- Observation/experimentation/analysis
- Student led experiments (reasoning to be given by children individually)
- Investigate the effect on pressure when walking on flat shoes and pointed heels on our body support system

  For example: Children reasoning as to why is it easier to hammer a sharp pin respective to a blunt pin?

KNOWING CONCEPTS

- Turning effect of force (moment of force): concept, definition and calculation
- Pressure
  - Definition • Unit
  - Calculation of pressure in simple cases
  - Pressure exerted by liquids (Qualitative only)
  - Pressure exerted by gases — Atmospheric pressure (qualitative only)

FORCE

We have read that a body which does not change its position with respect to its surroundings is said to be at rest or stationary, whereas a body which changes its position with respect to its surroundings is said to be in motion or a moving body.

A force is a cause (push or pull) which tends to result in movement or change in size or shape of the body. A force when applied as push or pull on a stationary body which is free to move, can produce motion in it and if applied on a moving body, it can change the speed of motion of body (*i.e.* can speed up or slow down the moving body) or it can change both the speed and direction of motion.

Examples :

1. A grass roller initially at rest when pulled, begins to move.
2. A fielder when catches a ball, stops the moving ball.
3. A moving car slows down on applying brakes on it.
4. A push on a swinging girl speeds up her swing.
5. A player when applies force by his hockey stick on the ball, the direction of motion of ball changes.

When force is applied as stretch or squeeze on a body which is not free to move, it changes the size or shape of the body.

Examples :

1. On stretching a rubber string, its length increases.
2. On squeezing a tube of gum, its shape changes.

Thus, we define force as below :

Force is that cause which changes the state of a body (either the state of rest or the state of motion) or changes the size or shape of the body.

Do You Know ?

1. The speed of a body is defined as the distance travelled by it in one second.
2. Speed up means more distance travelled in one second and slow down means less distance travelled in one second.

Note : 1. A force does not change the mass of the body on which it is applied.

2. We cannot see a force. However, we can see or feel the effect of a force.

3. A force is expressed by stating both its magnitude and direction.

4. A force is represented by an arrow (→). The length of arrow is a measure of its magnitude and the arrow head shows the direction.

UNIT OF FORCE

The S.I. unit of force is newton. The symbol for newton is N. This unit is named after the English scientist Sir Issac Newton who did a lot of research work on force.

One newton is defined as the force which when applied on a moving body of mass 1 kg in the direction of its motion, increases its speed by 1 m in one second.

We have read that our earth attracts each body towards it. The force of attraction exerted on a body by earth is called the weight of the body or the force of gravity that acts on the body.

The force of gravity (or weight) of a body is different at different places on earth. At a place, the force of gravity on a body of mass 1 kg is called 1 kgf or 10 N. In other words, 1 N is the force of gravity at a place on 0·1 kg (100 g) mass. Thus, the unit of force kgf and N are related as :

$$1 \text{ kgf} = 10 \text{ N (nearly)}^*$$

In other words, one newton is the force that we have to exert to hold a mass of 100 g on our palm (Fig. 3.1).

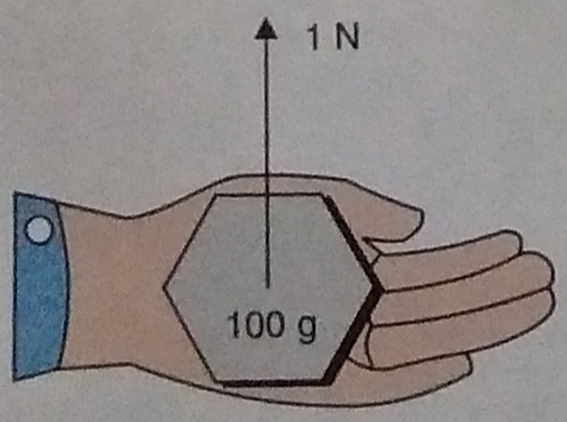

Fig. 3.1 Force of **1 N** *on a mass of* **100 g** *to hold it*

Do You Know ?

1. A body in which the inter-spacing between its constituent particles do not change when a force is applied on it, is called a rigid body and if it changes, the body is called a non-rigid body.

2. A force when applied on a rigid body can cause only change in motion of the body. But a force when applied on a non-rigid body can cause both change in its size or shape and motion in it.

TURNING EFFECT OF A FORCE

We have read above that if a force is applied on a stationary rigid body, it starts moving in a straight line in the direction of force as shown in Fig. 3.2. In Fig. 3.2, a ball moves on pushing.

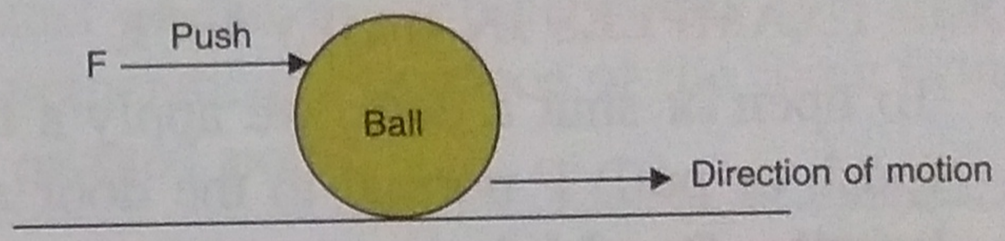

Fig. 3.2 A ball moves on pushing

Now if the body is not free to move, but it is pivoted at a point O and a force F is applied at a suitable point A, it begins to turn about the point O (Fig. 3.3). The vertical axis passing through the point O about which the body turns, is called the axis of rotation. In Fig. 3.3, on pushing, the wheel begins to turn about its pivoted point O.

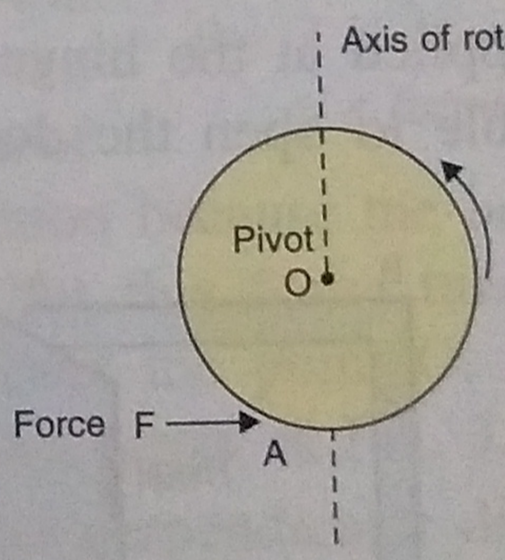

Fig. 3.3 Turning of a wheel about the pivot, on pushing

Similarly, when the handle of a door is either pushed or pulled, the door begins to turn about the hinges which hold the door at rest.

* Precisely 1 kgf = 9·8 N

Thus, *a force (push or pull) has a turning effect on a body which is not free to move in a straight line, but is pivoted at a point about which it can turn.*

FACTORS AFFECTING THE TURNING OF A BODY

The turning effect of a force on a body depends on the following two factors :

1. **The magnitude of the force applied.** Larger the magnitude of force applied, more is the turning effect on the body.
2. **The perpendicular distance of the force from the pivoted point.** Larger the perpendicular distance of point at which the force is applied, from the pivoted point, more is the turning effect on the body.

SOME EXAMPLES IN DAILY LIFE

1. To open or shut a door, we apply a force (push or pull) F normal to the door at its handle P which is provided at the maximum distance from the hinges as shown in Fig. 3.4. We can notice that if we apply the force at a point Q (near the hinge R), much greater force is required to open the door and if the force is applied at the hinge R, we will not be able to open the door howsoever large the force may be. Thus, the handle P is provided near the free end of the door so that a smaller force at a larger perpendicular distance, produces the required turning effect of force to open or shut the door.

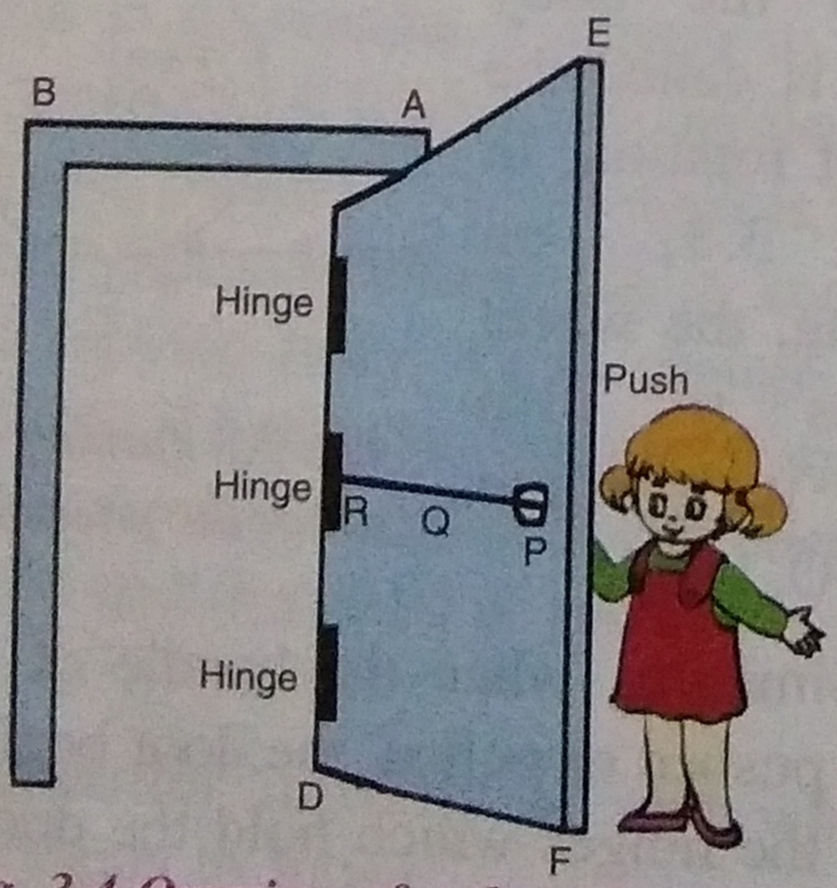

Fig. 3.4 Opening of a door by push

2. The upper circular stone A of a hand flour grinder is provided with a handle H near its rim (*i.e.* at the maximum distance from centre) so that it can easily be rotated about the iron pivot P at its centre by applying a small force at the handle H (Fig. 3.5).

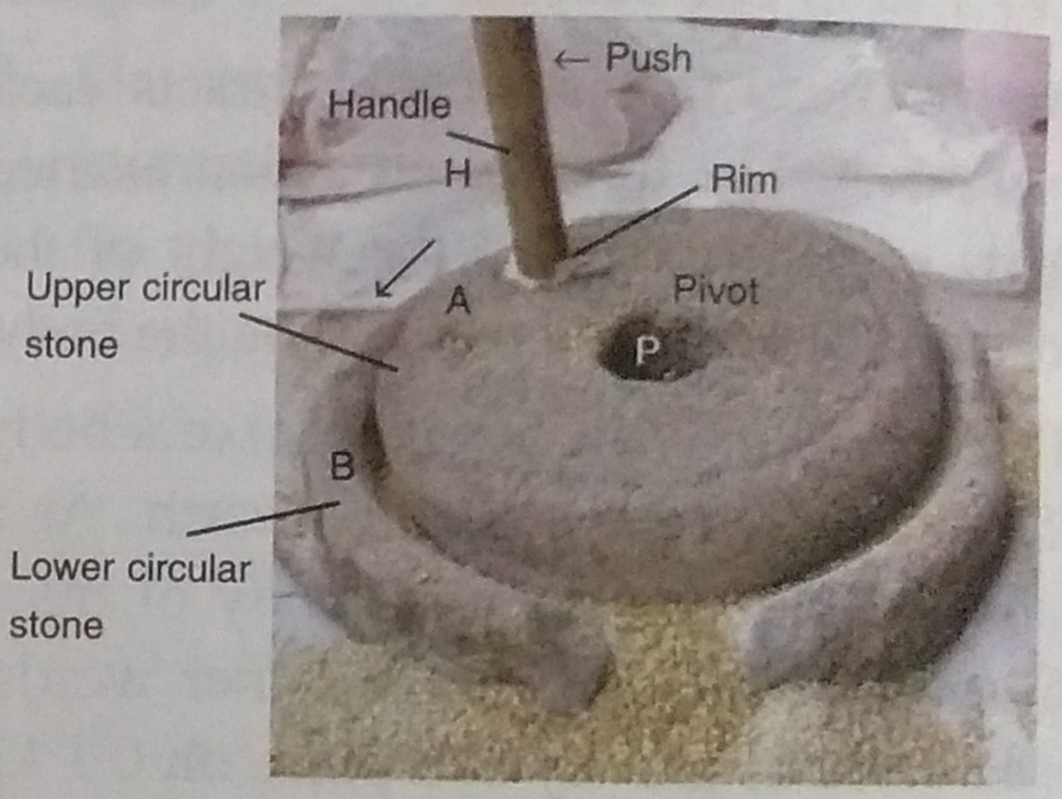

Fig. 3.5 Turning of a hand flour grinder

3. A potter's wheel has a wheel pivoted at the centre. The potter turns the wheel by means of a stick at the rim of the wheel as shown in Fig 3.6.

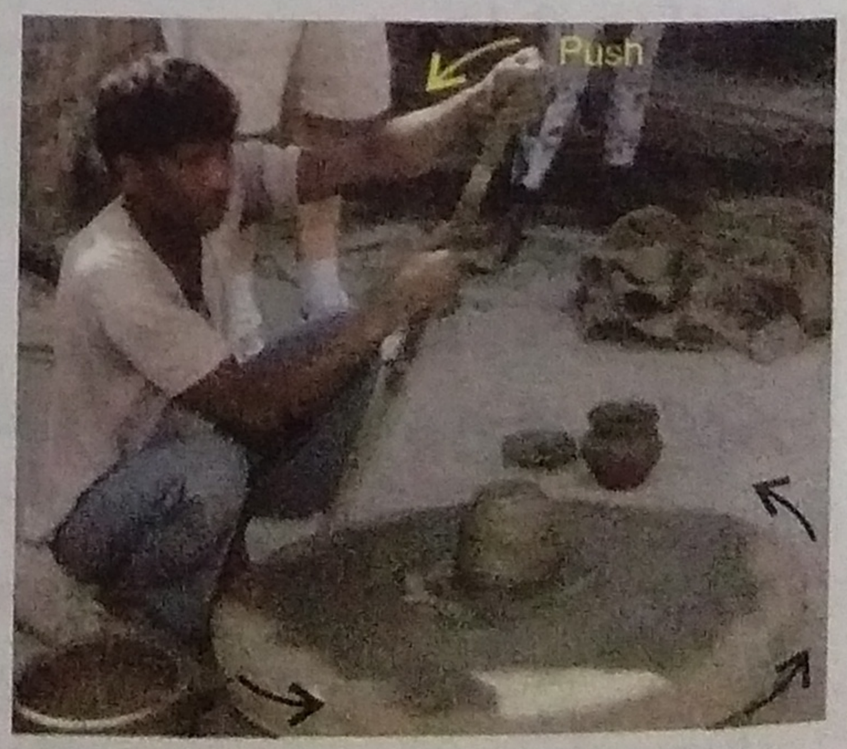

Fig. 3.6 Turning of a potter's wheel

Answer the following questions.

1. What is force?
2. What is the S.I unit and C.G.S unit of force?
3. What are the effects of force?
4. Which factors affect the turning of a body?
5. Give two examples from our daily life which shows the turning effect of force.