Chapter – 11

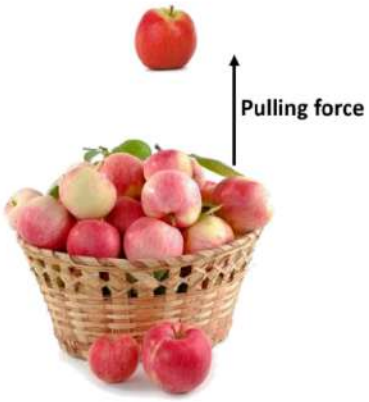
Force and Pressure

Force - a Push or a Pull

Force: A push or pull on an object is called force. Force is a vector quantity and its SI unit is newton (N).

Example:

1) Ram picked one apple by pulling from the fruit basket.



2) Batsman hitting (push) a cricket ball.

Tip: Remember the actions which are examples of push or pull.

Push: Kicking, Hitting, Throwing, Pushing, Flicking etc.

Pull: Picking, Lifting, Shutting, Pulling etc.

Force due to interaction

Force due to interaction: Whenever there is an interaction of one object with another object, there is a force between the two objects.

- If two forces are acting in the same directions on an object, the net force acting on it is the sum of the two forces.

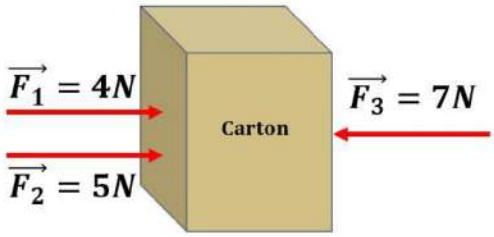
  $\mathbf{F = F_1 + F_2}$

- If two forces are acting in opposite directions on an object, the net force acting on it is the difference between the two forces.

  F = F1 - F2 **[F1>F2]**

  F = F2 – F1 **[F2>F1]**

Example: Find the net force on the carton.



Solution: $F_1 = 4$ N and $F_2 = 5$ N are the forces acting on the carton box in the same direction.

$F_3 = 7$ N is the force acting on the carton box in the opposite direction.

Net force acting on the carton is F_{net}

$F_{net} = (F_1 + F_2) - F_3$

$F_{net} = (4 + 5) - 7$

$F_{net} = 9 - 7$

$F_{net} = 2$ N

Tip: Whenever computing net force on an object be careful with the direction of net force applied.

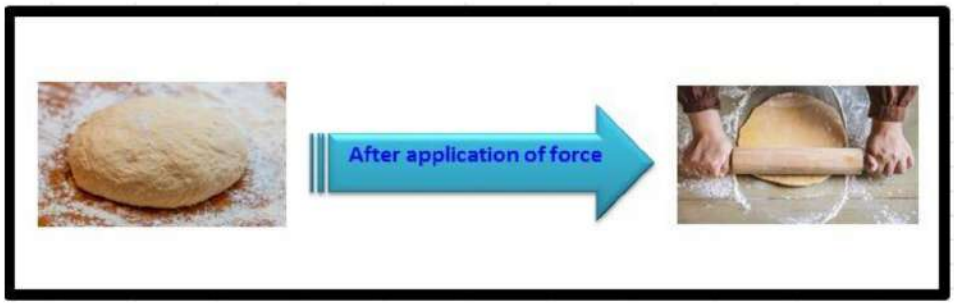
Effect of force

Effect of force: A external force acting on an object can change

1. The shape and size of an object.
2. The state of motion of an object.
3. The speed and direction of a moving object.

Example:

(a) Conversion of dough ball into chapati is an example of a force that changes the shape of an object.



(b) When a batsman hits a cricket ball with his bat, he applies force to change the direction and speed of the moving ball.

(c) When you apply a force on a cart, it starts moving and the state of motion of the cart is changed from rest to motion.

Contact and Non-contact Forces

Contact forces: A force that can be applied by an object on another object only through physical touching is called a contact force. E.g. Muscular force and Frictional force.

(a) Muscular force: The force applied due to the action of muscles is called muscular force.

(b) Frictional force: The force which opposes the relative motion between two surfaces in contact is called friction.

Non-contact forces: A force that can be applied by an object on another object even without touching each other is called a non-contact force.

Examples:

(a) Magnetic force: The force exerted by a magnet on another magnet or iron piece is called magnetic force.

(b) Electrostatic force: The force exerted by a charged object on another charged or uncharged object is known as electrostatic force.

(c) Gravitational force: The force of attraction between two objects having mass is called gravitational force.

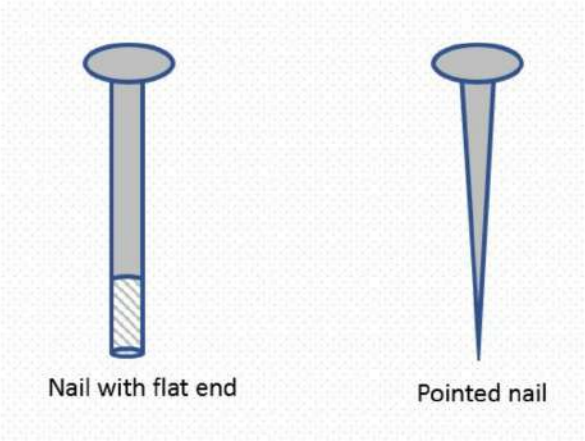
Pressure

Pressure: The force acting per unit area on a surface is called Pressure.

$$Pressure = \frac{Force}{Area}$$

The SI unit of pressure is Pascal (Pa) or (N/m^2).

Example: Which of the following nail fix in the wall easily.



Solution: The pointed nail covers a smaller area on the wall than a flat end nail. As a result of which pressure exerted by the pointed nail on the wall is greater as compared to the pressure exerted by the flat end nail on the wall.

Therefore, a pointed end nail easily pierces the wall as compared to a nail with a flat end. Hence, pointed nail fix in the wall easily.

Tip: Remember pressure increase when the area decreased and the applied force is increased.

Pressure exerted by liquids and gases

Pressure exerted by liquids and gases: Liquids and gases exert pressure on the wall of a container in all directions.

Two factors affect the pressure exerted by liquids and gases:

(a) The depth of the liquid or gas: The pressure exerted by a liquid or a gas at a point increased with an increase in the depth of the liquid.

(b) Density of the liquid or gas: The pressure exerted by a liquid or a gas increased with the increase in density of the liquid or the gas.

Example: Why the thickness of the walls of a dam is increased towards the bottom?

Solution: The pressure exerted by a liquid at a point increased with an increase in depth of the liquid.

Therefore, the thickness of the walls of a dam is increased towards the bottom so that the dam is withstand with the increasing pressure of water.

Tip: While answering questions based on this topic state the reasoning based on given two factors which affect pressure exerted by liquids and gases.

Atmospheric pressure

Atmospheric pressure: The pressure applied by air on the body is called atmospheric pressure.