DELHI PUBLIC SCHOOL
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SUBJECT: PHYSICS CH-6: FORCE AND PRESSURE CLASS: VIII

NOTES

Force (F): A push or pull exerted by an object on another is a called force.
e.g. 1. Filling the air in a balloon. **(Ans to the Q.no 6:1 from TB pg.no 94)**
2. Closing or opening a door

Note: 1. The interaction between objects can change the state of the objects.
2. The amount of force is called magnitude of force and direction in which it is applied is called direction of force.

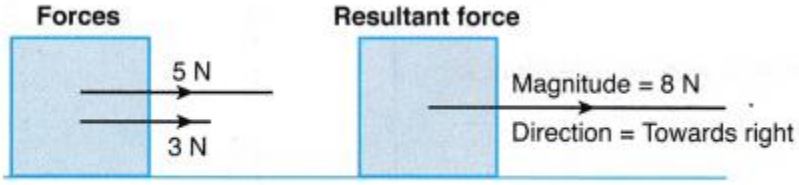
Formula: F=m x a

- C.G.S unit: dyne
- S.I unit: newton(N)
- Other units of force: kilogram force (Kgf) and Pound force.

H.W: Read the lesson from pg.no 88,89

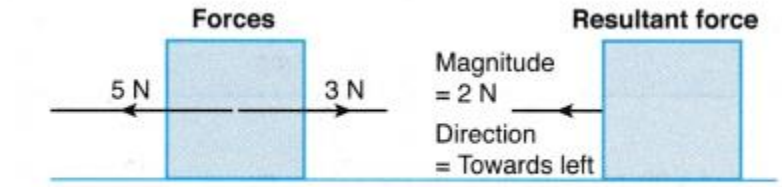
Resultant or Net Force: When more than one force is exerted on an object during an interaction, the overall force acting on the object is called the resultant force.

- **Case 1:** Force applied on an object in the same direction, resultant force acting on an object is sum of the forces acting on it.



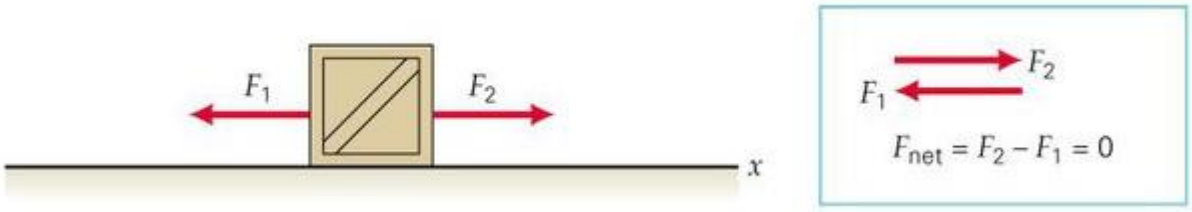
(a) Forces acting in the same direction

- **Case 2:** If the two or more forces act in the opposite direction on an object, the net force acting on it is the difference between the two forces.



(b) Forces acting in opposite directions

Case 3: When two forces are equal in magnitude and opposite in direction, the resultant force acting on it is zero. We call these forces as balanced forces.



(c) Zero net force or balanced forces.

EFFECTS OF FORCE:

(Ans to the Q.no 7:3 from TB pg.no 94)

- Change in state of motion of an object(Rest to motion or motion to rest)

Ex 1: A ball which is at rest starts moving when pushed by the player and will stop if another player catches the moving ball.

Ex 2: When breaks are applied to a moving car, the force acts on all the four wheels in the opposite direction to that of the car, due to which it slows down.

- Change in speed of a moving object-

Ex; when you press on the accelerator of the car, the speed of the car increases as the force of the car applied in the same direction as that of the car.

- Change in direction of a moving object-

Ex: A batsmen hits the moving ball and changes its direction

- Change in shape and size of an object-

Ex: Rolling a piece of dough into round chapattis.

H.W: Complete in text Q & A of TB p.no. 85

TYPES OF FORCE:

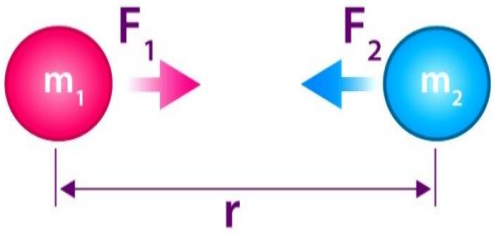
1. **NON-CONTACT FORCE OR ACTION AT A DISTANCE:** The forces that come into play when interacting bodies are not in contact with each other or are at a distance.

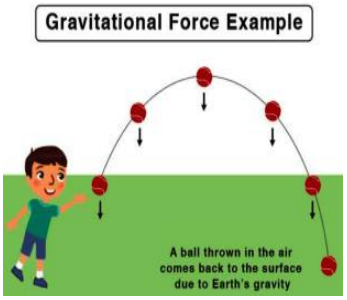
Some important non-contact forces are:

a. **Gravitational force:** Every object in the universe exerts force on every other object. This force is known as gravitational force.

E.g. A ball thrown upwards in the air, it reaches a certain height, and then falls to the ground.

Universal law of gravitation: Every object in the universe attracts every other object with a force which is proportional to the product of their masses and inversely proportional to the square of the distance between them.





Gravity or Force of gravity (g) :

(Ans to the Q.no 7:1 from TB pg.no 94)

The force with which the earth attracts all objects towards itself.

Note: 1. Gravity was discovered by Sir Isaac Newton.

1. Mass of the object increases, gravitational force exerted by it also increases.

HOTS: If all objects attracts one another then why don't we see them moving towards each other? **(Ans to the HOTS Q. no 1 from TB Pg.no 94)**

Ans: We can't see objects attracted towards each other because the force of attraction between them is very less as they have less mass so, gravitational force of attraction between them is very, very weak.

H.W: Complete Topic-1, 2 from Force & pressure worksheet.

MASS AND WEIGHT

Mass	Weight
It is the amount of matter contained in an object	It is the force with which the Earth attracts an object towards its centre.
It is a constant quantity	It is a variable quantity
It is measured with the help of a physical or beam balance	It is measured with the help of a spring balance.
Fundamental and scalar quantity	Derived and vector quantity
SI unit - Kilogram	SI unit- Newton
Mass of an object can never be zero	Weight of an object can be zero, if g = 0

W = m x g or m = w / g

W = Weight of an object
m = Mass of an object
g = acceleration due to gravity

Note: 1. Acceleration due to gravity of the Earth (g_e) = 9.8 m/s^2

2. Acceleration due to gravity of the Moon is $1/6^{th}$ of the Earth's gravity

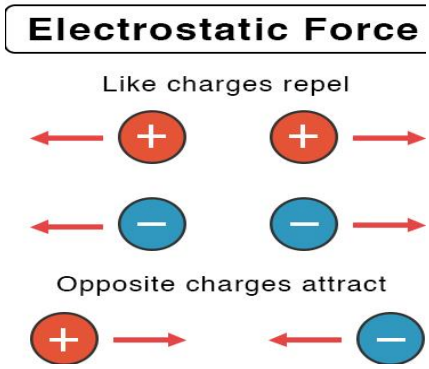
i.e $g_{moon} = g_{earth}/6$

$g_m = 9.8/6 = 1.6333 m/s^2$

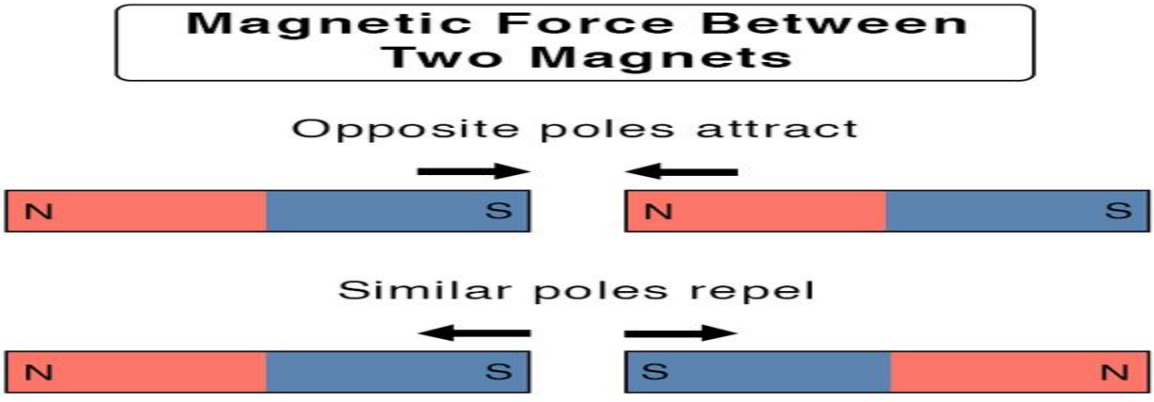
$W_{moon} = W_{earth}/6$ or $W_{earth} = W_{moon} \times 6$

b. **Electrostatic force:** It is the force exerted by a charged body on other charged or uncharged bodies.

E.g. On rubbing a plastic comb on dry hair and bring it near to tiny pieces of papers, it attracts bits of paper due to electrostatic force.



c. **Magnetic force**: It is the force of attraction between a magnet and magnetic material.



e.g. When two magnets are brought close, they either attract or repel without being in contact.
Ex: Magnetic force is used in cranes to lift heavy loads, to separate iron objects from garbage etc.

2. **CONTACT FORCE:** The forces that come into play only when bodies are in contact with each other.
Note: The bodies will move slow or fast depends on the magnitude of contact force acting on them.
Two important contact forces are:
a. **Muscular force:** The force applied by the muscles of the body is called muscular force.
e.g. lifting a bag to carry it on your shoulder, running, pushing an object, and kicking a ball

Frictional force: the force that resist motion when the surface of one body moves or tends to move on the surface of another body. **(Ans to the Q.no 6:2 from TB pg.no 94)**
E.g. A ball stops rolling on the ground due to friction
H.W: Complete Q. No. 1 from exercises of TB pg.no. 91

Pressure

Pressure is defined as the force acting on a unit area of a surface.

- It can be represented as:

Pressure= Force/Area or P= F/A

- Pressure is directly proportional to force and inversely proportional to the area over which it is applied.
- So, if we decrease the amount of area, pressure increases and if we increase the amount of area, pressure decreases.

Unit of pressure:

The SI unit of pressure is Pascal.

P= F/A

- S I Unit= N/m^2 or Pascal (Pa)
- CGS unit= $dyne/cm^2$
- 1 Pa= 10 $dyne/cm^2$
- It is a scalar quantity.

Note: One Pascal is the pressure exerted by a force of one newton on an area of one metre square.

$1Pa = 1N/m^2$

Examples of pressure in everyday life:

1. Cutting and piercing tools like knife, scissors, needles etc have sharp cutting edge or pointed tip so as to reduce the area of contact and thereby increasing the pressure to do our work easily.
2. School bags have broad straps so that the weight of the bag falls over a large area and thereby producing less pressure over the shoulder.

HOTS Questions:

1. Why do porters wear a turban (round piece of cloth) on their head when they carry the luggage?

Ans: Increase the area of contact of the load on their head and thus reduces pressure.

2. It is easier to sew with sharp pointed needle.

Ans. Tip of needle is sharp to produce more pressure on a small area of cloth and able to pierce easily while sewing.

HW

Complete Q.no 2 from TB exercises p.no. 92 and write answers to the following questions in C.W

3. The rear wheels of a tractor are very wide. Why?

4. Foundation of tall buildings are kept wide and broad. Why?

Numericals:

1) Calculate the pressure if a solid body weighing 150N is placed on the ground and the area of contact is found to be $3m^2$.

Sol: Force or Thrust= 150 N

Area of contact = $3m^2$

Pressure= Force/Area = $150/3 = 50N/m^2$ or 50 Pa

2) A man exerts a pressure of 12 Pa by applying a force of 85 N on a box. Find the area on which the force is acting.

Sol: P= 12 Pa

F= 85 N

A=?

P= F/A so A = F/P = $85/12 = 7.08m^2$

3) A boy exerts a force of 64 N on an area of $16cm^2$. Find the Pressure.

Sol: F= 64N

$A=16cm^2 = 16 \times 10^{-4} m^2$ ($1cm^2 = 10^{-4}m^2$)

$P=F/A = 64/16 \times 10^{-4} = 64\times10^4/16 = 4\times10^4$ Pa

4) Calculate the pressure exerted by a person weighing 600N when she is:

i. Standing on her feet, with area of contact between each foot and floor being 0.0015 m^2.

ii. Sitting on a chair with total area of contact on the chair being 0.01 m^2 (Ans to the Q.no 7:2 from TB pg.no 94)

Sol: i. Weight of the person = 600 N = Force

Area of contact of her feet = 0.0015 m^2

Total area of contact = 2 x 0.0015 = 0003 m^2

Therefore Pressure (P) = F/A

=600/0003

= 200000 Pa = $2x10^5$ Pa

ii. Weight of the person = 600 N = Force

Area of contact with chair while sitting = 0.01 m^2

Therefore Pressure (P) = F/A

= 600 / 0.01

= 60000 Pa = $6x10^4$ m^2

5) Calculate the pressure exerted on the floor by a boy standing on both feet if the weight of a boy is 40 kg. Assume that the area of contact of each side is 6cm ×25cm (Take 1kgwt =10N) (Ans to the Q.no 7:4 from TB pg.no 94)

Sol: Force = Weight of the boy= 40kgwt = 400 N

Area of contact of both the shoes = $2\times6\times25= 300cm^2= 300 \times 10^{-4}m^2$.

P =F/A = $400 \times10^4/300 = 1.33 \times 10^4$ Pa.

H.W: Complete Q.no.3 from TB p.no. 92

<u>Pressure Exerted by liquids:</u>

It is the force exerted by liquids or gases per unit area.

- Liquids exert pressure in all the directions i.e. downward, upward and on the sides of the container.
- Liquid pressure is same at all points in a horizontal plane at a given depth.
- Pressure exerted by the liquid increases with the increase in depth or height of liquid column.

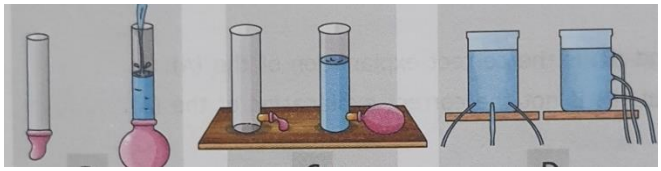


Fig: Liquid exerts pressure downward, lateral and pressure of liquid increases with depth.

- Liquid pressure increases with the increase in the density of the liquid.
- Pressure exerted by the liquid does not depend on the shape of the container.

- Pressure exerted by the liquid = Weight of the liquid (downward force)/Area of the bottom of the container.

Note: The walls of the dams are made very thick at the base, so that they can withstand higher lateral pressure exerted by water. This pressure of water used to generate electricity. (Ans to the Q.no 6:5 from TB pg.no 94)

H.W: Complete topic-4 from Force and pressure worksheet.

PRESSURE EXERTED BY AIR : Gases (air is a mixture of gases) also have weight and exert pressure in all directions.

E.g. The balloon inflates due to air pressure on the inner walls of the balloon.

- **Atmospheric pressure:** The pressure exerted by atmospheric gases on various objects on earth is called atmospheric pressure.
- **Standard pressure:** Atmospheric pressure at sea level is called normal pressure or atmospheric pressure.

➢ It is maximum at the sea level because the column of air is tallest at the sea level.

➢ Standard atmosphere (symbol: atm) is a unit of pressure.

➢ 1 atm = 760mm of Hg(mercury)
= 76cm of Hg

Measurement of pressure:

- A barometer is a device used to measure atmospheric pressure.
- U-tube manometer is a device is used to measure difference between atmospheric pressure and pressure exerted by fluids

H.W: Draw barometer (TB pg.no 89) and manometer (activity 9 T.B pg.no 90)

HOTS Questions:

1. Why don't we experience atmospheric pressure?

Ans: We do not normally feel this large atmospheric pressure because the pressure inside our bodies is almost equal to the outside air pressure and so it is balanced.

2. Why does nose bleed in high altitude?

Ans: Atmospheric pressure decreases with increase in altitude. Therefore, as we go higher the pressure within the blood vessels exceeds the outside pressure. This causes the blood vessels to rupture. As a result, a mountaineer suffers nose bleeding, ear bleeding etc.

3. Can water be used in place of mercury on the barometer?

(Ans to the Q.no 6:4 from TB pg.no 94)

The density of water is 13.6 times smaller than that of mercury that means we would require a 13.6 times taller column of water than that of mercury to measure same pressure difference. Thus obviously water will be very inconvenient to use

H.W: Complete Q.no 5 from TB exercise, p.no 93

Applications of atmospheric pressure in daily life:

- Drinking soft drinks using a straw:

(Ans to the Q.no 6:3 from TB pg.no 94)

When we place the ink dropper inside the ink pen and press the rubber of the dropper, high pressure is created inside the tube of the ink dropper. Due to the pressure difference created, the ink moves into the ink pen.

- Filling liquid medicine in a syringe.
- Filling any liquid like ink, chemicals in a dropper.
- Installing rubber sucker on a flat surface.

HOTS Questions:

1. Why is cooking food difficult at high altitudes?

Ans: High altitudes like mountains, the atmospheric pressure is low so the boiling point of Water is slightly less than 1000C.Thus it doesn't provide enough heat to cook the food. So, cooking becomes difficult and takes more time.

2. Why is the pressure inside an aeroplane maintained at normal ground level atmospheric pressure?

Ans: At high altitude (30000- 40000 feet above sea level), the atmospheric pressure will be very low. So, to safeguard passengers and crew members, the air pressure inside the cabin is maintained at normal ground level.

3. Why do deep sea divers wear a specially designed suit?

Ans: Pressure exerted by water increases with the increase in depth. Very deep down in ocean or sea, the pressure is enough to crush the human body. So, to withstand high pressure and more swiftly they wear special suits.

4. Why are fountain pens likely to leak while travelling in an aeroplane?
(Ans to the HOTS Q. no 2 from TB Pg.no 94)

Air pressure is low at higher altitudes. Fountain pens or toothpastes brought to higher altitudes from lower altitude regions contain air at high pressure Due to this difference in air pressure, the air inside the pen forces the ink to come out.

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