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Chapter – 9

Friction

FRICTION

When we push a box lying on the floor with a small amount of force, it does not move at all. It means that the surface of floor, on which the box is resting, exerts some force on the box which acts in a direction opposite to the force of our push. This natural force between the floor and the bottom of the box which opposes the motion of box on the floor is friction.

Friction occurs between the two surfaces which are in contact with each other. Friction is a force which occurs when the two objects tend to slide over each other and even when they are actually sliding (moving) over each other.

FACTORS AFFECTING FRICTION

1. Friction is caused by the irregularities on the two surfaces in contact.

a. Even those surfaces which appear very smooth have a large number of minute irregularities on them. Irregularities on the two surfaces lock into one another. When we attempt to move any surface, we have to apply a force to overcome interlocking.

b. On rough surfaces, there are a larger number of irregularities. So the force of friction is greater if a rough surface is involved.

2. Friction is caused by the interlocking of irregularities in the two surfaces. It is obvious that the force of friction will increase if the two surfaces are pressed harder.

DIRECTION OF FORCE OF FRICTION

The force of friction always opposes the motion of one object over another object. So, the force of friction acts in a direction opposite to

the direction in which an object moves (or tends to move). When the motion of the book is towards right side, then the force of friction acts on it towards the left side. This is the reason why the force of friction always opposes the motion of an object.

FRICTION: A NECESSARY EVIL

If an object started moving, it would never stop if there were no friction. Had there been no friction between the tyres of the automobiles and the road, they could not be started or stopped or turned to change the direction of motion.

On the other hand, friction is an evil, too. It wears out the materials whether they are screws, ball bearings or soles of shoes.

Friction can also produce heat. Vigorously rub your palms together for a few minutes it produces heat. When you strike a matchstick against the rough surface, it catches fire. In fact heat generated causes much wastage of energy.

INCREASING AND REDUCING FRICTION

We reduce friction in order to increase efficiency. When oil, grease or graphite is applied between the moving parts of a machine, a thin layer is formed there and moving surfaces do not directly rub against each other. Interlocking of irregularities is avoided to a great extent. Movement becomes smooth. The substances which reduce friction are called lubricants. In some machines, it may not be advisable to use oil as lubricant. An air cushion between the moving parts is used to reduce friction.

STATIC FRICTION, SLIDING FRICTION AND ROLLING FRICTION

Friction is of three types:

(i) Static friction,

(ii) Sliding friction, and

(ii) Rolling friction.

1. Static Friction

Static friction comes into play when we try to move an object at rest. The maximum frictional force present between any two objects when one object just tends to move or slip over the surface of the other object, is called static friction.

2. Sliding Friction

The frictional force present when one object moves slowly (or slides) over the surface of another object, is known as sliding friction. Thus, sliding friction comes into play when an object is sliding (moving slowly but continuously) over another object.

3. Rolling Friction

When an object (like a wheel) rolls over the surface of another object, the resistance to its motion is called rolling friction. It is always easier to 'roll than to slide an object over another object. So, rolling friction is much less than sliding friction. Thus, rolling reduces friction.

Fluid Friction

Air is very light and thin. Yet it exerts frictional force on objects moving through it. Similarly, water and other liquids exert force of friction when objects move through them. The frictional force exerted by fluids is also called drag.

The frictional force on an object in a fluid depends on its speed with respect to the fluid. The frictional force also depends on the shape of the object and the nature of the fluid. When objects move through fluids, they have to overcome friction acting on them. In this process they lose energy. Efforts are, therefore, made to minimize friction.

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