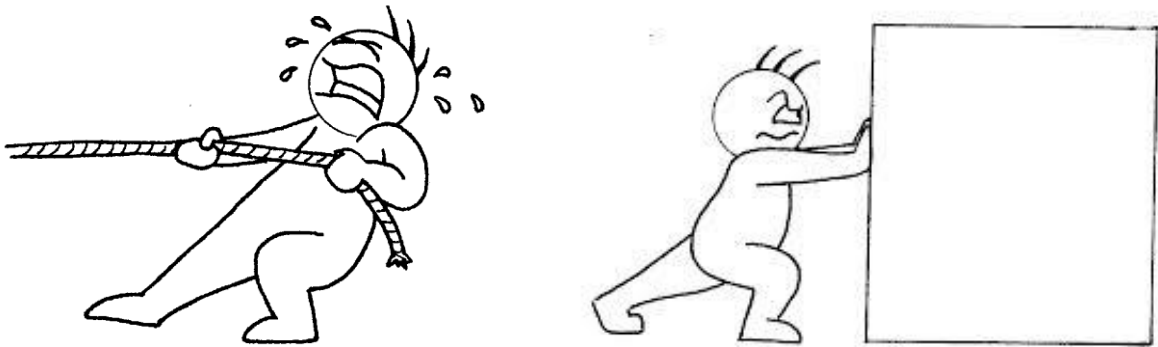


## 2. FORCE AND MOTION

### Force

We do many jobs in our daily life like lifting things, moving things from one place to another, cutting objects, etc. To do these jobs, we have to move.

We are surrounded by a variety of moving objects. Think of some moving objects you come across in your day-to-day life. Cars, buses, airplanes and boats are some examples of moving objects. Even the earth and stars are moving all time. Observe the following pictures carefully.



In the above, the objects are being moved by a push or pull. ***A push or pull acting on objects is called a force.***

Force and motion are closely connected. We use force to do work. Actions such as opening a door, picking up a school bag, or turning on a tap all require force. Even the earth is exerting a force on us all the time. It is pulling all things towards it. This is why things fall down if you toss them up.

### Effects of force

We cannot see force, but we can see its effects. A force can affect an object in different ways.

1. A force can make a stationary object move or make a moving object move faster



2. A force can make a moving object slow down or stop



3. A force can change the direction in which an object is moving



4. A force changes the shape of an object



### **Types of forces:**

There are two types of forces- Contact force and non-contact force

The non-contact force acts on the physically separated objects; for example, gravitational force or the force between the sun and stars, electric force, magnetic force. The contact force acts on the interacting objects which are physically connected with each other; for example, normal force, friction, applied force, air resistance, tension etc. let's discuss all about the contact force and its complete explanation.

## What is Contact Force

**A contact force** as the name suggests acts on a point of an object by direct contact. The Contact may be Continuous or sometimes momentary. The former case is known as Continuous force and the latter case is known as impulse force.

## Contact Force Examples

### 1) Pushing an object along the floor:

This is an example of a continuous force. Here, continuously, the direct force is put on the object to move it along the floor.

### 2) Kicking a Soccer ball :

This is the example of an impulse force. Here force is applied to the ball with a given mass for a given time and we can see the ball is moving away with some velocity in a particular direction.

3) When a marble on a glass surface is subjected to an applied force, the marble moves a considerable distance.

4) A book on a table is subjected to an applied force, the book moves only for some distance till the force is being applied.

5) The weight of an object is a contact force called force of gravity.

## The Various types of Contact Forces are:

1. Applied force
2. Frictional force
3. Air resistance force
4. Spring force
5. Tension force
6. Normal force

1. **Applied force:** Force which is applied to an object by another object. A person pushing his car is an example of applied force. When the person pushes the car then there is applied force acting upon the car. The applied force is the force exerted on the car by the person.

2. **Frictional force:** Friction force is the result of two surfaces being pressed together closely. This causes intermolecular attractive forces between molecules of different

surfaces resulting in friction. The frictional force depends upon the nature of the surfaces. The more rough the surface the more the frictional force.

3. Air Resistance force: The Air resistance force acts upon objects as they travel through the air. This force opposes the motion of the object in the air.  
Example: A skydiver diving in the sky.
4. Spring force: The Spring force is the force exerted by a compressed or stretched spring upon any object which is attached to it. Here the magnitude of the spring force is directly proportional to the amount of stretch or compression of the spring.
5. Tension Force: The tension force is transmitted through a string, rope or cable. The tension force is directed along the length of the wire. This force pulls the objects equally on the opposite ends of the wire.
6. Normal force: This is also called the support force. If an object is resting upon a table then the table is exerting an upward force upon the object in order to support the weight of the object. If a person leans against a wall, the wall pushes horizontally on the person.

### Frictional Forces:

Friction is a force that stops things from moving easily

Whenever an object moves or rubs against another object, it feels frictional forces. These forces act in opposite direction to the movement. Friction makes it difficult for things to move.

In the figure below, the smooth base of the snowblade slides smoothly on the snow. The boy on the grass is having difficulty sliding, because the grass is not smooth and his are getting stuck in the grass. The friction is more between the shoes and grass than the snow and snowblade.



Frictional forces are usually greater on rough surfaces than on smooth surfaces.

Frictional forces can be good and helpful. For example:

- When we walk we do not slip because of the friction between our shoes and the floor.
- When you ride your bike, friction between the tires and the road help you not to skid off



Friction between two materials, such as a shoe sole and flooring, can generate a walking charge.

Sometimes friction can cause problems



Friction between rubber-soled shoes and a slide can slow down the ride.



Friction between skin and concrete can cause a painful scrape.

### Friction produces heat

You know that friction produces heat. That is why rubbing your palms together make them warmer. But do you know why? Friction causes the molecules on rubbing surfaces to move faster, so they have more energy. This gives them a higher temperature, and they feel warmer. Heat from friction can be useful. It not only warms your hands. On the other hand, heat from friction between moving parts inside a car engine can be a big problem. It can cause the car to overheat.



How is friction reduced between the moving parts inside a car engine?

To reduce friction, oil is added to the engine. The oil coats the surfaces of the moving parts and makes them slippery. They slide over each other more easily, so there is less friction.

**A Non contact force is a force which acts on body remotely without any contact with the object.**

### Types of Non Contact Force:

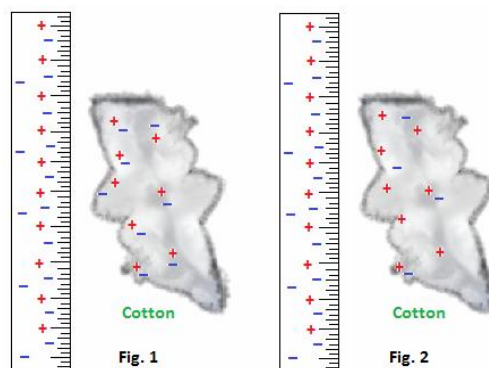
**Gravitational Force:** This is the force that attracts objects to the centre of the earth. If you throw an object up in the air, it comes down due to gravity. It is the earth's gravity that keeps us and other objects on the ground



**Magnetic force:** This is the push or pull applied by a magnet on magnetic materials (things which get attracted by a magnet) and other magnets.



**Electrostatic force:** Electrostatics is all about attraction and repulsion of charges and is another type of non contact force. Some materials have special properties of developing charge on their surface once they are rubbed like amber. These materials then attract opposite charges and hence display the property of electrostatics.



### Non Contact Force Examples

There are various examples from our daily life depicting non contact forces, some of them are:

1. Apple falling down from the tree is the best and most popular example of non contact force viz. gravity.
2. Iron pins being attracted when in the vicinity of a magnet without any physical contact.

3. Repulsion force, when two magnets are close to each other is also an example of non contact force.
4. The charging of the hair and attraction of paper bits towards it.
5. Falling of rain drops on earth is also an example of non contact force.
6. Free fall of feather towards earth is by the virtue of gravity.
7. There are many real life examples from electrostatics showing the attraction of small materials towards objects.

**Answer the questions given below**

1. Imagine you are asked to push a heavy box across the floor. At first you need to push very hard but once the box has started to move you can push less strongly yet still keep it moving. Why is this?
2. Why does oiling the axle of a bicycle make the bicycle move more easily?
3. How could you find out if cooking oil reduces friction more than water/
4. If you had a magnet with its north and south poles marked on it and a magnet without its poles marked, how could you identify the poles of the unmarked magnet? Explain your answer.
5. What is the weight of the following masses on earth?
  - a) 2 kg
  - b) 3.5 kg
  - c) 5.25kg