

## 10.

## Force and Types of Force



**Observe and discuss.**



**10.1 : Various actions**

1. Will a boat move ahead unless pushed with the help of an oar ?
2. Who exerts force to move a bullock-cart forward ?
3. What makes the ball move during a game of football ? How does its direction change?
4. Will the wheel go forward if it is not pushed with a stick ?

When we kick the football coming in our direction, towards the goal, we apply force. In day-to-day life, we do many actions such as lifting, pulling, riding a bicycle and stopping it at times, pushing a load, squeezing or bending something and driving vehicles. It is necessary to apply force for doing all these actions. Force is applied to an object to pull it or push it in any manner.

**No object changes its position on its own. Force is required to move an object.**

**Force is used to change the direction of an object in motion, or to stop it.**



**Can you tell ?**

1. What happens when you hold the two ends of a spring and pull them apart ?



2. What happens when a blacksmith hammers a red hot piece of iron?



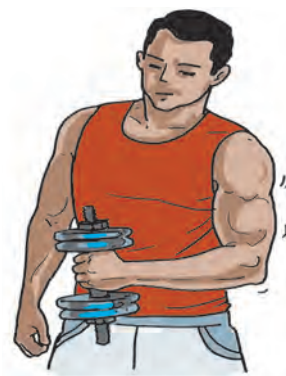
**Force is necessary to change the shape an object.**

**10.2 : Changing the shape of an object**

## Types of force

### 1. Muscular force

In all the actions shown in the picture 10.1, the movements take place with the help of the bones and muscles in the body. The person in the picture alongside is lifting the weight by using muscular force.



10.3 : Lifting a weight



**Use your brain power !**

For which tasks in your day-to-day life do you use muscular force ?

### 2. Mechanical force

We use different machines for doing many tasks. Muscular force is used for running some machines. Some machines are run by using electricity or fuel. Machines like the latter are called ‘automatic machines’, because a mechanical force is used here. For example, sewing machine, electric pump, washing machine, mixer, etc. Make a list of other such machines.



10.4 : Machines

**The force applied by means of a machine is called mechanical force.**

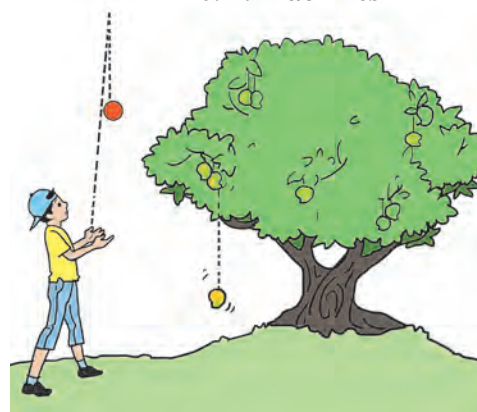
### 3. Gravitational force

If an object is thrown upward by applying force, it reaches a certain height and comes down again. Why is this so?

Why do fruits on trees fall to the ground ?

The earth pulls all the objects towards itself.

**The force applied by the earth to pull objects towards itself is called gravitational force.**



10.5 : Falling down of a ball and a mango

### In the past ...

Sir Isaac Newton discovered gravitation in the 17th century. The earth's gravitational force acts in a direction opposite to that of an object moving upwards. Hence, the speed of that object goes on decreasing till in the end it becomes zero. Then the object starts falling down instead of going up any further. While falling, its speed goes on increasing all the time due to gravitational force.





### Let's try this.

1. Take a small stone and a bucketful of water. Drop the stone into the water from a height of about 20 cm. You will hear the sound of the stone dropping in the water. Now drop the same stone into the water from a height of about 100 cm. You will hear its sound again.

What is the difference in the sounds in the two actions above? What can we conclude from this?

2. The actions of lifting a sack are shown in the picture. One sack looks empty, the other one is full. What difference do you notice in the way the two sacks are lifted?

The gravitational force on the empty sack is less, that is to say, it weighs less.

The gravitational force on the bigger sack is greater. In other words the bag weighs more.

**Greater force must be applied to lift a greater weight.**



10.6 : Dropping a stone in water



10.7 : Carrying a load



### Do you know?

To weigh an object, it is hung from the hook of a spring balance.

The suspended object is pulled downwards by the force of gravity. At the same time, the force of the tension in the spring constantly pulls the object upwards.

The object comes to rest when the tension in the spring and the gravitational force on the object become equal. In this position, the scale on the spring balance shows the gravitational force acting on the object which is the weight of the object. The gravitational force acting on an object is called the weight of that object.

## 4. Magnetic force

Place a magnet on a table. Take a big iron nail towards the magnet. It sticks to the magnet. Now hold the magnet upright in the air, away from the nail. What happens?

**The force exerted by a magnet is called magnetic force.**



### Find out and discuss.

The gravitational force operates between the sun and the planets in the solar system. Because of this, the planets revolve around the sun. At the same time, gravity also operates between planets and their satellites. Then, why don't all the planets and satellites fall towards the sun?



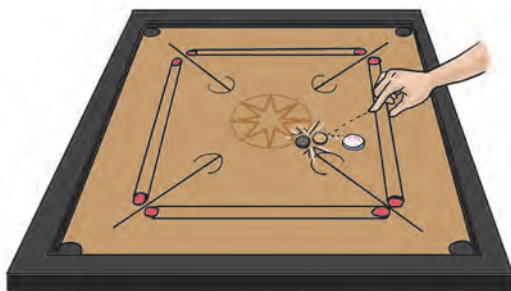
### Use your brain power!

Which forces are acting upon an aeroplane taking off into the sky?





## 5. Frictional force



10.8 : Frictional force



### Use your brain power!

Why is powder sprinkled on the carrom board while playing carrom ?



### Try this.

Take two pieces of smooth paper and two of sandpaper and rub them against each other. What do you notice ?

The smooth surfaces can be easily rubbed against each other because the force of friction between them is less, while rough surfaces cannot be easily rubbed against each other because the force of friction between them is much greater.

It is possible for us to walk on the ground only because of the force of friction. If there is no friction, we would slip and fall. For example, we are very likely to slip while walking on an oily or wet floor.

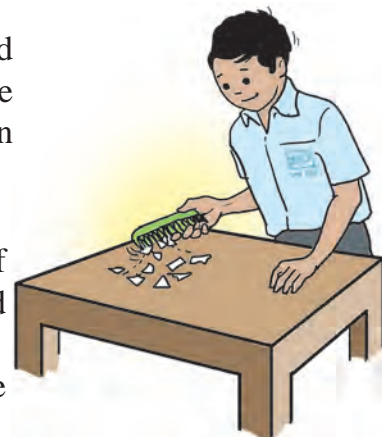
Why is a wooden plank laid down for pulling out a car which is stuck in mud?

A force of friction is generated between the wheel and the wooden plank laid down under the car. Hence, it can be pulled out from the mud. In short, the force of friction can either be decreased or increased as desired.

## 6. Electrostatic force

1. Spread small pieces of paper on a table. Rub a piece of thermocol or an inflated balloon against silk cloth and bring it near these pieces.
2. Rub a plastic comb against dry hair and repeat the above activity.
3. Rub a peacock feather between two pages of a notebook and bring it near your fingers. What do you see?

In the above activities, the pieces of paper, hair, and the peacock feather are seen to move. Why does this happen ?



10.9 : Electrostatic force

Static electricity is produced on materials like rubber, plastic and ebonite due to friction. The force exerted by such electrically charged materials is called **electrostatic force**.



**Combined forces :** While an action is taking place, various types of forces act on the object in question. You might have seen a roller coaster or the juggling of a sail board on the seashore. A variety of forces act together in these cases. To obtain more information about these, type the words 'Trick Science' in Google search on the Internet.



### A little fun !

Cut out fish shapes from coloured plastic sheets. Fix a pin on one side of the fishes. Take water in a big deep plate. Release the fishes in it. They will float on the water. Take a magnet and move it around over the water.

Can you make other games like this ?  
What makes such games possible ?



### What we have learnt-

- Force is required to bring about any action. Force is necessary for making an object move, to change the direction of motion and also to change the shape of an object.
- There are various types of forces such as muscular force, mechanical force, gravitational force, magnetic force, frictional force and electrostatic force.



### 1. Choose the term to fill in the blanks.

- ..... has to be applied to change the ..... of a ..... object.  
(moving, direction, force)
- When an elephant drags a wooden log over the land, the forces that are applied on the log are..... , ..... and ..... .  
(muscular force, mechanical force, gravitational force, frictional force)
- A ball was set rolling on a large table. If its ..... is to be changed, a ..... will have to be applied on it.  
(force, motion, gravitation)
- The force of friction always acts ..... the motion.  
(along, against)

### 2. Match the following :

#### Group 'A'

- An ox pulling a cart
- Lifting a heavy iron object with a crane
- Weighing with a spring balance
- Applying brakes to a bicycle
- Picking up pieces of paper with a plastic scale

#### Group 'B'

- Magnetic force
- Electrostatic force
- Muscular force
- Gravitational force
- Frictional force

### 3. One or more forces are acting in the following examples. Name them.

- An object falling from a tall building ....
- An aeroplane flying in sky ....



- (c) Squeezing sugarcane juice with a squeezer .....
- (d) Winnowing foodgrain .....

**4. Explain in your own words giving one example each.**

Muscular force, gravitational force, mechanical force, electrostatic force, the force of friction and magnetic force.

**5. Why?**

- (a) Machines are oiled from time to time.
- (b) An object thrown upwards comes down after reaching a point.
- (c) Powder is sprinkled on a carrom board.
- (d) The ramp at a railway station has a rough surface.

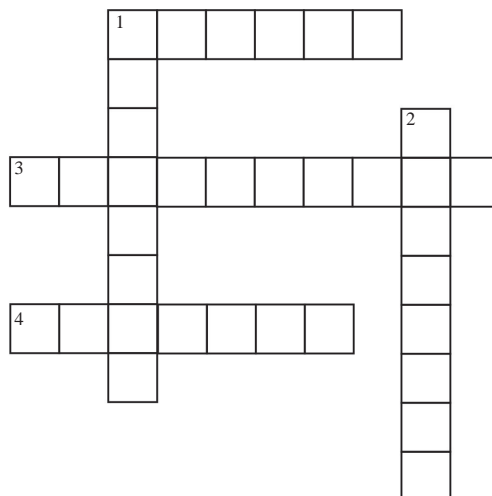
**6. In what way are we different?**

- (a) Muscular force and mechanical force.
- (b) The force of friction and gravitational force.

**7. Write answers to the following questions in your own words.**

- (a) What are the things that can be done by applying force?
- (b) What is meant by weight?
- (c) Which machines run on muscular force?

**8. Solve the following crossword puzzle.**



**Down :**

- (1) ..... force is to be applied to push a scooter that has failed.
- (2) ..... force can be used to pick up scattered pins.

**Across :**

- (1) A ..... pulls an iron nail towards itself.
- (3) ..... force was used when the farm was ploughed with a tractor.
- (4) It is due to the force of ..... that raindrops fall to the ground.

**Activity :**

- Collect more information about the various forces that are used in our day-to-day life.
- Make a list of such actions where many forces are applied simultaneously.

