FORCE AND PRESSURE

CLASS 8

Units – Newton, Kgf

FORCE
(Push or Pull)

Effects:
- Move a stationary body
- Stop or changes direction of a moving body
- Change size or shape of a body

Classification

Contact
(acts between objects in physical contact)

- **Muscular** → Exerted by muscles of the body
- **Mechanical** → Exerted by machines to do work
- **Frictional** → Opposes motion of one body over the other

Non-contact
(acts between objects not in physical contact)

- **Magnetic** → exerted by magnet on magnetic materials
- **Electrostatic** → exerted by charged body on other charged or uncharged body
- **Gravitational** → Earth's pull to attract every object towards it.

Units - N/m^2, Pascal (Pa)

PRESSURE

(measure of the effect of force per unit area)

Liquid pressure

- Increases with depth
  - To measure L.P we use **Manometer**
- Remains same in all directions at the same depth

Atmospheric Pressure

Decrease with increase in altitude

To measure A.P we use **Barometer**

A push or pull on an object is called force.

Units - The SI unit of force is Newton (N)

The force required to lift a body of mass 1 Kg vertically upwards is called one kilogram force (Kgf)

$$1\,Kgf = 9.8\,N$$

or, $\boxed{1000gf = 1Kgf}$

RESULTANT FORCE -

* when 2 forces act on an object in the same direction, the R.F is calculated by adding the forces. It moves the object in the direction of the applied force.

* when 2 equal forces act on an object in the opposite directions, the resultant force becomes zero and the object doesnot move.

Such forces are balanced forces.

(10) When 2 unequal forces act in opposite directions on an object, the resultant force is the difference between the two forces.
It moves the body in the direction of the larger force.

Application of Pressure

(1) Cutting by sharp knives are easier when compared to blunt edges because sharp edges have less area hence pr. exerted increases. This large pressure helps to cut the objects easily.

(2) Foundations of high rise buildings are kept wide, so that they exert less pressure on the ground.

③ School bags having wide straps so that (3) less pressure is applied on the shoulders

④ Wide steel belt is provided over the wheels of army tanks so that it exerts less pressure on ground and donot sink into it.

* Liquid pressure increases with depth.

Examples - ① The wall of a dam is made thicker at the bottom bcoz, L.P increases with depth.

② Water supply tank is placed at a high place in the building.

ATMOSPHERIC PRESSURE -

The pressure exerted by the air due to its own weight.

When we go to high altitudes then atm. pr. decreases.

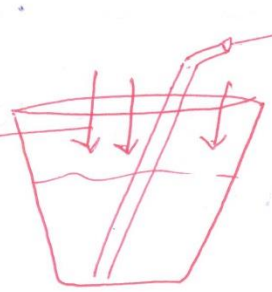
eg: ① Mountaineers suffer nose bleeding at high altitudes bcoz. atm. pr. is less than our blood pr. Due to which some of the blood capillaries burst and blood comes out.

② Astronaut wears special space-suit which maintains normal atm. pr. for his body.

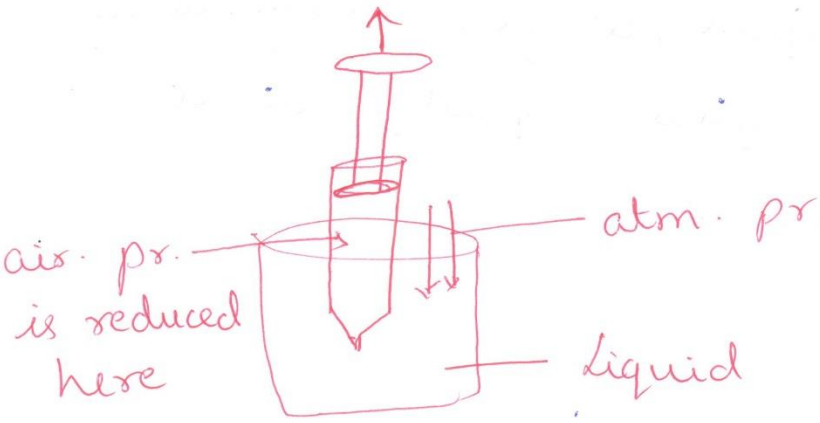
Note - Parachutes use atm. pr. against gravitational force.

③ Drinking Straw - when we suck air at upper end of straw, pr. of air inside straw is reduced But pr. on juice is equal to A.P.

Reason - Liquid rises into straw due to Partial vacuum created inside straw.



(4) Syringe - when syringe is dipped in liquid and piston is pulled, Pr. inside syringe reduces. The atm. pr. on surface of liquid is more in comparison to air pr. in syringe & thus pushes liquid up in the syringe.



Imp. Points -

1) Barometer records Atm. pr. At sea level, ht. of mercury column is 760mm or 76cm.

2) Atm. pr. decreases with altitude.

* Aneroid Barometer does not use any liquid but measures Atm. Pr.

Points to know -

- Pressure of a liquid is same in all directions at the same depth.
- Ps. at a point in a liquid increases with depth.
- Pr. doesnot depend on the size and shape of the container.
- Pascal's law - when pr. is applied on liquid, it gets transmitted throughout, equally in all directions.

Questions

1) When the force applied on an object is doubled, how does the pressure exerted on the object change?

2) Tractors have large tyres, bulldozers have caterpillar tracks and heavy buses/trucks have eight rear wheels. Give one common reason for all these cases.

3) Why all cutting instruments have sharp edges? Give reasons.

4) Can a rubber sucker be stuck on a rough surface? Give reason.

5) Two boys pull a rope from 2 ends with a force equal to 1000N each. What is the resultant force?

6) A plastic comb when rubbed in dry hair can attract small pieces of paper. Name the force and its nature.

Imp. points -

$1\ kgf = 9.8\ N$

$\simeq 10\ N$

Resultant force, $= F - F = 0$

Action	Result
force → object in motion	→ Speed increases
Object in motion → force ←	→ Speed decreases

Conversion -

$1\ m = 100\ cm$

$1\ cm = \frac{1}{100}\ m$

$1\ cm^2 = \frac{1}{100} \times \frac{1}{100}\ m^2$

Numerical -

① A girl weighing 50 kg is standing on pencil heels, each having cross sectional area of $1\ cm^2$. An elephant weighing 1000 kg and foot area of $250\ cm^2$. which of exerts more Pressure?

→ Pr. exerted by girl -

Mass of girl = 50kg

Force exerted = 50kgf

= 50×10 = 500N

Area of 1 heel = 1cm²

Area of 2 heel = 2×1 = 2cm²

$= 2 \times \frac{1}{100 \times 100}$

$= \frac{2}{10,000}\ m^2$

Pr. exerted by girl = $\frac{\text{Force}}{\text{Area}}$

$= \frac{500\ N \times 10000}{2}$

$= 2,500,000\ N/m^2$

Pr. exerted by Elephant -

Mass of elephant = 1000kg

Force = 1000kgf = 1000×10

= 10,000N

Area of 1 foot = 250cm²

Area of all 4 feets = 4×250 = 1000cm²

$= \frac{1000}{10000}\ m^2 = \frac{1}{10}\ m^2$

Pr. $= \frac{10000 \times 10}{1} = 100,000\ N/m^2$

Pr. exerted by girl > Pr. by elephant

Ratio $\Rightarrow \frac{\text{Pr. Girl}}{\text{Pr. Elephant}} = \frac{2,500,000}{100,000} = \frac{25}{1}$

(1) A solid block weighs 250N. when placed on ground, area of contact is found to by $10m^2$. (8)

(2) A brick is 52cm long, 10cm wide and 10cm thick. It weighs 40N and is lying on ground. Find pr. exerted by brick on the ground.

(3) A force of 120N is applied to an object of area $5m^2$. Calculate the pressure.

(4) Name the type of forces acting on a Parachute when it goes up in sky?