Chapter- 12 Friction

Friction

Friction: A Necessary Evil

Types of Friction



Friction

The force which always opposes the motion of one object over another object in contact with it is called **friction**.

The force of friction always acts in a direction opposite to the direction in which an object moves (or tends to move).

Cause of friction

Friction is caused by the interlocking of irregularities in the surfaces of two objects which are in contact with each other. In order to move one object over the other, we have to apply force to overcome interlocking.

Factors affecting Friction

The friction between two surfaces depends on two factors:

The nature of two surfaces (smoothness or roughness of the two surfaces) More the roughness of a surface, larger is the number of irregularities on its surface & hence greater will be the friction.

The force with which two surfaces are pressed together: Pressing together two surfaces of objects with a greater force will increase the interlocking in the two surfaces & hence increase the friction.

Activity

Make an inclined surface with the help of a wooden board. Mark a point on the upper end of the inclined surface. Now take a pencil and place it on the marked point. Slide the pencil from the marked point. Note down the distance travelled by the pencil as it slides on the table. Now place a cloth over the table. Slide the pencil again from the marked point. Note down the distance travelled by the pencil. Do you find any change in



the distance travelled by the pencil? Now put the some sand on the table. Again slide a pencil from the marked point. Note down the distance travelled by the pencil this time. Now as we compare the three readings of the distance covered by pencil in the three cases; we will see that when there was nothing on table pencil travelled maximum and when there was sand on table, pencil travelled minimum.

This indicates that the sand offered maximum friction to the pencil and hence it stopped after travelling a small distance only.



Friction: A Necessary Evil

Friction is a necessary evil because in some cases, friction is useful but in other cases friction is harmful.

Advantages of friction

- It is the friction between the sole of our shoes & ground that enable us to walk without slipping.
- It is the friction between brake pad & rims that prevents the wheel from moving ahead. Due to this, the running bicycle slows down & finally stops.
- It is due to the friction between tip of the pencil & paper that rubs off black graphite particles from the tip of the pencil which stick to the paper leave black marks on paper. In case of smooth surface friction is not sufficient to rub off that black graphite.
- Friction enables us to light a matchstick. When we rub the matchstick against a rough surface, then friction between the tip of matchstick & rough surface produces heat, as a result matchstick catches fire.

Disadvantages of friction

- Friction wears away the soles of our shoes.
- Due to friction between the surfaces of tyres & the surface of road, the tyres wear out gradually.
- Friction wears out the brake pads of vehicles gradually. As a result brake pads of cycles have to be replaced quite often.
- Friction wears out steps of staircases in foot overbridges.
- Friction produces unwanted heat which can damage & reduce the efficiency of machines.

Striking a match stick produces fire by friction



Wear and tear of machines are caused due to friction



Types of Friction

(a) Static friction: The maximum frictional force present between two objects when one object just tends to move or slip over the surface of the other object. The object remains static in this case.

(b) Sliding friction: The frictional force present when one object slides over the surface of another object it is known as sliding friction.



Static friction

When the object starts sliding, the contact point on its surface, do not get enough time to lock into the contact points on the other object. So sliding friction is always less than static friction.

(c) Rolling friction: When an object rolls over the surface of another object, then the frictional force that comes into picture is called rolling friction. Rolling friction is less than sliding friction.

Minimizing friction

- By using a suitable lubricant, like oil (for light machinery) or grease (for heavy machinery). This helps because fluid friction is less than solid friction.
- By using wheels and ball bearings
- Use of wheels between surface moving over each other reduces friction. Ball bearings have small balls of steel between steel surfaces. Because of the balls the steel surfaces can easily moves over each other.
- By making the rubbing surfaces smooth by polishing them.



Oil is added to reduce friction

Friction due to air (air resistance) or water is reduced by using streamlined shapes in aeroplanes or ships. A streamlined shape is narrow in front and broader at the back. Birds and aquatic animals have streamlined shapes which held them in flying or swimming.



Increasing friction

- By making the moving surfaces rough, e.g. tyres have designs and patterns with grooves on the surface to increase resistance with the road. This prevents slipping of the tyres on a wet road.
- Sand and gravel is strewn on slippery ground during the rainy season to increase friction. It is then easier to walk on the ground.
- To increase friction, spikes are provided in the soles of shoes used by players and athletes.

Fluid Friction

Friction exerted by fluids i.e. gases or liquid is termed as fluid friction or drag.

The magnitude of drag (fluid friction) depends on



Spikes in shoes to increase friction

- Speed of the object
- Shape of the object
- Size of the object
- Nature of fluid

When object moves through the fluids, they have to overcome friction acting on them. In this process they lose energy. Therefore efforts are being made to minimize energy by giving special shape to the objects called 'streamlined shape'. Due to this the cars, airplanes & rockets are streamlined.

