

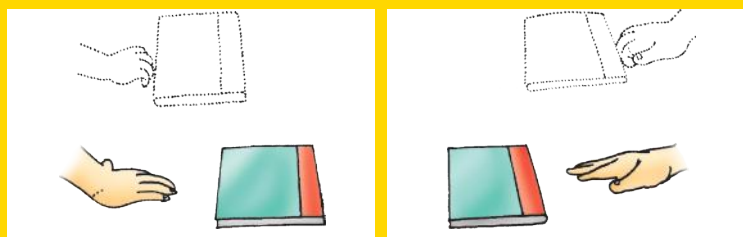

IN THIS CHAPTER

- Friction
- Spring balance
- Rough surface
- Lubricant
- Rolling friction
- Fluid friction (Drag)

In the day to day life of human being the word friction means rubbing or contact. In rainy season, it rains heavily. During the rainfall thunder arises among the clouds. It is due to rubbing of clouds. When rubbing is very fast lightning is produced and sometimes this lightning strikes the objects on the earth. When cat fur is rubbed with rod of ebonite, friction takes place. When some boy steps on the peel of banana, he falls down on the road. All these incident happen due to friction. Let us study these.

**Activity Time**

Push a book, place on a table, gently. You will observe that it moves for some distance and finally it stops or falls down to the floor. Now repeat the activity by applying force in the direction opposite to previous direction. It also stops or falls down but in opposite direction. Thus, we can say there must be some force acting on the book, which opposes the motion of the book. This opposing force is called friction.

**Force of Friction**

The force which always opposes the force applied on a moving body. In other words, force opposing the motion of body is called **force of friction** or **friction**. Obviously it acts in the direction opposite to the direction of motions.

Factors Affecting Friction :

1. It acts in the direction opposite to the force applied to move a body. If force is in left direction, the friction acts in right direction.
2. Friction opposes the motion.
3. Friction depends upon the nature of the surface. Smoother the surface lesser the friction.
4. It depends upon the fact, that how forcefully two surfaces suppress each other.
5. Friction depends upon the area of contact between two surfaces.
6. The friction depends upon the nature of surfaces in contact.

Do You Know ?

Microwave ovens use friction for cooking food by agitating the moisture in food very fast.

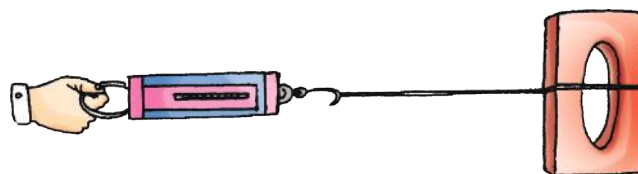


Activity Time

Tie a string around a brick. Pull the brick by a spring balance. You will have to apply some force. Note down the reading of the spring balance as soon as the brick just begins to move. It will give you the measure of force of friction, which is acting between the surfaces of the brick and the floor. Now wrap a piece of polythene around the brick and repeat the above activity. Is there any difference in the two readings of the spring balance ?

Spring Balance

Spring balance is a device, which is used to measure the force acting on an object. It consists of a coiled spring, which gets stretched, when a force is applied to it. The measure of stretching of the spring is measured by a pointer moving on a graduated scale. The reading on the scale gives the magnitude of the force.



Activity Time

All of us use L.P.G. in our houses daily for fuel. When the delivery man brings gas to our home, he measures the weight of the gas cylinder with the help of a spring balance with him. Thus, the spring balance is used for various purposes.

A tailor has a thick cloth stretched on his table. He removes wrinkles of the cloth to sew by spreading it over the thick cloth. Thereafter he sews it. Friction is caused by the irregularities on the two surfaces in contact. Even those surfaces which appear very smooth have a large number of minute irregularities on them. Irregularities of the two surfaces gets locked into one another. When we try to move one of the surface over the other, we have to apply a force to overcome these interlockings. There are a larger number of irregularities on rough surfaces. So force of friction is greater, if the surface is rough.



Friction is caused due to interlockings of irregularities in the two surfaces. Obviously, if the two surfaces are pressed harder, then the force of friction will increase. You may experience this fact by dragging a mat, when someone is sitting on it. In this situation the mat will become heavier.

We feel difficulty to move a heavy box instead of a empty box. Similarly, a box can easily be moved from one place to another on a place and smooth floor instead of a rough and non-even surface.

The force required to overcome friction at the instant an object starts moving from rest, is a measure of **static friction**. On the other hand, the force required to keep the object moving with the same speed is a measure of **sliding friction**.

When a box starts sliding, the contact points on its surface, do not get enough time to lock into the contact points on the floor. Therefore the sliding friction is slightly smaller than the static friction. Hence, it is easier to maintain the speed of the box. Which is already in motion instead to start it to move.

Friction is an Evil but Necessary

We come across a number of experiences in our day to day life. For example, we take milk or tea in a glass or **kulhar**. If the outer surface of the glass has a greasy layer, then due to grease the friction between our hand and the surface of glass will become very less and it will be difficult to hold it. Sometimes it may fall on the floor. Thus, so much smoothness is harmful.

It is difficult to move on a wet floor or muddy track. We may slip due to excessive smoothness and some part of our body may get fracture. Cycle or scooter may also slip if the wet soil is muddy. We cannot write by pen or pencil in absence of friction. Due to this reason, when a teacher writes on the blackboard with a chalk, its rough surface rubs off some chalk particles which stick to the black so that you may see the letters clearly on the board because these rough particles stick to the board. If the surface of the paper is greasy then writing is not clear due to lack of friction. On the other hand, the friction is harmful also. The things or objects are tears and wears due to friction such as : screws, ball bearings or soles of shoes.

Heat is also produced by friction. Rub you palms together for a few minutes vigorously. You will feel that your palm have become warm. When you rub a match stick against the rough surface it catches fire. Jar of a mixer becomes hot when it is operated for a few minutes. There may be many more such examples in which heat is produced due to friction. Thus, much energy gets wasted in the form of heat generated by friction.

Increasing and Reducing the Friction

In our daily life, we use different type of things in which we try to increase or decrease the friction. We use shoes daily, the sole of your shoe are grooved. The tyres of automobiles like car, truck, bulldozers are grooved. The grooved sole of shoes and grooved tyres of automobiles provide better grip with the ground. The movement becomes easier. We deliberately increase friction by using brake pads in brake system of automobiles and bicycles. When you are riding a bicycle, the brake pads do not touch the wheels. But when you press the brake lever, these pads arrest the motion of the rim due to the friction.

Few drops of oil are poured on the hinges of doors and windows to reduce the friction, then the door moves smoothly. A bicycle and a motor mechanic uses grease between the moving parts of

the machines. When oil, grease or graphite is applied between the moving parts of a machine, a thin layer of these substances is formed there and moving surfaces do not directly rub against each other. Thus, interlocking of irregularities is avoided to a great extent. Movement becomes smooth and easy. The substances used to reduce the friction are called **lubricants**. It is advised not to use oil as lubricant in some machines. In such machines an air cushion is used, between the moving parts, to reduce friction.

Wheels Reduce Friction

Attaches an other pieces of heavy luggage are fitted with rollers (wheels). Due to this reason even a child can carry them by pulling these pieces of luggage, i.e. due to decrease of frictional force the wheels carry the load easily. When one body rolls over the surface of another body, the resistance to its motion is called rolling friction. Rolling reduces friction. It is always easier to roll than to slide a body over the another body. It is the reason that it is convenient to pull the luggage fitted with wheels. Due to this reason the invention of wheel is said to be one of the greatest inventions of mankind. That is why that the potters wheel is considered as the first invention.



Since rolling friction is smaller than the sliding friction, therefore in most of the machines sliding is replaced by rolling to reduce the friction by using ball bearings. Use of ball bearings between hobs and the axles of ceiling fans and bicycles are the most common examples of such use.

Fluid Friction

Air is very light and rarer (thin). Even then air exerts frictional force on objects moving through it. Similarly, water and other liquids also exert frictional force on objects moving through them. In science, the common name of gases and liquids is **fluids**. So we can say that fluids exert frictional force on objects moving through them. The frictional force exerted by fluids is also called **drag**.



The frictional force on an object exerted by the fluid during motion 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 fluid, they have to overcome the friction acting on them. They lose energy in this process. Therefore efforts are made to minimize the friction. So objects are given special shapes. Some birds and other living beings also move about in fluids such as kite, birds, fishes. Their bodies have developed in such a way that their shapes make convenient to move in the fluids. Aeroplane and rockets are given shape to minimize the friction and loss of energy.



Know the Keywords :

Friction always opposes the force applied.

Spring balance is a device to measure. It can measure force applied on a body easily.

Friction is caused due to irregularities on the two surface in contact.

The tyres and wheels of bicycle and heavy vehicles are made coarse (grooved).

Heat is produced by friction.

The substances which reduce friction are called lubricants.

The players of kabaddi and gymnasts rub their hands with soil to increase friction for better grip.

Potter's wheel is the first ancient invention.

The frictional force exerted by fluids is called drag.

Rolling friction is smaller than the sliding friction.



Point to Remember

- Force opposing the motion of body is called force of friction.
- The force required to overcome friction at the instant an object moving from rest is a measure of static friction.
- The force required to keep the object moving with the same speed is a measure of sliding friction.

EXERCISE TIME

A. Answer the following questions :

1. How the friction is both a friend and a foe ?
2. Which are the factors affecting frictional force?
3. How do the pencil, ball pen function on paper?
4. Why is it harmful to walk on a footpath rather than on a straight road?
5. How the static friction is measured?
6. On what factors the friction force on a body moving in fluid depends?
7. Give some examples where friction is useful or necessary?
8. Rollers (wheels) reduce the friction confirm it.
9. What do you understand by fluid friction?

B. Fill in the blanks :

1. _____ may be reduced by using lubricants.
2. Some times friction is _____.
3. The friction depends upon the _____ of two surfaces in contact.

4. Sliding friction is lesser than _____ friction.
5. The sole of shoes and tyres of vehicles are made _____ to increase the friction.
6. Friction is important for many of our _____.
7. _____ may be increased by making a surface rough.

C. Write short notes on :

1. Rolling friction
2. sliding friction
3. Drag
4. Increasing and decreasing of friction.

D. Tick (✓) the correct option :

1. Some times friction is :

(i) undesirable	<input type="radio"/>	(ii) desirable	<input type="radio"/>
(iii) fluid	<input type="radio"/>	(iv) none of these	<input type="radio"/>
2. By applying lubricant, friction is :

(i) reduced	<input type="radio"/>	(ii) increased	<input type="radio"/>
(iii) maintained	<input type="radio"/>	(iv) none of these	<input type="radio"/>
3. Friction produced by sliding is called :

(i) sliding friction	<input type="radio"/>	(ii) rolling friction	<input type="radio"/>
(iii) friction	<input type="radio"/>	(iv) fluid friction	<input type="radio"/>
4. To increase friction in the sole of shoes and tyres of vehicles are made :

(i) plane	<input type="radio"/>	(ii) uneven	<input type="radio"/>
(iii) grooved	<input type="radio"/>	(iv) none of these	<input type="radio"/>
5. The bodies moving through fluids are given special shape to reduce :

(i) friction	<input type="radio"/>	(ii) speed	<input type="radio"/>
(iii) relative speed	<input type="radio"/>	(iv) fluid speed	<input type="radio"/>



Creative Work

- Draw any two devices which cause friction.
- Know from your teacher, how wheels reduce friction and prepare a chart.