Chapter - 12

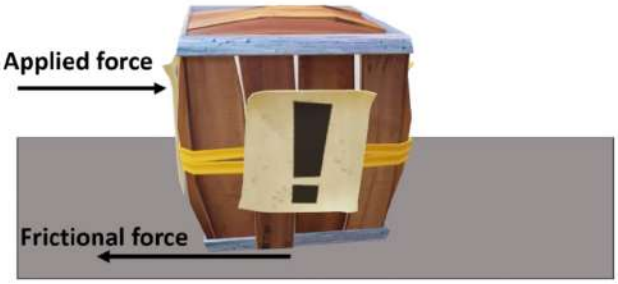
Friction

Force of Friction

Friction: The force which opposes the relative motion between two surfaces in contact is called friction.

Example: What is the direction of the friction force in the given figure below?

Solution: The force of friction is opposite to the force applied.



Tip: To find the direction of the force of friction, identify the direction of the net force applied on the body. The frictional force is always opposite to that force.

Factors affecting Friction

Factors Affecting Friction: Friction is caused by the interlocking of irregularities on the surfaces of the two objects, which depends on two factors:

(i) Nature of the surfaces

(ii) Mass of the object

Factors	Nature	Friction
Nature of the surfaces	Smooth	Decrease
	Rough	Increase
Mass of the object	Heavy	Increase
	Light	Decrease

Example: Why snow chain is used in the vehicle when driving on snow and ice?

Solution: The snow chain is used in the vehicle to increase the friction of the tyres so that the tyres do not slip in the snowing path. Snow chain makes the surface of the tyre rougher and as we know the friction will be greater in the case of the rough surface.

Tip: Whenever need to answer the problem like in the example, think about the reasoning based on the factors affecting friction i.e. nature of the surface and the mass of the object.

Static friction: The frictional force that exists between the surfaces in contact when there is no relative motion although the force is also applied continuously is called static friction. Static friction is self-adjusting friction.

Sliding friction: The frictional force that exists between the surfaces in contact when the object is actually sliding over the surface of the other object is called sliding friction.

Example: Manish pulls a toy car. If F1 is the force required to keep the object moving with the same speed and F2 is the minimum force required to move an object from the state of rest. Identify F1 and F2.

Solution: F1 is the sliding friction and F2 is the static friction.

Tip: Remember sliding friction is always less than static friction.

Friction : A Necessary Evil

Friction a necessary evil: Friction force has many disadvantages as well as advantages.

Disadvantages:

1) Friction produced heat in machines.

2) Friction cause wastage of energy.

3) Tyres of vehicles and sole of shoes wear out due to friction.

4) Friction slow down the motion.

Advantages:

1) Friction help in motion.

2) We are able to write with pen, pencil, chalk etc.

3) Matchstick lights due to friction.

Increasing and Reducing Friction

Rolling friction: The frictional force that exists between the surfaces in contact when an object roll over the surface of the other object is called rolling friction.

Example: Why the shape of tyres is circular and not flat?

Solution: Wheels are made circular in shape to reduce friction as they roll on the surface and experience rolling friction which is smaller than the sliding friction. If wheels are flat in shape instead of roll, they slide on the surface which increases the friction between the surface and the wheel. Because sliding friction is greater than rolling friction.

Tip: Rolling Friction $<$ Sliding Friction $<$ Static Friction

Increasing or reducing friction: Friction desirably increased or decreased by using some methods.

Methods of increasing friction: Friction can be increased by making the surface rough e.g. athlete's shoes are provided with the spikes.

Methods of reducing friction: Friction can be reduced by using ball bearings and lubricants.

Fluid Friction

Fluid friction: Friction exerted by air and water on the objects is called fluid friction (Drag). The fluid friction depends on the nature of the fluid, shape of the object and the speed of the object.

Example: Why the shape of the aeroplane is streamlined?

Solution: The streamlined shapes do not lose much energy in overcoming friction as they experienced minimum friction and move in fluids easily. That's why the shape of vehicles used in fluids is streamlined.

Tip: When there is a question on drag think about the shape of the objects.

The streamlined shapes are narrow from the front and broader at the back like birds and aeroplanes. This streamlined shape offered minimum friction and help the object to move easily.