

TENDER HEART HIGH SCHOOL, SEC.-33B, CHD.

CLASS - IX

SUBJECT - PHYSICS

DATE 8.04.2024

CHAPTER - 4

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TOPIC - THRUST AND PRESSURE

THRUST - When a force is applied in a direction normal (or perpendicular) to the surface, it is called thrust. Thrust exerted by a body placed on a surface is equal to its WEIGHT. i.e.,

$$\text{Thrust} = \text{Weight of the body} = mg$$

FOR EXAMPLE - If a body is having a mass of 50 kg and is placed on a horizontal surface, then thrust exerted by the body on the surface will be given by $= m \times g = 50 \times 9.8 = 490 \text{ N}$

* Thrust is a vector quantity.

S.I. unit = Newton (N)

C.G.S. unit = Dynes

$$1 \text{ N} = 10^5 \text{ dynes}$$

If we have a cylindrical object (as shown in figure - 1), then for surfaces S_1 and S_2 , the thrust is shown as T_1 and T_2 .

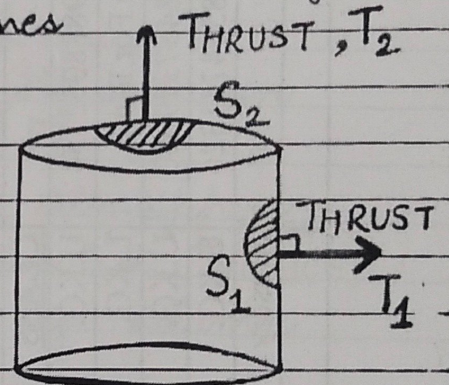


FIGURE - 1

NOTE - It should be observed that, thrust is acting perpendicularly to the surface at each point.

Thrust can also be measured in :

(i) kgf or kg wt.

(ii) gf or gwt.

$$1 \text{ kgf} = 9.8 \text{ N}$$

$$1 \text{ gf} = 980 \text{ dynes}$$

PRESSURE

The effect of thrust depends on the area of surface on which it acts. This effect of thrust is called pressure. Thus, it can be defined as thrust per unit area of surface.

$$\text{Pressure} = \frac{\text{Thrust}}{\text{Area}}$$

* It is a scalar quantity

S.I. unit of Pressure = N/m^2 = Pascals

It is named after the name of French scientist

BLAISE PASCAL

$$1 \text{ Pa} = 1 \text{ N}/1 \text{ m}^2$$

1 Pa is the pressure exerted on a surface of area 1 m^2 by a force of 1 N acting normally on it.

C.G.S. unit : $\text{dyne}/\text{cm}^2 = \text{dyne} \cdot \text{cm}^{-2}$

Other units :

a) $1 \text{ bar} = 10^5 \text{ N}/\text{m}^2$ (or 10^5 Pa)

$$1 \text{ milli bar} = 10^{-3} \text{ bar} = 10^2 \text{ Pa}$$

b) The unit atmosphere (symbol atm) is used to find atmospheric pressure.

$$1 \text{ atm} = 0.76 \text{ m of Hg column}$$

also,

$$1 \text{ atm} = 1.013 \times 10^5 \text{ Pa}$$

c) TORR is also used as unit of atmospheric pressure after the name of scientist TORRICELLI

$$1 \text{ torr} = 1 \text{ mm of Hg column}$$

$$1 \text{ atm} = 760 \text{ torr}$$

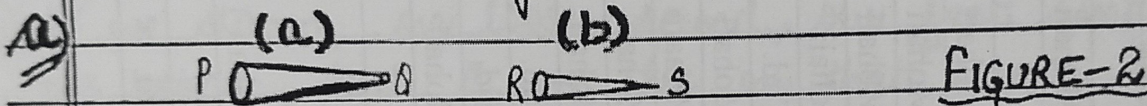
Also, from relation between Pressure, force (thrust) and area, it can be inferred that pressure is inversely proportional to area (the application of this formula is given on next page of this p.d.f.).

It might be observed by you that a truck or a bus has much wider tyres. It is done so that pressure acting on the road due to weight of truck or motor-bus may be small (which will further reduce the damage done to the roads due to movement of heavy transport vehicles).

According to formula, $P = \frac{\text{Thrust}}{\text{Area}}$,
pressure is :

- i) directly proportional to thrust, ($P \propto \text{Thrust}$)
inversely proportional to area of the object ($P \propto 1/\text{Area}$),
i.e. less is the area of the body, more will be the pressure exerted by it on the surface and if more is the area, then less will be the pressure exerted by the body.

For the given thrust, the pressure on a surface is increased by reducing the area of surface on which it is acting. FOR EXAMPLE -



If you observe figure -2, you will see two iron nails (a) and (b) of different thickness. If you are provided with nail (a) to embed in a wooden plank, then it will be tough as more force has to be applied. This happens because the area at point A is more and hence less pressure will be exerted by point A on the wooden plank.

While in part (b), the point S is having less area as compared to point A, thus more pressure will be exerted by point S on the wooden plank even on the application of less force.

Students, now I am giving one question to you all which is based on the concept that $P \propto 1/\text{Area}$.

Q1. Why it is easier to cut with sharp knife than with a blunt one?

Q2. Why is the tip of an alpinis made sharp?

(Pause this learning session and write the answers of these questions in your Physics Notebook)

CHAPTER-4

Charanjit Kaur

Let us see the correct reasons for the questions:

a) Sharp side of knife has less area and thus it exerts more pressure on the object even on application of less thrust and thus cutting with sharp side becomes easy as pressure is inversely proportional to area ($P \propto 1/\text{Area}$).

In case if we use blunt side, then the blunt side is having more area and thus less pressure is exerted on the body even on application of more thrust.

b) If we stand on loose sand, our feet sink into the sand, but if we lie on that sand, our body does not sink in the sand. The thrust applied in both cases is same, that is, the weight of our body, but the area covered by our body while standing is less and thus pressure exerted will be more.

But while lying on the sand, the area covered by the body is more due to which less pressure is exerted by the body on the sand.

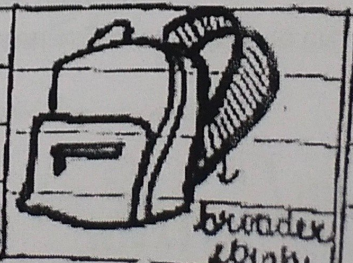
For the given thrust, the pressure on a surface is reduced by increasing the area of the surface.

For example:

i) The foundations of buildings are made wider than the walls so that the pressure exerted by the building on the ground becomes less.

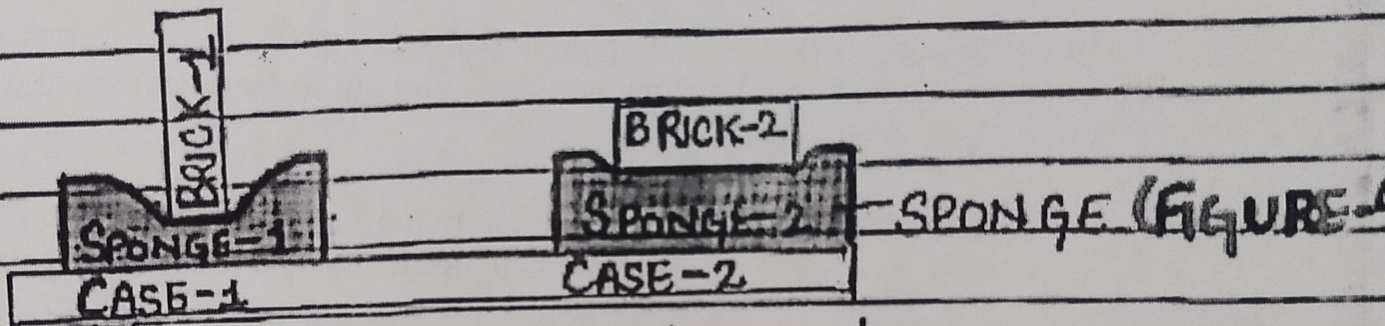
ii) Assume your school bag - The straps of school bags are broader as broader straps will have more area and hence it exerts less pressure on your shoulder (see figure - 3)

FIGURE-3



With this, I am ending today's interactive session and below I am giving a question for your home assignment.

HOME ASSIGNMENT.



Observe the above drawn figure-4, case-1 and case-2 are two different configurations of brick placed on a sponge. In case-1, sponge is pressed more as compared to case-2. State the reason for such observation.

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