# Force and Pressure

## Thrust and Pressure

### ❖ PRESSURE

It is defined as the force per unit area. The SI unit of pressure is Pascal (Pa), which is Newton per square meter.

$$\text{Pressure (in Pa)} = \frac{\text{Force(in newton)}}{\text{Area (in m}^2\text{)}} \quad [P = F/a]$$

**Ex.** If a force of 2 N is applied over an area of 2 cm2, calculate the pressure produced.

**Sol.** To get the pressure in Pa, we have to make sure that the force is in Newton and the area in m2.

Here, the area is in cm2. To convert this to m2, we have to divide the given are a by 10, 000

$$\text{Thus, area} = \frac{2}{10{,}000} = 0.0002 \text{ m}^2$$

$$\text{Now, Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{2\text{N}}{0.0002\text{m}^2} = 10,000 \text{ Pa}$$

**Ex.** Calculate the pressure if a force of 2N is applied on an area of 2 mm2. Here, again the area is not in m2. To change it into m2, we divide the area by 1, 000,000.

**Sol.**

$$\text{Thus, area} = \frac{2}{1{,}000{,}000} = 0.000002 \text{ m}^2$$

$$\text{Now, Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{2\text{N}}{0.000002\text{m}^2} = 1,000,000 \text{ Pa}$$

## ❖ VARIATION OF PRESSURE WITH AREA

The same force, increasing the area over which it acts decreases the pressure applied. The inverse is also true: decreasing the area of application increases the pressure produced for the same force.

**Ex.** The area under the edge of a knife's blade is extremely small.

Beneath it the pressure is high enough for the blade to push

easily through the material that needs to be cut.

➢ Wall foundations have a large horizontal area. This reduces the pressure underneath so that the walls do not sink further into the
ground under the weight of the building.

### UNITS OF PRESSURE

The SI unit of pressure is called Pascal (Pa) in honour of Blaise Pascal.

$$I\ Pa = 1\ N/m2$$

One Pascal is defined as the pressure exerted on a surface area of 1 m2 by a thrust of 1 N (acting normally on it).

Other units:

(i) In C.G.S unit of pressure is dyne/cm2

(ii) 1 bar = 105 N/m2

(iii) 1 milibar = 102 N/m2

(iv) 1 atmospheric pressure (1 atm) = 101·3 k Pa = 1·013 bar = 1013 m bar = 760 mm of Hg

(v) 1 Torr = 1mm of Hg