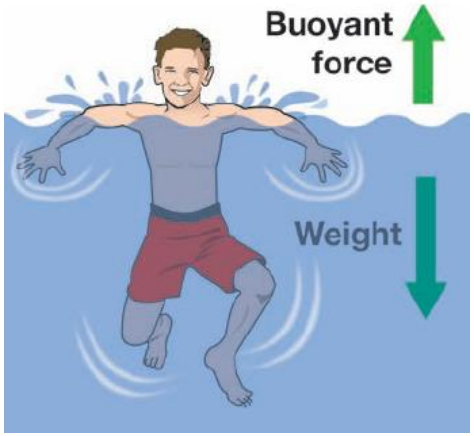
# Science 8

## Unit 2:

## *Topic 6: Buoyancy*

# Buoyancy

- **Buoyant force** or **Buoyancy** refers to a force that acts upwards on an object, opposite of gravitational force, on a floating object



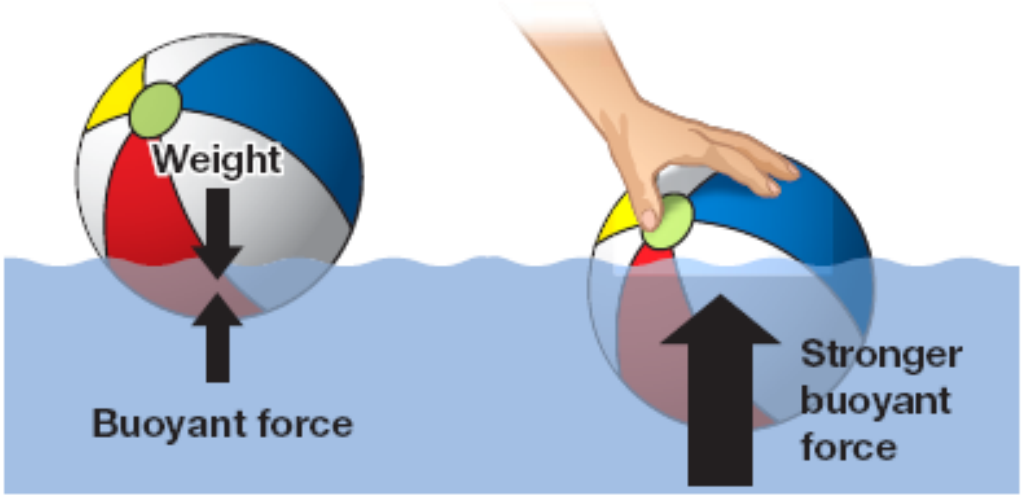



# Objects Which Have Buoyant Forces Acting Upon Them

- Boat
- Hot air Balloon
- Airplane
- Swimmer
- Parachutist

# Volume and Buoyancy

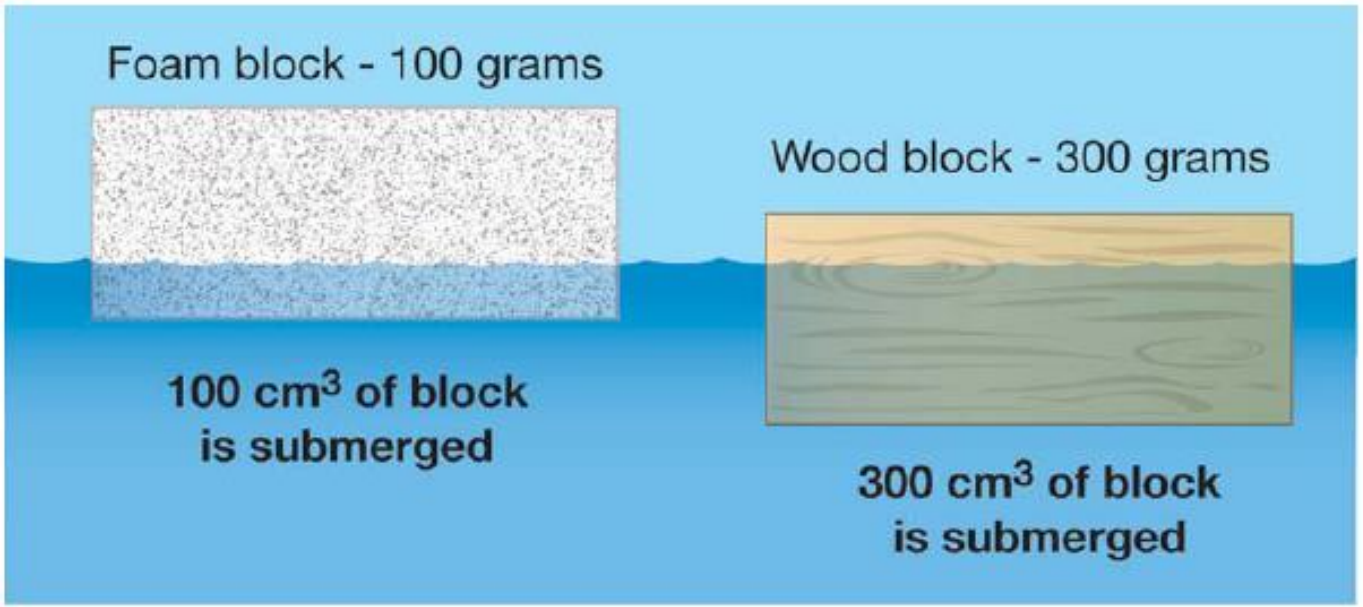
- The strength of the buoyant force on an object in water depends on the volume of the object that is underwater.




**As you keep pushing downward on the ball, the buoyant force gets stronger and stronger. Which ball has more volume underwater?**



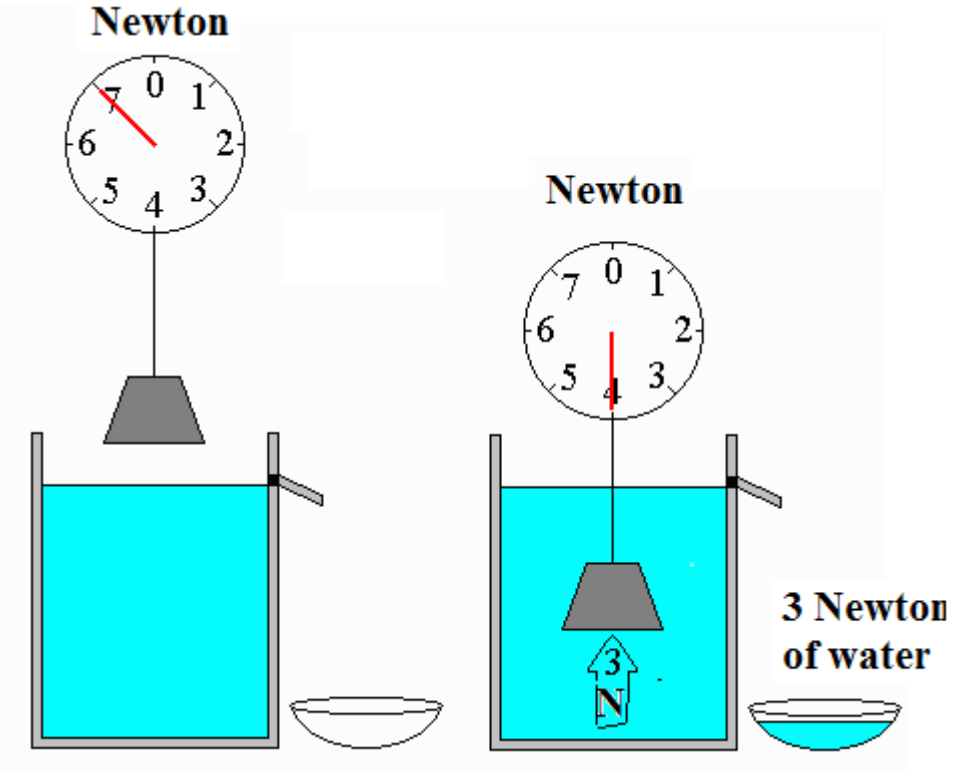
# 10.4 Sinking and floating



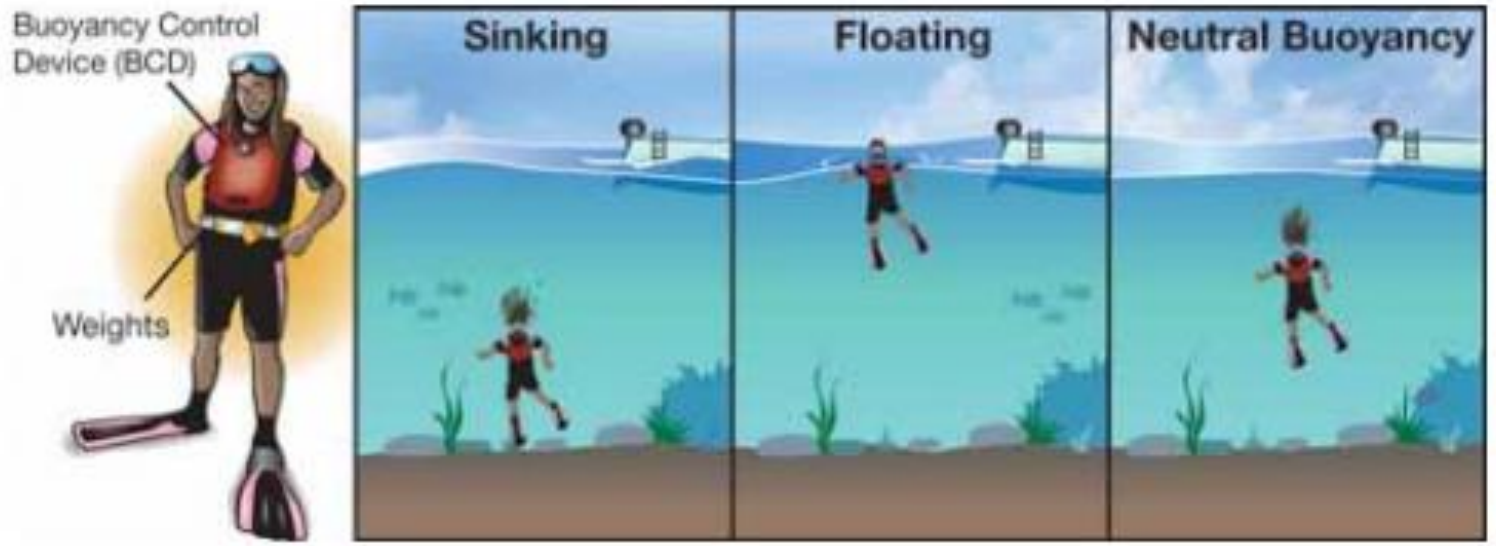

**These blocks are the same total volume.**
**Which block has more buoyant force acting on it?**
**Which block weighs more in air?**

# Archimedes' Principle

- The buoyant force acting on an object equals the weight (force of gravity) of the fluid being displaced by the object.

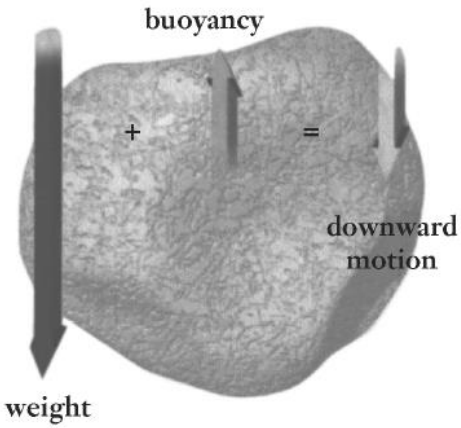


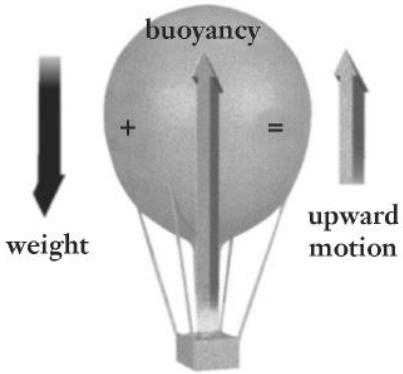

- If the force of gravity  pulling down on an object is equal to the amount of buoyant force pushing up then the object is said to have **neutral buoyancy**; it will neither rise or sink.

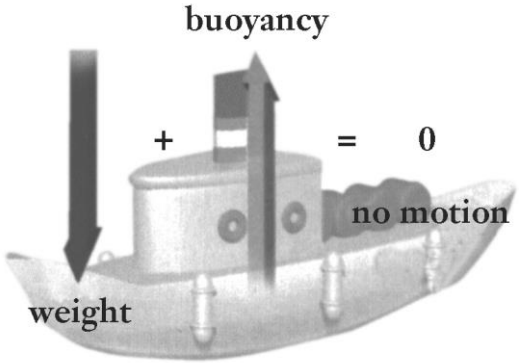



The diver has the same density as the water around her

The “push up” on the object (buoyant forces) needs to be greater than the “push down” pull of gravity on an object or it will not float.



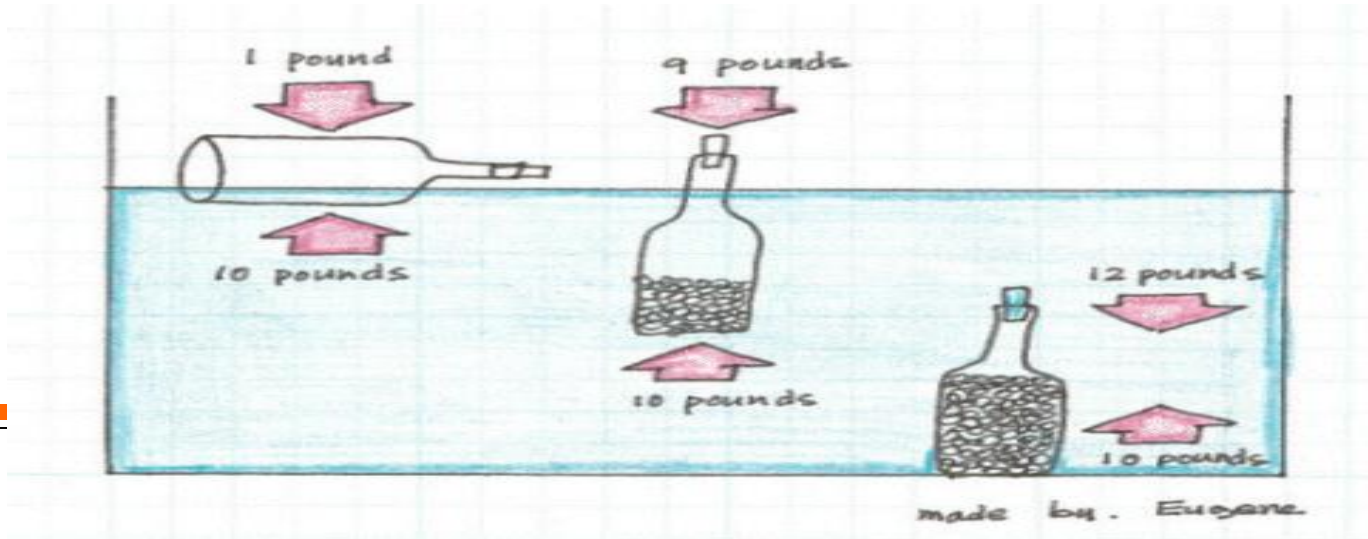



# Salt Water vs. Fresh Water

- Fluids with *high density* (particles are closer together) exert a greater buoyant force than fluids with *low density* (particles farther apart from each other).
- **Example**: Salt water is more dense than fresh water, therefore, object is salt water will float better than is fresh water.

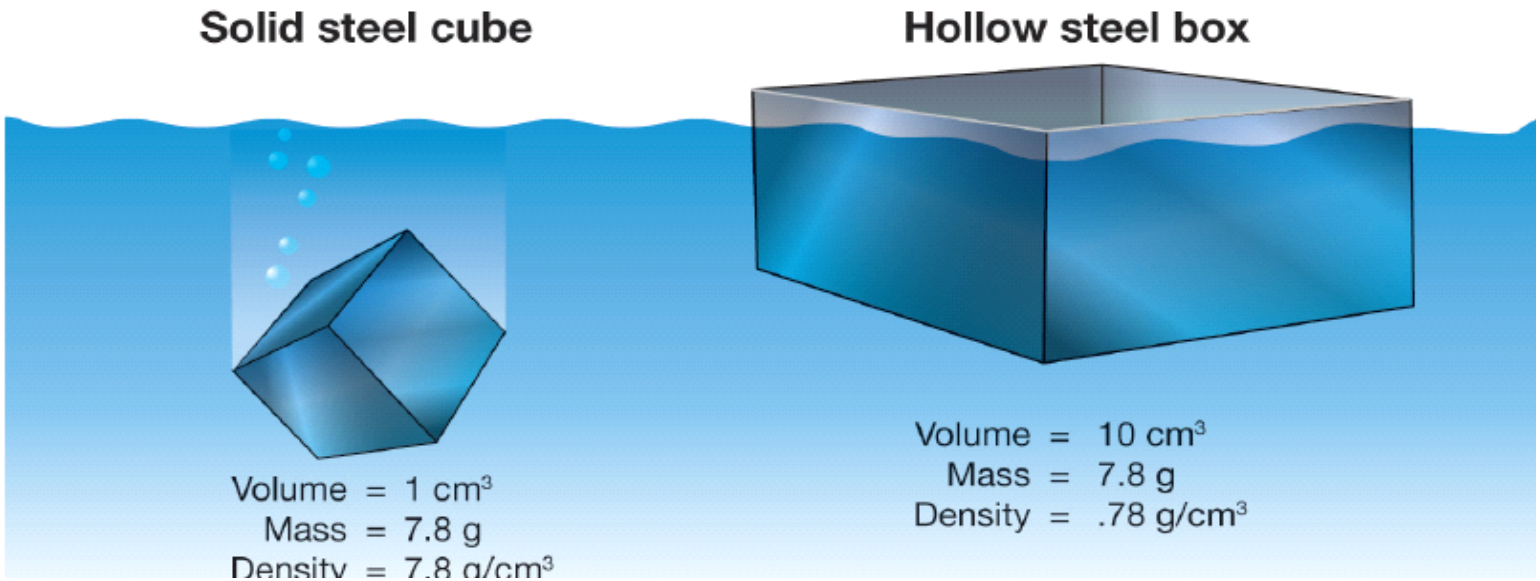
# Design Influences an Object's Ability to Sink or Float

- Concrete or steel boat vs. a chunk of concrete or a section of steal.
- A silk/canvass hot air balloon vs. a sheet of canvass.
- Submarine vs. an iron pole.



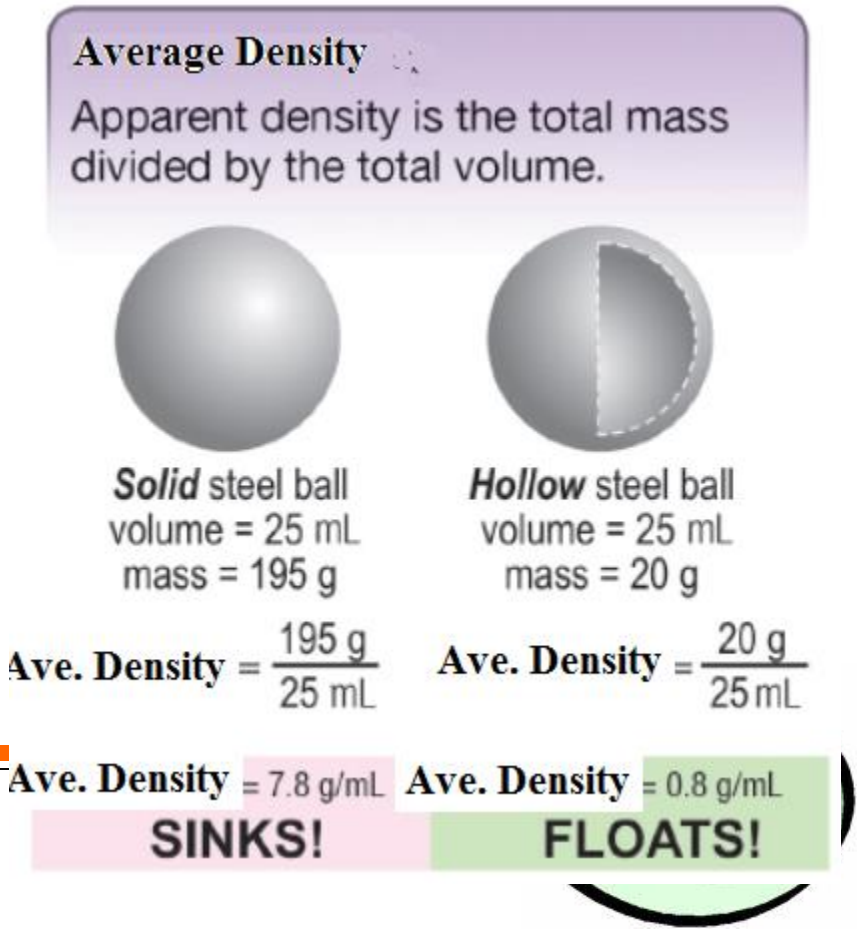
# Average Density

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

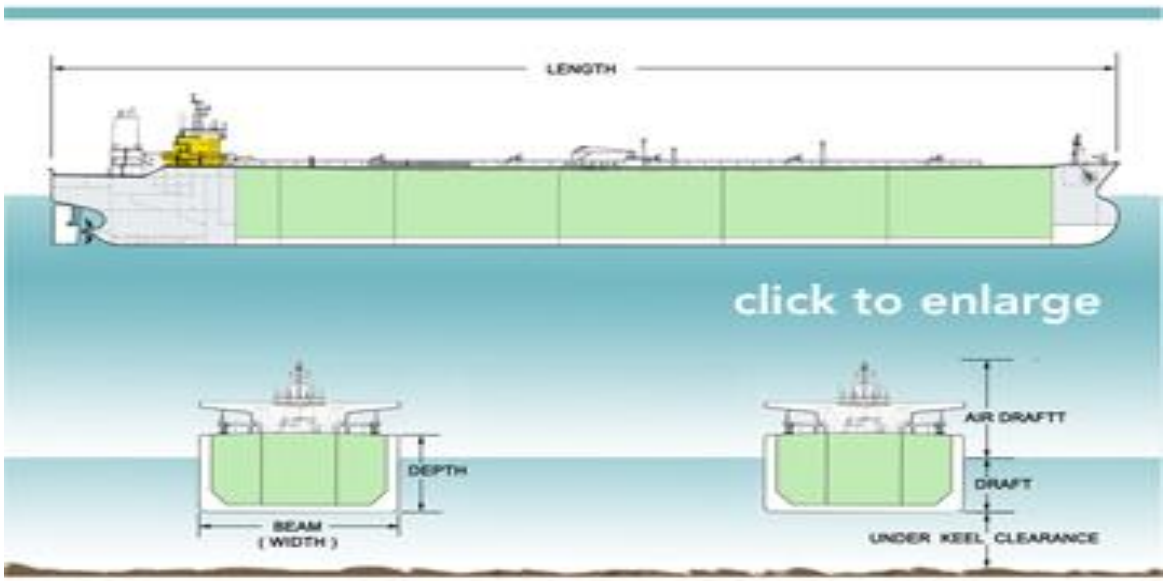



An object with an average density GREATER than the density of water will sink.

An object with an apparent density LESS than the density of water will float.



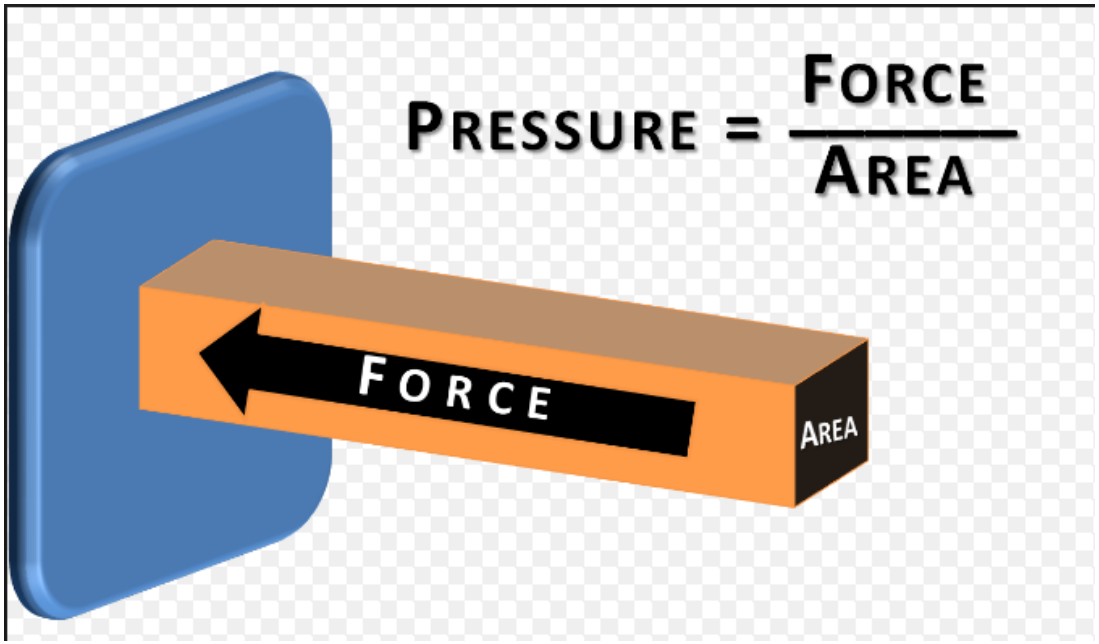
- Ships can be built of steel because the haul of the ships can be constructed large enough to ensure the density  of air in the haul is low.

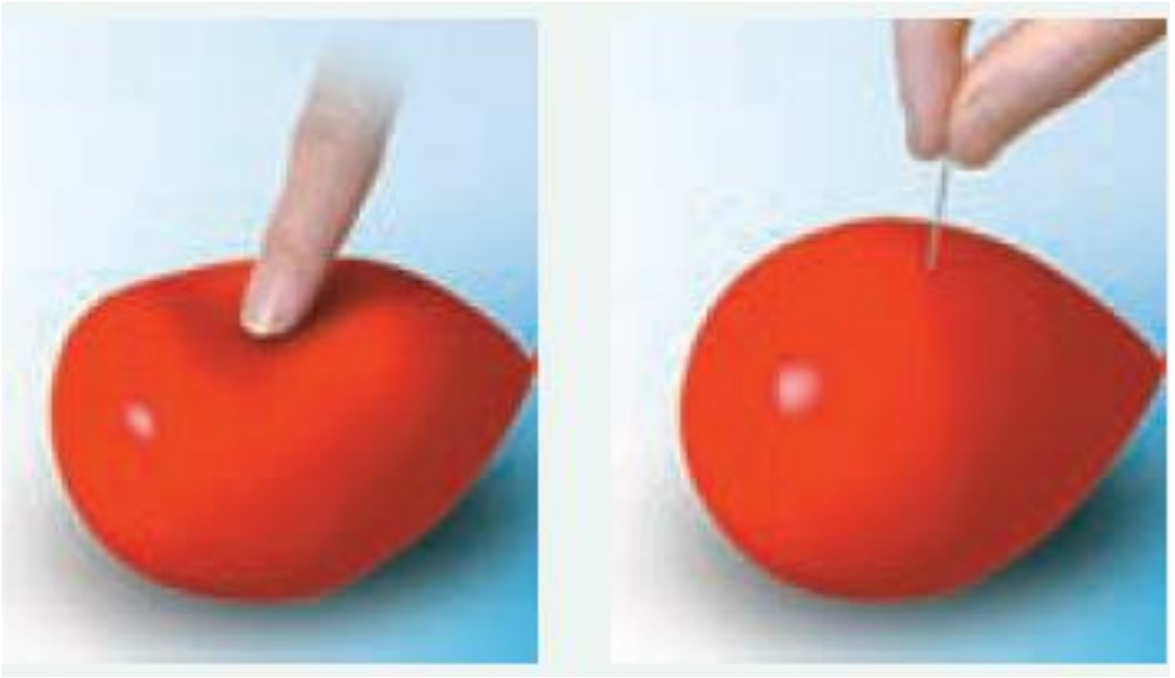



# Science 8

## Unit 2:

## *Topic 7: Pressure*



Which  balloon is more likely to break?

Why do you think this?


HEY LADY! DON'T YOU KNOW IT'S NOT SAFE TO DRIVE IN HIGH HEEL SHOES?!
Lucky
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# Pressure

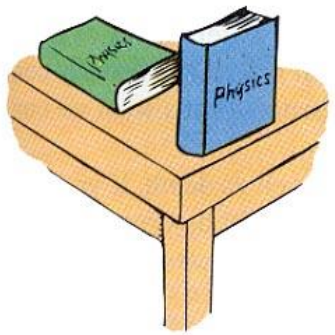
- Pressure is the force acting on a certain area of a surface.

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

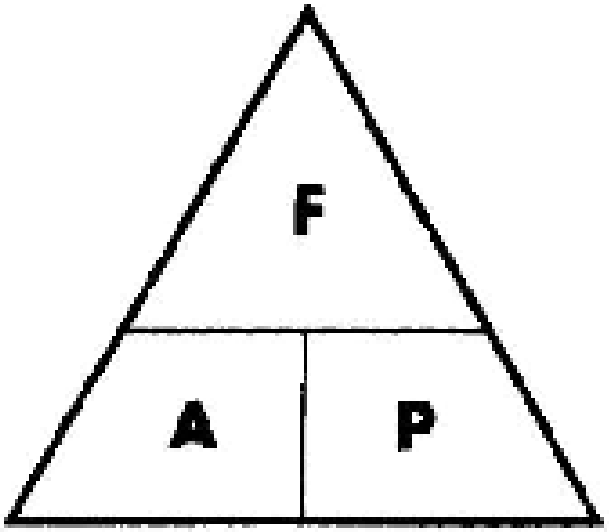
**Force** is measured in newtons **(N)**

**Area** is often measured in square metres ($m^2$).

**Pressure** is newtons per square metre (**$N/m^2$**).
This unit is also called a **pascal** (Pa),



What three formulae you write using the triangle below:




# Example 1

An aquarium is filled with water that weighs 10 000 N. If the base of the aquarium has an area of 1.6 m2, what pressure does the water exert on the base of the aquarium?

# Example 2

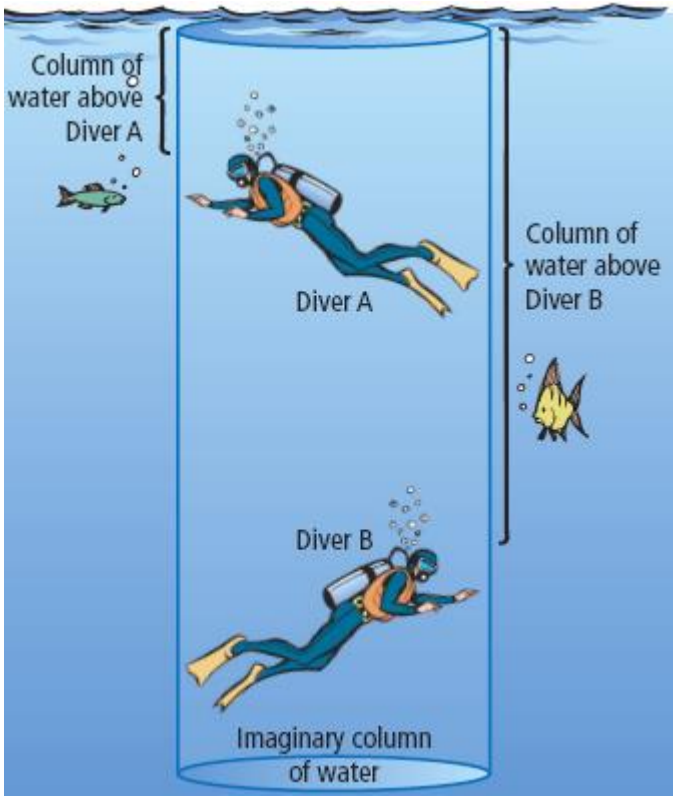
- If the atmospheric pressure is 101 200 Pa and you are holding out your hand, the atmosphere is exerting a force on your hand. If the area of the palm of your hand is 0.006 m2, how much force is the atmospheric pressure exerting on the palm of your hand?

# Example 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?

# Pressure and Liquids in Nature

The deeper in the ocean, the amount of water in the column above you increases, and therefore, the weight of the water increases




water pressure is greater the deeper you go underwater.

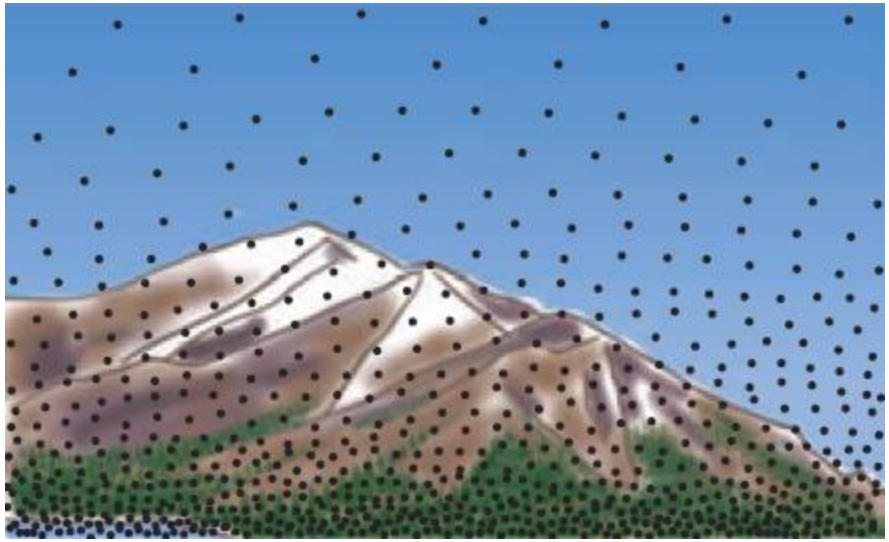
# Compressibility of Solids, Liquids, and Gases

- Compressibility—the ability to be squeezed into a smaller volume, or space.

Gases are compressible because gas particles are so far apart.

Liquids and solids are said to be incompressible because they cannot be squeezed into a smaller volume,

# Atmospheric Pressure

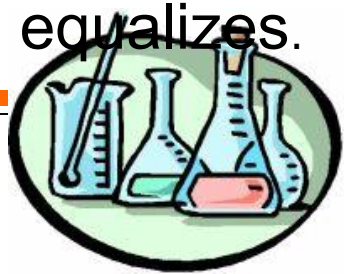


Every layer of air exerts pressure on the layers below because all of the air particles are pulled toward Earth by the gravitational force.

As you climb higher in the atmosphere, the amount of air above you decreases. Therefore, the air exerts less pressure on you with higher altitudes.

How do you feel this difference in pressure between the inside and outside?

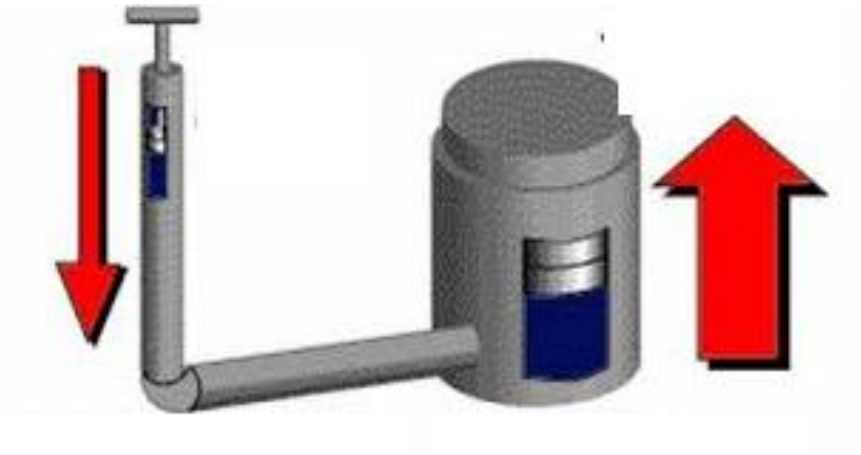
Your eardrum is a very thin membrane that can move in response to a difference in air pressure. If the difference in pressure on either side of the eardrum becomes great, you experience a “pop” inside your ear as the pressure equalizes.



# Science 8

## Unit 2:

## *Topic 8: Pascal's Law*



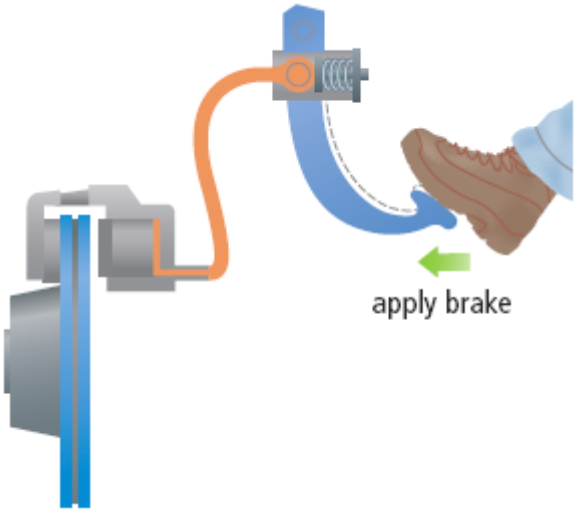
# Pascal's Law


- Blaise Pascal was a 17th century scientist who studied pressure.

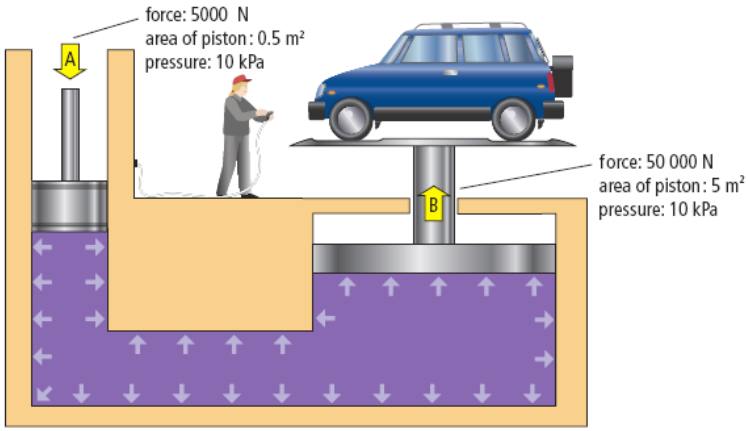
His law states that *pressure applied to an enclosed fluid is transmitted with equal force throughout the entire container*.

The pressure that your fingers exert at the bottom of the tube is transmitted through the toothpaste and forces the paste out at the top.

# Example of Pascal's Law




Why isn’t air used instead of brake Fluid?




# Hydraulics

- **Hydraulics** is the study of pressure in liquids.

hydraulic systems refers to devices that transmit applied force through a liquid to move something else

Examples of hydraulic systems are
-dentist's or a hairdresser's chair,
-the Jaws of Life that are used by fire departments,
-dump trucks

# Pneumatic Systems

- **Pneumatics** [pronounced new-MA-tics] is the study of pressure in gases

pneumatic systems, a gas transmits a force exerted on the gas in an enclosed space.

Compressors devices that compress air—are needed for pneumatic devices

Many tools use pneumatics,

- jackhammers,
-precision drills used by dentists.
- Air Brakes on large trucks and buses

# Reading Check

- Page 359

#1, #2, #3, #4