Chapter – 1

FORCE AND PRESSURE

8th class

Physical Science

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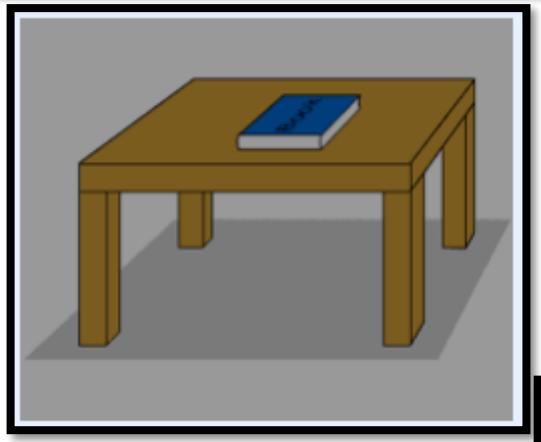
Identifying Actions as Push or Pull or both



Moving a book placed on a table

Opening or shutting a door

Drawing a bucket of water from a well

A football player taking a penalty kick

A cricket ball hit by a batsman

Moving a loaded cart

Opening a drawer

Erasing black board

From above examples, A force is a push or a pull or both

FORCE

A force is a push or a pull or both.
A force cannot be seen but we can feel and observe the effects of the force.

Push

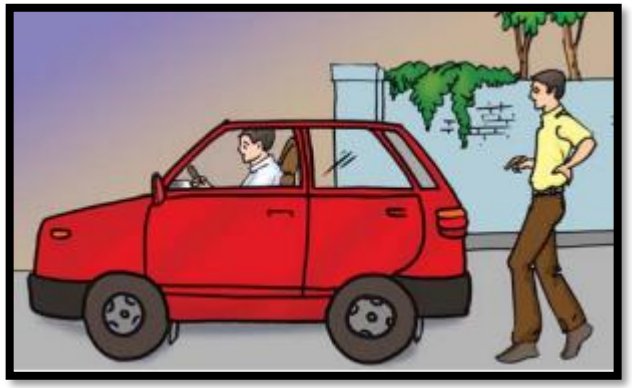
A force to move an object away from our bodies

Pull

A force to move an object towards our body

Combination of push and pull

Forces are due to an Interaction



If a man stands behind a car, the car does not move.

If a man pushes the car, he applies force and the car begins to move in the direction of the applied force.

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1. Both the girls appear to push each other .

2. Both the girls appear to pull each other.

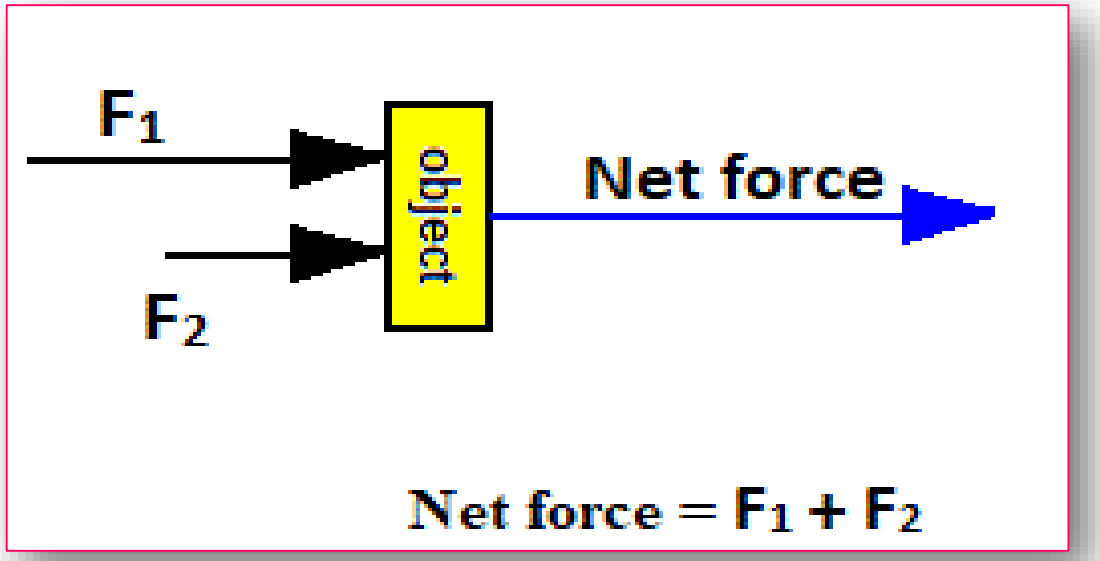
3. The cow and the man appear to pull each other.

From this observations

- At least two objects must interact for a force to come into play.

- An interaction of one object with another object results in a force between the two objects.

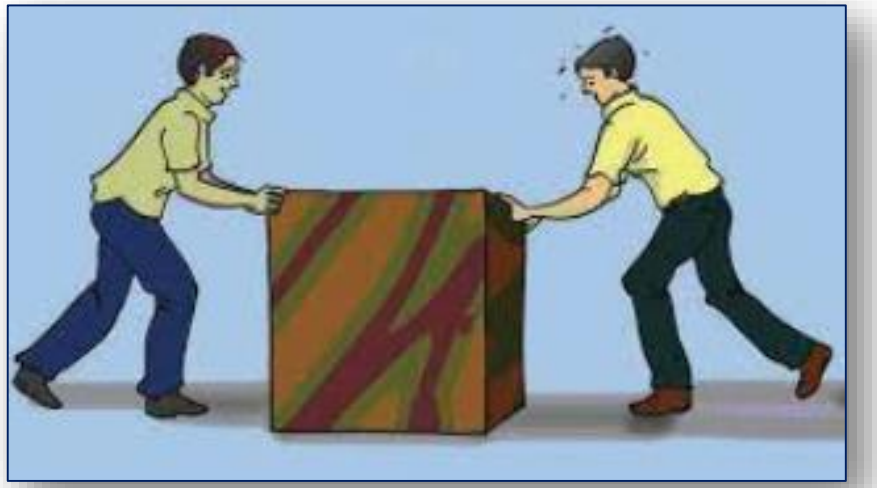
Exploring Forces

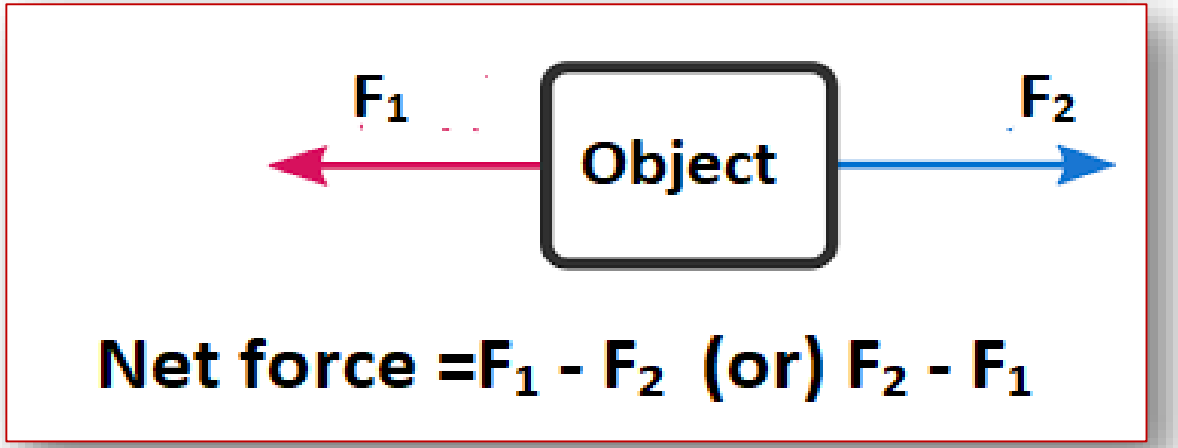


If two forces acting on a body in the same direction, the net force is the sum of the two forces.

Unbalanced force acting in the same direction combine by addition.

Exploring Forces





If two forces acting on a body in opposite direction, the net force is the difference between the two forces and is exerted in the direction of the larger force.

Unbalanced forces acting in opposite direction combine by subtraction.

- The strength of a force is usually expressed by its magnitude.
- We have also to specify the direction in which a force acts.
- If the direction or the magnitude of the applied force changes, its effect also changes.
- Newton (N) is the S.I unit of force.
- Force is a vector quantity.

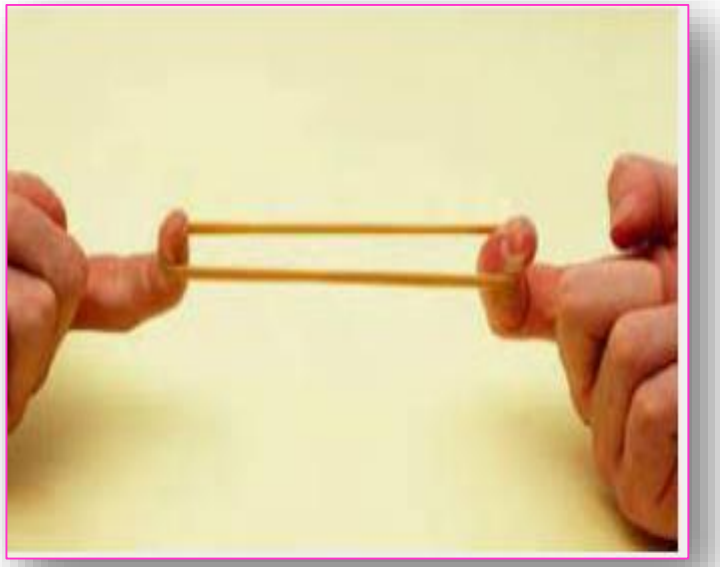
Effects of force

- A Force can Change the State of Motion
  - Moving from rest
  - Coming to rest from motion
  - Change the Speed
- A Force can Change the Shape of an Object
- A Force can Change the Direction of a Motion of an Object

A Force can Change the State of Motion

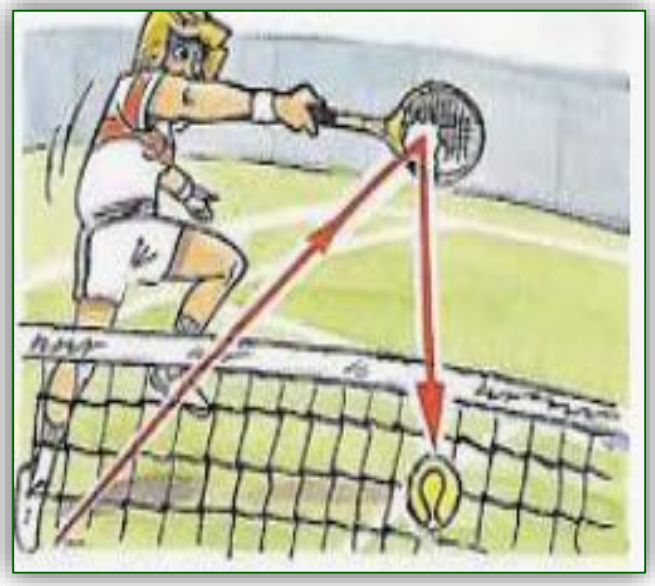
A force applied on an object may change its speed. If the force applied on the object is in the direction of its motion, the speed of the object increases. If the force is applied in the direction opposite to the direction of motion, then it results in a decrease in the speed of the object.

Force can Change the Shape of an Object

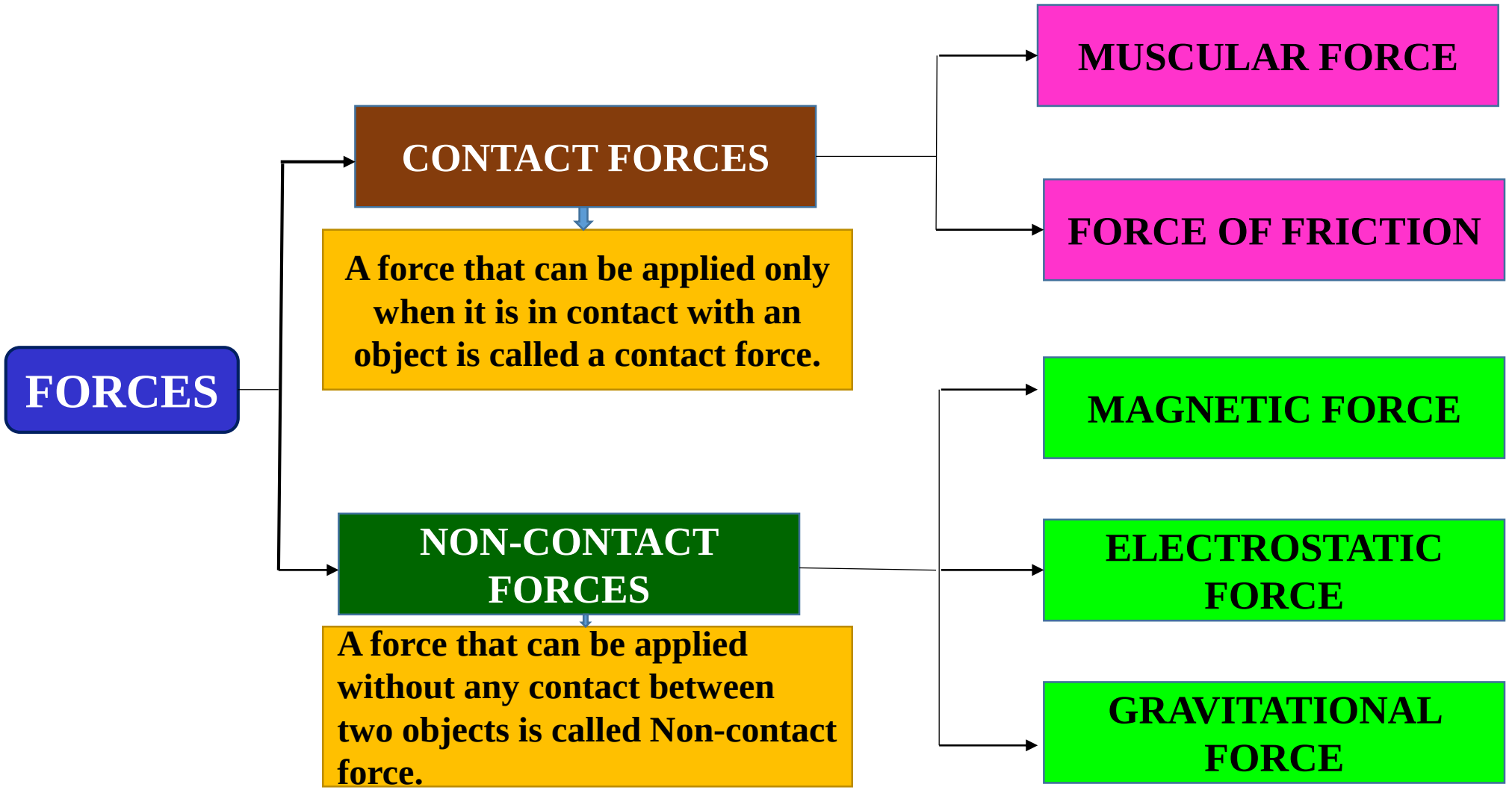


A force applied on an object may change its shape.

A Force can Change the Direction of a Motion of an Object



A force applied on an object may change its direction of a motion of an object


FORCES
CONTACT FORCES
A force that can be applied only when it is in contact with an object is called a contact force.
MUSCULAR FORCE
FORCE OF FRICTION
NON-CONTACT FORCES
A force that can be applied without any contact between two objects is called Non-contact force.
MAGNETIC FORCE
ELECTROSTATIC FORCE
GRAVITATIONAL FORCE

CONTACT FORCES: - Muscular force

The force resulting due to the action of muscles is known as the muscular force.

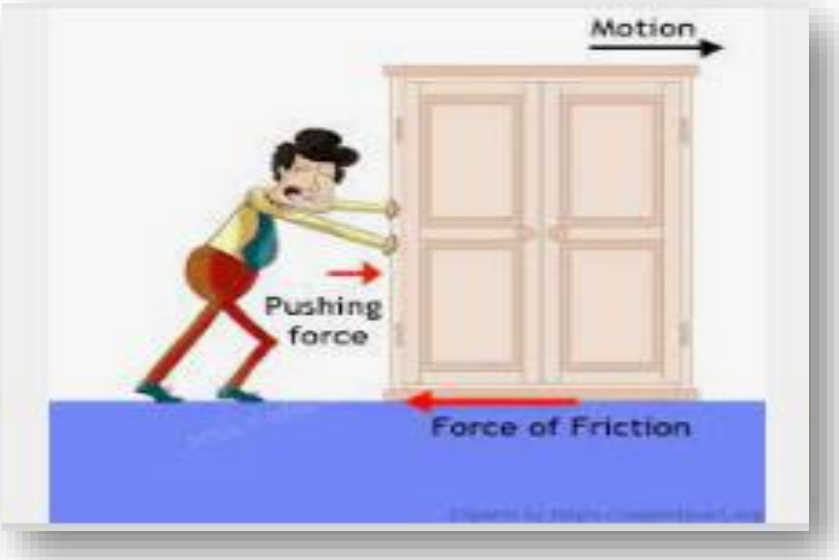
We use muscular force for our various activities and animals also.

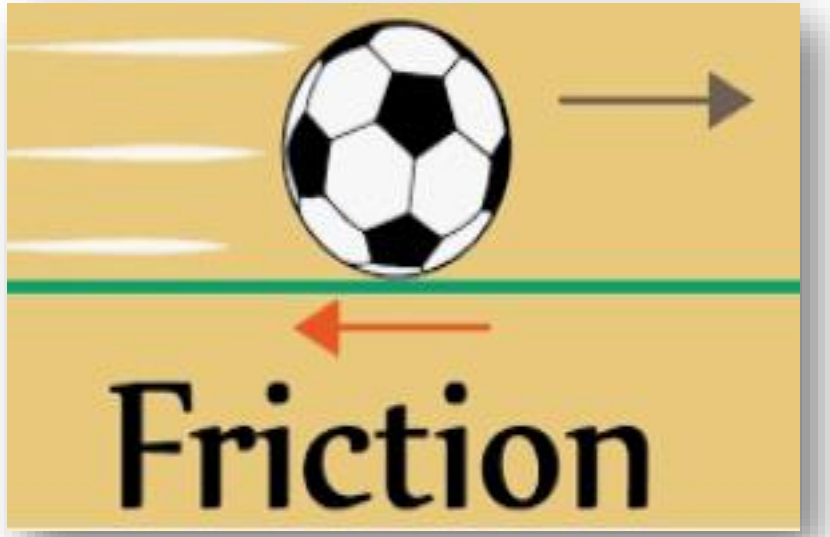



CONTACT FORCES: - Force of friction

The force of friction always acts on all the moving objects and its direction is always opposite to the direction of motion.

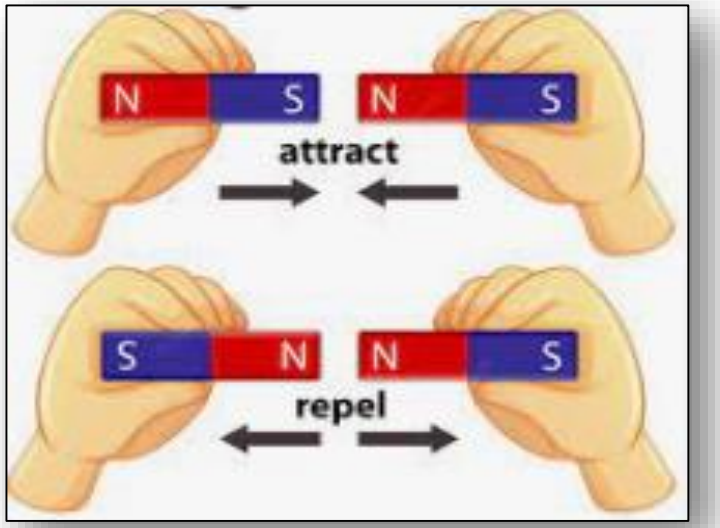
Force of friction is the force which opposes the motion of an object over a surface.

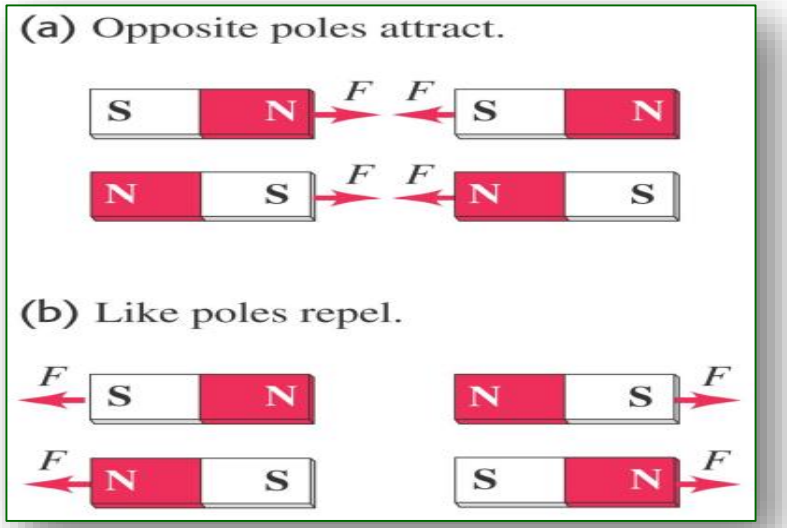




Non-Contact forces: - Magnetic force

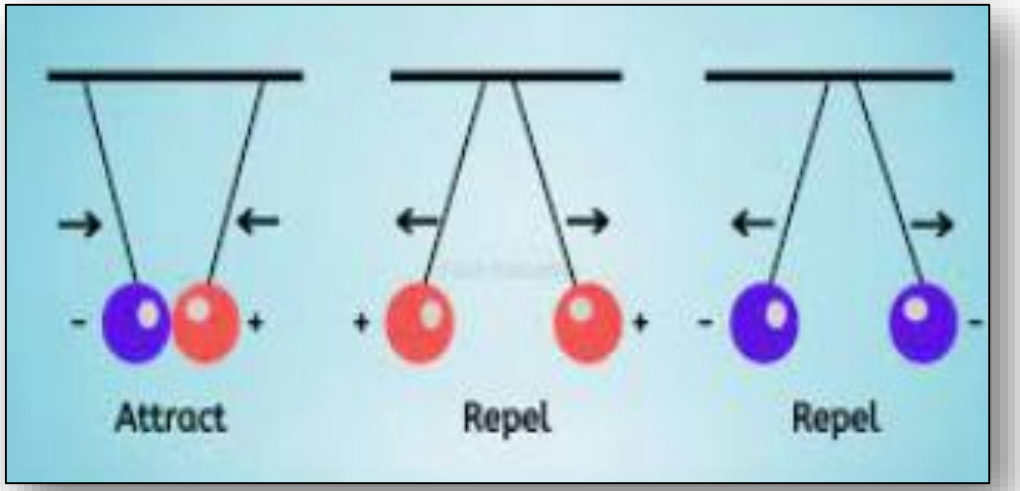
The force exerted by a magnet to pull/push a metallic object is called magnetic force.





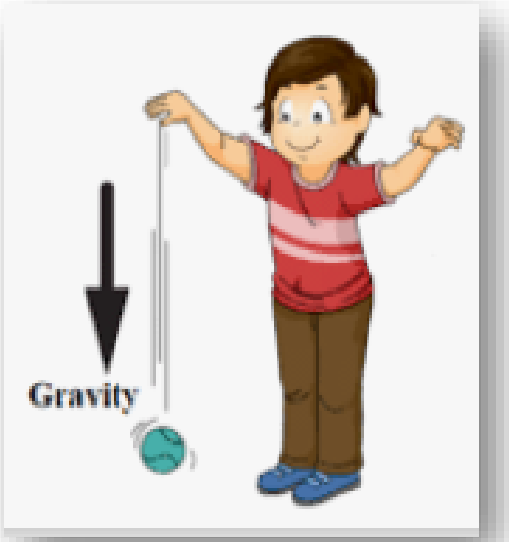
Non-Contact forces: - Electrostatic force

The force exerted by a charged body on another charged or uncharged body is known as electrostatic force.



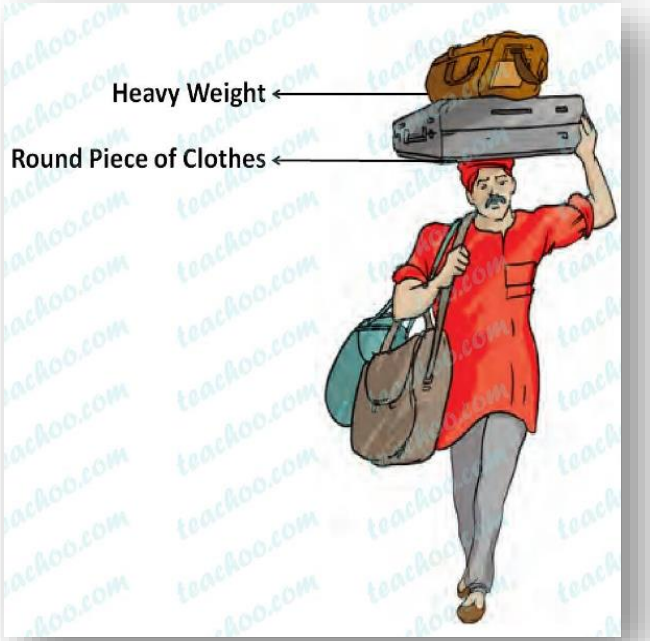
Non-Contact forces: - Gravitational force

The force exerted by the earth to pull the objects towards itself is called as Gravitational force.

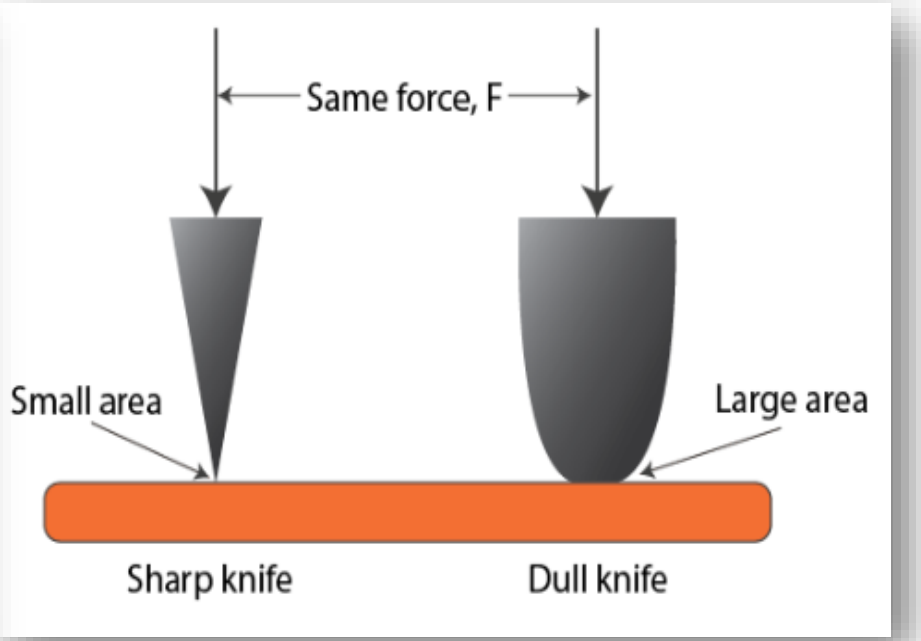


Pressure

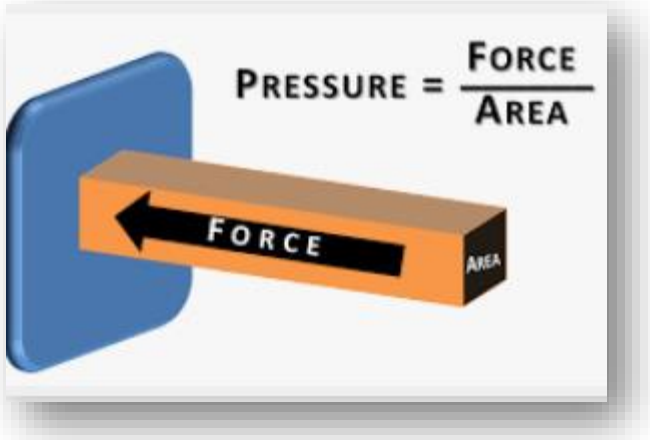
Pushing a nail into a wooden plank

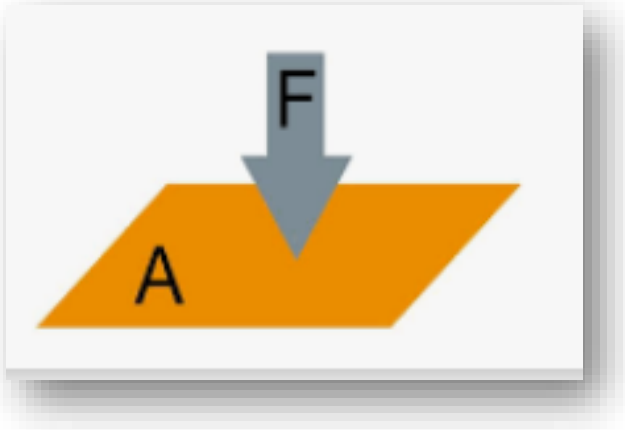


A porter carrying a heavy load



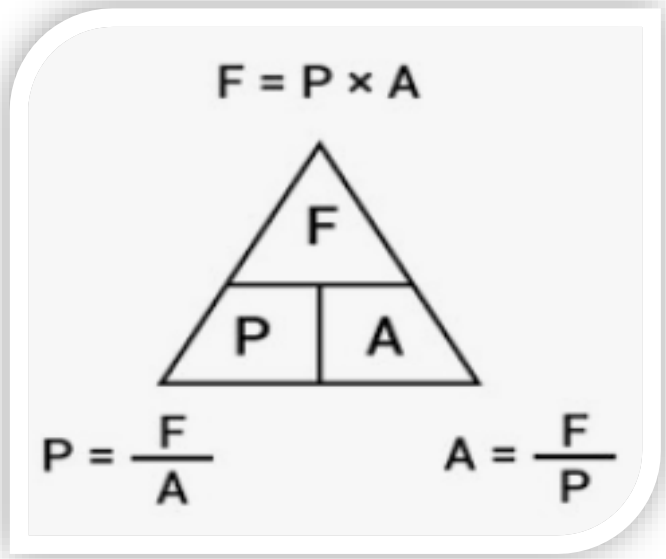
Cutting vegetables with a blunt knife and then with a sharp knife.





Pressure: **The force acting on a unit area of a surface is called pressure.**

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



$P \propto \frac{1}{A}$ (If same force is applied)

$P \propto F$ (If same area)

- The smaller the area, larger the pressure on a surface for the same force.
- Pressure depends on Force and Area.
- S.I unit of Pressure is N/m^2 (or) Pascal

Increasing the Pressure by Reducing the Area

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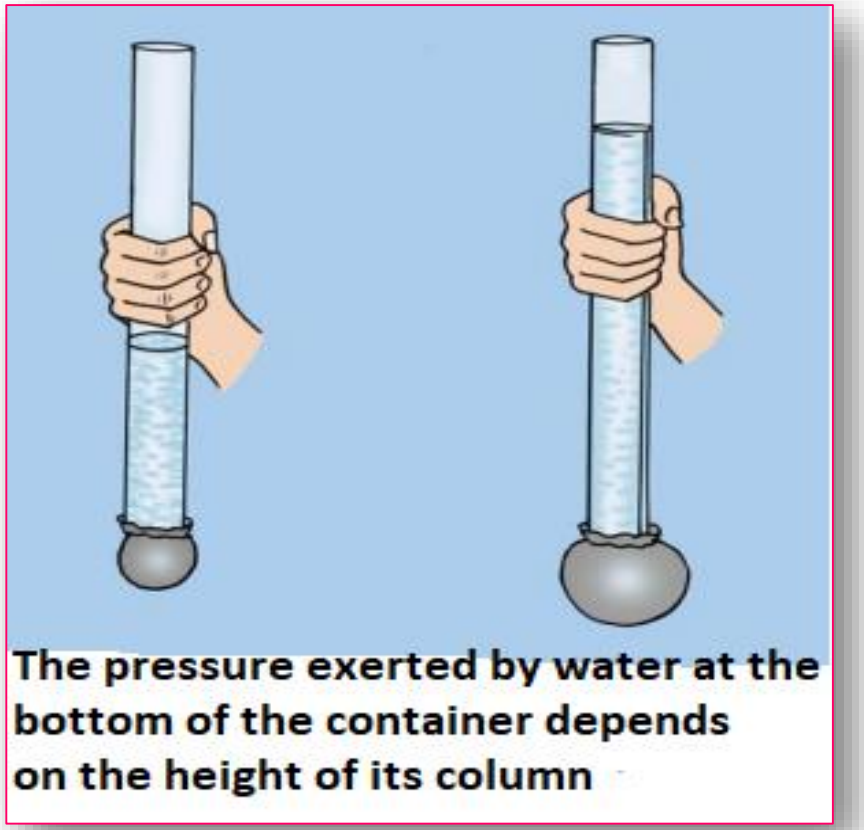
1. A Sharp knife has a very small surface area on its cutting edge, so that high pressure can be exerted to cut the vegetables.
2. The high pressure on surface of the ice, so that the ice melts and allowing the ice skater to glide smoothly.
3. The ends of the nails and pins are made sharp in order to minimize the area which in turn increases the pressure.

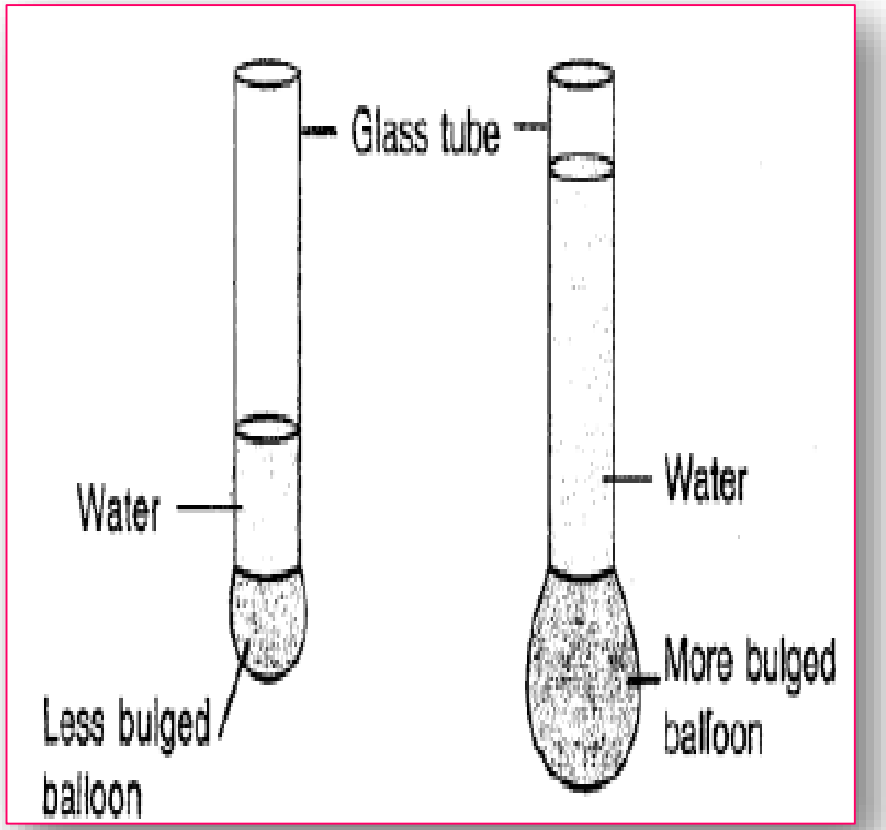
Reducing the Pressure by Increasing the Area

The lorry have broad tyres, so there is less pressure on ground and do not sinking to comparatively soft field.

School bags have wide straps so the weight of bag may fall over a large area of the shoulder of the students producing less pressure on shoulder.

Pressure Exerted by Liquids

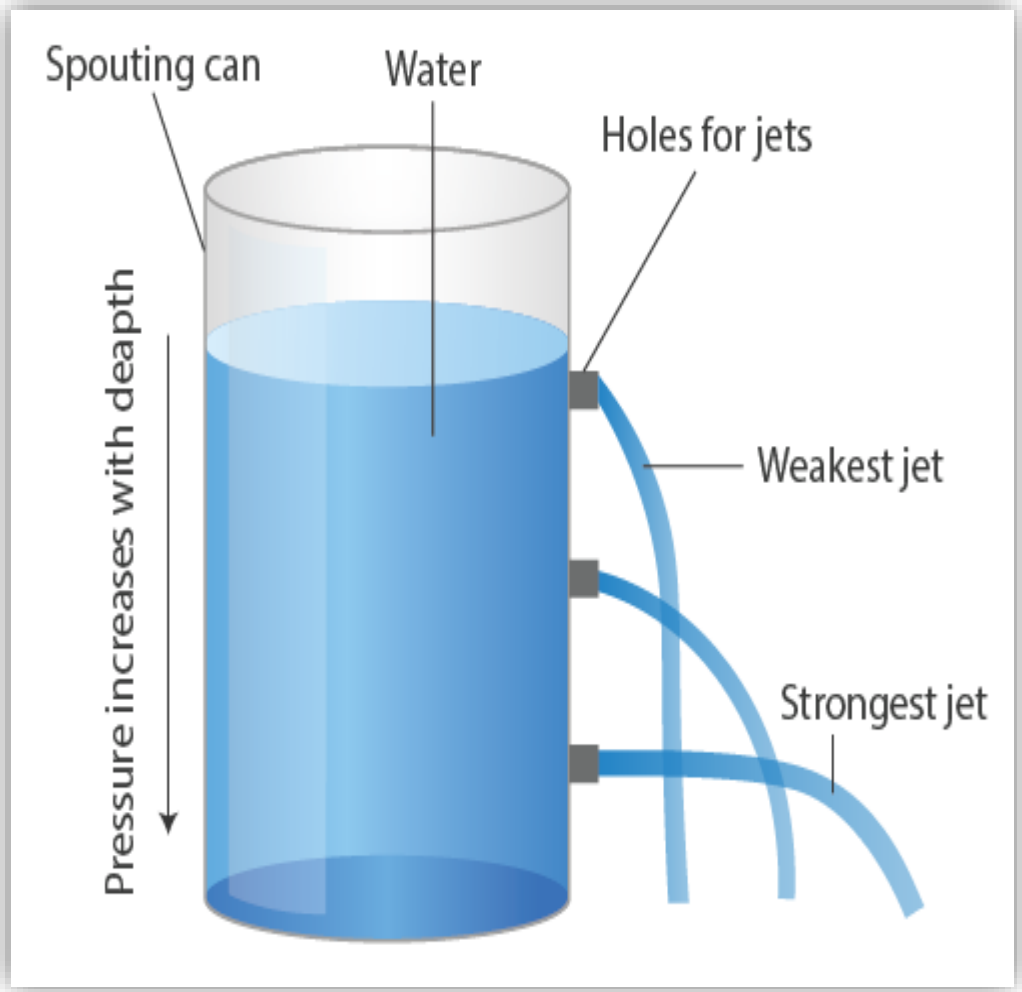




Pressure Exerted by Liquids

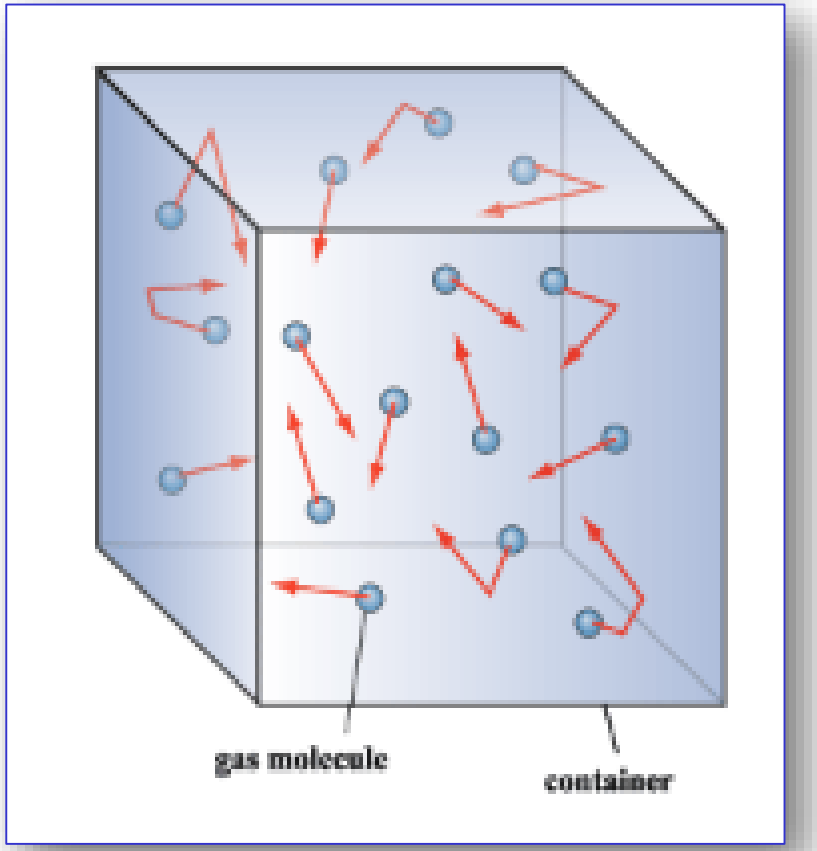
A liquid exerts pressure on the walls of the container

Liquids exert equal pressure at the same depth



- Liquids pressure on the bottom of the container does not depend on the area of the bottom. It act perpendicular to the base.
- Liquids exert pressure on the walls of the container.
- Liquids exert equal pressure at the same depth.
- Liquid pressure increases with depth.

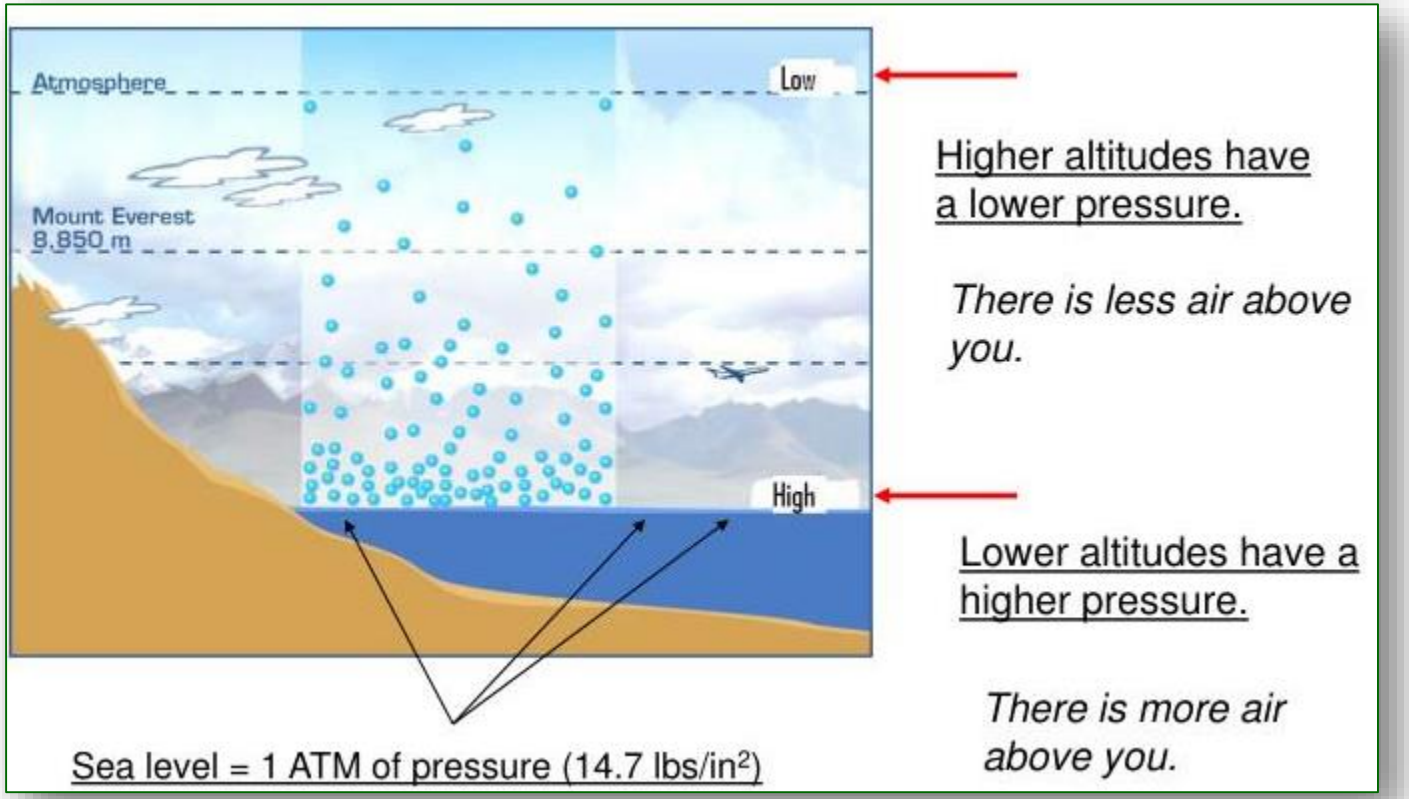
Pressure Exerted by Gases

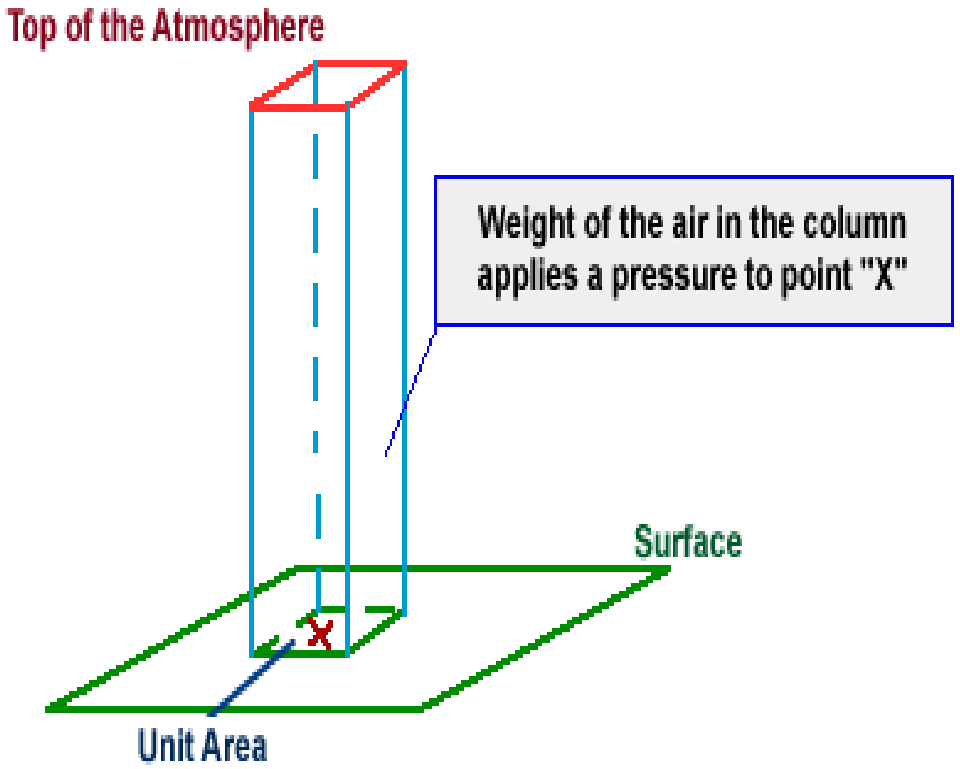


- Gases exert pressure on the walls of the container.
- Air exerts pressure in all direction.
- Air pressure arises due to the constant collision of the tiny molecules of the gases present in the air with the walls of the container in which it is enclosed.

Atmospheric Pressure

The pressure exerted by this air is known as atmospheric pressure.

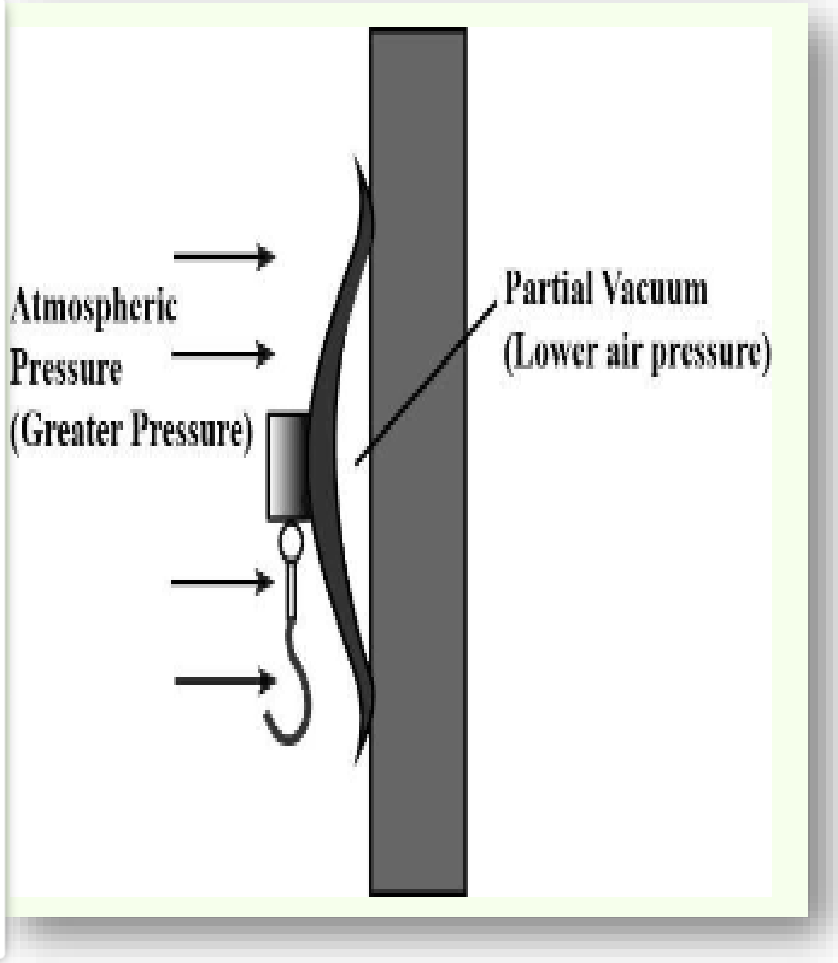




A unit area and a very long cylinder standing on it filled with air, then the force of gravity on the air in this cylinder is the atmospheric pressure

A rubber sucker pressed on a surface

When you press the sucker, most of the air between its cup and the surface escapes out. The sucker sticks to the surface because the pressure of atmosphere acts on it. To pull the sucker off the surface, the applied force should be large enough to overcome the atmospheric pressure.



If the area of my head were 15 cm × 15 cm, how much force air will exert on my head?

Area of the head(A) = 15cm x 15cm = 225 cm^2 = 225 x 10^{-4} m^2

Atmospheric pressure is (Average) (P) = 1.01 x 10^5 N/m^2 or Pa

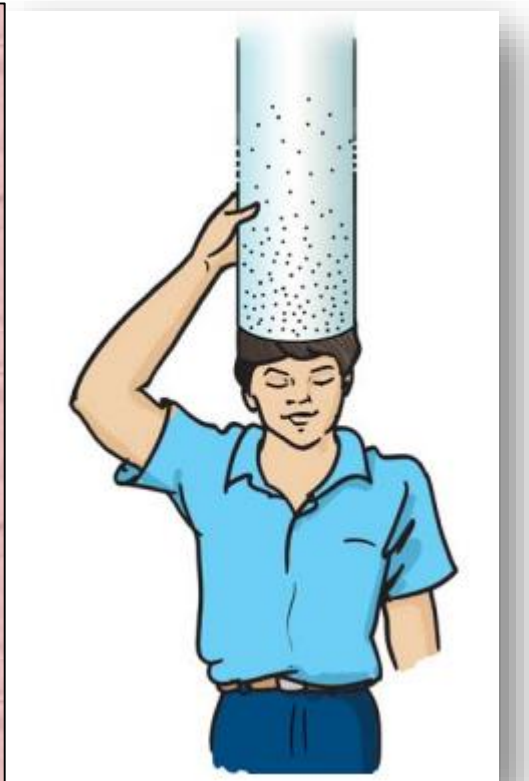
According to the formula, F = A x P

F = 225 x 10^{-4} x 1.01 x 10^5

= 2279.8125 N

= 227.25 kg

Weight(force) of the air on the head (W) = 227.25 kg



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