1. Meteors burn up when they hit the Earth's atmosphere. Why doesn't the space shuttle?

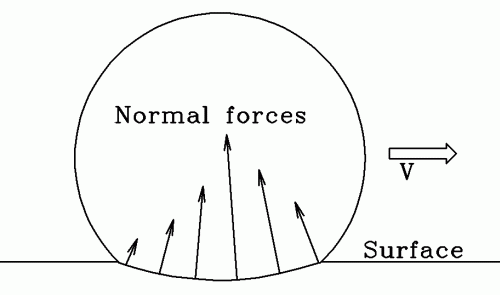
* When a small ­meteor enters the Earth's atmosphere, it goes from traveling through a vacuum to traveling through air. Traveling through a vacuum is effortless -- it takes no energy. Traveling through air is another story.
* A meteor moving through the vacuum of space typically travels at speeds reaching tens of thousands of miles per hour. When the meteor hits the atmosphere, the air in front of it **compresses**incredibly quickly. When a gas is compressed, its temperature rises. This causes the meteor to heat up so much that it glows. The air burns the meteor until there is nothing left. Re-entry temperatures can reach as high as 3,000 degrees F (1,650 degrees C)!

1. show that rolling friction is smaller than sliding or

# [What is the cause of rolling friction? & why is it less than sliding friction?](https://physics.stackexchange.com/questions/149409/what-is-the-cause-of-rolling-friction-why-is-it-less-than-sliding-friction)

Rolling friction is the resistance to motion experienced by a body when it rolls upon another. **It is much less than sliding friction for same pair of bodies.** When one body rolls upon another, there is theoretically no sliding or slip between them. And if both are perfectly rigid, there is no surface of contact.

Rolling friction is the force resisting the [motion](http://en.wikipedia.org/wiki/Motion_(physics)) when a body (such as a [ball](http://en.wikipedia.org/wiki/Ball), [tire](http://en.wikipedia.org/wiki/Tire), or [wheel](http://en.wikipedia.org/wiki/Wheel)) rolls on a surface. Sliding friction is the force resisting the [motion](http://en.wikipedia.org/wiki/Motion_(physics)) when a body slides on a surface. The force of friction depends on the area of contact between the two surfaces. As the area of contact is less in the case of rolling than in the case of sliding, rolling friction is less than the sliding friction.



1. Name the force which always opposes motion?
2. What is the direction of force of friction acting on moving object?
3. Define the term friction?
4. When we try to push a heavy box kept on ground it does not move at all.Which force is preventing this box to move forward.Where does this force acts?
5. A ball moving on the ground slows down gradually and stops after covering some distance.Which force is acting on ball?
6. Name the force which always opposes motion?
7. What is the direction of force of friction acting on moving object?
8. Define the term friction?
9. When we try to push a heavy box kept on ground it does not move at all.Which force is preventing this box to move forward.Where does this force acts?
10. distance.Which force is acting on ball?
11. On what factors does the friction depends?
12. Which will cause more friction: a rough surface or smooth surface?
13. Iqbal has to push a lighter box and seema has to push a similar heavy box on the same floor.Who will have to apply a larger force and why?
14. Give an example to show that friction depends on the nature of two surfaces?
15. Give an example to show that friction depends on the force with which the two surfaces are pressed together?
16. The friction between two surfaces depends on two factors:

1)the nature of the two surfaces ie smoothness or roughness of two surfaces

2)the force with which two surfaces are pressed together.

**1)Dependence of friction on the nature of two surfaces**

Friction depends on the smoothness or roughness of the two surfaces which are in contact with each other.

a)When the two surfaces are in contact are smooth, then the friction between them will be small because the interlocking of smooth surfaces is less.As the degree of roughness of the two surfaces in contact increases, the friction also increases.

b)When the two surfaces in contact are very rough, then the friction between them will be very large because the interlocking of very rough surface  is too much.

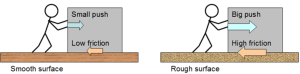
**Activity**

Place a brick on the floor.Tie a string the around the brick and connect it to the hook of a spring balance.Apply a  pulling force to the brick by pulling the other end of spring balance by hand till the brick just begin to slide on the floor.Note down the reading on spring balance. This reading of spring balance will give us the magnitude of force of friction between the surface of floor and the surface of brick.

**a)**Now wrap a piece of polythene around the brick and repeat the above activity.We note the spring balance reading when the polythene wrapped brick just begin to slide on the floor. This reading of spring balance is smaller than the first reading of spring balance indicating that the force of friction has decreased. Wrapping of polythene sheet makes the surface of bricks smooth due to which the friction with floor decreases.

**b)**Now wrap a jute cloth around the brick and repeat the above activity once again. Note the spring balance reading when the jute Wrapped brick just begins to slide on the floor.The reading of spring balance is greater than the first reading of spring balance indicating that the force of friction has increased.Wrapping of jute cloth makes a surface of brick more rough due to which the friction with the floor increases.

**2)Dependence of friction on the force with which two surfaces are pressed together**



Friction is caused by the interlocking of irregularities of the two surfaces when one object is placed over another object.If the two surfaces of objects are pressed together harder by a great force, then the friction will increase.

**Activity**

Suppose we have two boxes of same size but one box is light and other box is heavy.If we push both the boxes on the floor ,one by one, we will find that we have to apply only a small force to make the lighter box move on the floor but a much larger force has to be applied to make the heavier box move on the floor. This shows that there is less friction between the light box and floor but much more friction between the heavy box and the floor. The weight of a box is also a force which acts in the downward direction. Because of its smaller weight, the light box presses on the floor with less force and hence the friction between lighter box and floor is less. This lesser force of friction allows the lighter box to be moved easily by applying smaller push.

Because of its greater weight the heavy box presses on the floor with greater force. Since the surface of heavy box and floor are pressed together harder the friction between them increases and become much greater. This greater friction does not allow the heavy box to be moved on the floor by applying a small force. A much larger force of our Push has to be applied to make the heavy box move on the floor.

1. What is sliding friction?
2. What is static friction?
3. What is rolling friction?
4. which type of friction comes into play when a book kept on cylindrical pencils is moving by pushing?
5. Explain why sliding friction is less than static friction?
6. Explain why rolling friction is much less than sliding friction?
7. How can a very heavy machine be moved conveniently from one place to another in a factory?

**Friction is of 3 types**

1)Static friction

2)Sliding friction

3)Rolling friction

**Static friction**

The maximum fictional 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**.Static friction is a kind of starting fiction because an object just tends to start moving, it does not actually move.

**Activity**

A wooden block is kept on the horizontal surface of a table.A spring balance is attached to the hook of wooden block.We pull the spring balance to the right side with a small force of our hand.This will exert a force on the wooden block.The wooden block, however does not move because its motion is being opposed by the force of friction which acts in the opposite direction.As we increase the pulling force applied to the wooden block ,the friction also goes on increasing. When the applied force becomes a little more than the maximum frictional force, the wooden block just tends to move or slip on the surface of table.

The force which we are exerting in making the wooden block just tend to move or slip is equal to the force of friction.In static friction the object is actually not moving or sliding over the other object ,it only tends to move or slide.

**Sliding friction**

The frictional force present when one object moves slowly or slides over the surface of another object is known as **sliding friction**

**Activity**

A wooden block is kept on the horizontal surface of a table.A spring balance is attached to the hook of wooden block.Now increase the force applied to the pull the wooden block a little more. We will see the wooden block begins to slide on the table top.The force required to keep an object moving slowly or sliding with the same speed is a measure of the sliding friction.**The sliding friction is smaller than the static force**.

Since the sliding friction is smaller than the static friction it is easier to keep an object moving which is already in motion than to move the same object from rest.

When an object has already started moving on sliding the irregularities on its surface do not get enough time to lock into the irregularities on the surface of the other object completely.Since the interlocking of the two surfaces is less when an object has already started moving ,therefore ,the sliding friction is smaller than the static friction.

**Rolling friction**

When an object 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 the sliding friction.

**Activity**

Let us take a thick book on our table.Now push the book with your hands.We will find that it is not very easy to put the thick book lying on the table and make it move.We have to apply fairly large amount of force to make the book Move or slide on the table.When the book lying directly on the surface of table moves,then sliding friction comes into play.The large sliding friction between the surface of table and the bottom of thick book makes the book comparatively difficult to move.

Place the round pencils parallel to one another on the table top.Let us place the same thick book over the round pencils.Now push the book with your hands. When we push the book ,the round pencil kept below it start rolling or turning and make the book move forward easily.We have to apply a very small amount of force to make the book move when it is placed on rollers. It is much more easy to move the book placed on rollers then to slide it directly over the surface of table.

It is much easier to move an object kept on rollers then to slide it because**rolling friction is much less than sliding friction.**

Since rolling friction is much less it is very easy and convenient:

1)To pull heavy luggage fitted with rollers.

2)Heavy machines can be easily moved from one place to another by placing round logs of wood under them and then Pushing with the force of hands.

3)The round logs of wood act as rollers and make it much easier to move the heavy machine kept on them.

4)Wheels greatly reduce friction by rolling and hence can be used to move even heavy objects like cars, buses trucks , trains rather easily.

1. Why is it difficult to move on wet marble floor?
2. Why is it difficult to walk properly on a well polished floor?
3. What prevents you from slipping every time you take a step forward?
4. What enables us to fix nails in a wall and knots to be tied?
5. Why does a man slip when he steps on a banana peel thrown on the road?
6. Why a pencil will write on paper not  on glass?
7. Why climbing a greasy pole is very difficult?
8. Why does a matchstick light when we strike it on rough surface?
9. Why is it difficult to light a matchstick by striking it on smooth surface?
10. Explain how friction enable us to walk without slipping?
11. What enables a car to move on road without skidding?
12. Why it is difficult to drive and control a car on wet road?
13. What enables us to apply brakes and slow down or stop a moving car?
14. What enables a teacher to write on the blackboard with a chalk?
15. What enables us to pick up and hold things in our hands?

**Advantages of friction**

**1)Friction enables us to walk without slipping**

**We are able to walk on ground because friction between the sole of our shoes and ground prevents us from slipping over the ground**.To take a step forward during walking ,we lift one foot Off the ground and push the ground backwards with the other foot.If there were no friction between the sole of our shoe and ground, then our shoe on the ground would slip backwards.Since we push the ground backwards, the force of friction acts in the opposite direction, forward direction, and prevents our foot from slipping backward.

Walking on slippery ground is difficult because the frictional force on slippery ground is much less which may not be sufficient to prevent us from slipping.It is also difficult to walk on well polished floor because the friction on these smooth surfaces is very small.

If a person throws a bucket of water on a smooth marble floor, it would become even more difficult for us to walk on this with marble floor.This is because the friction on wet marble floor becomes very small which cannot prevent us from slipping.

**When we accidentally step on a banana peel thrown on the road we usually fall down.**This is because the inner side of banana peel being smooth and slippery reduces the friction between the sole of our shoe and the surface of road.And this small frictional force is not enough to prevent our food from slipping backwards.

**2)Friction enables a car to move on road without skidding**

The friction between tyres of a car and road enables a car to move on road without skidding.When the engine of car makes the wheel of car turn, the tyre pushes the road backwards at its point of contact with the road.The friction between tyre of car and the surface of road acts in the forward direction and prevent it from skidding.Friction provides the forward force which drives the car. If there were no friction between the car tyres and road, then the wheels of car would spin at the same place but the car would not move forward at all the.The car would stay where it was.

It becomes difficult to drive and control a car on the wet road.This is because the presence of water on the surface of a wet road reduces friction and makes it slippery.And because of reduced friction there are more chances of skidding of car.Friction also enables a bicycle to move along a road.All the vehicles are able to move on road because of the presence of friction between their tyres and the surface of road.  
**3)Friction enables us to apply brakes and slow down or stop a moving car**

In a disc brake, a steel disc attached behind each car wheels spins between two small brake pads.When the brakes are applied to the running car by pushing the brake pedal, the brake pads press against the discs of the rotating car wheels.This produce friction between brake pads and the discs, making the wheels to slow down and ultimately stop.

When the bicycle is running , the brake pads of bicycle do not touch the wheels.When we press the brake lever  to apply brakes to running bicycle ,then the brake pads rub on the rims of the bicycle wheels.The friction between brake pad and Rim prevents the wheel from moving ahead. Due to this, the running bicycle slows down and finally stops.

If there were no friction then once a vehicle started moving, it would never stop.  
**4)Friction enables us to write and draw on paper**

**We are able to write and make drawings on paper because there is friction** between the tip of pencil or pen and paper.The pencil has a thin black core made of carbon which is called **pencil lead** .When we write with a pencil, friction with paper rubs off carbon particles from the pencil lead which sticks to the paper and leaves black marks on paper.

When we write with a pen ,the particles of ink drop off from the pens refill due to friction with paper, stick on the paper and leave marks of writing on paper.

**We cannot write with a pencil on a glass** sheet because the glass surface is very smooth due to which the friction between the tip of pencil and glass surface is much less.This friction is not sufficient to rub off black graphite particles from the tip of pencil.

**A teacher is able to write on the blackboard with a chalk due to friction** between the blackboard and Chalk. When the teacher starts to write on the blackboard with a chalk, the rough surface of the blackboard rubs off some chalk  particles with sticks to the blackboard and appear as writing on the blackboard.  
**5)Friction enables us to pick up and hold things in our hands**

We are able to pick up book and hold it in our hands due to the friction between the book and the hands.We can hold a glass tumbler in our hands because of friction.

If the outer surface of a glass tumbler is oily all greasy then it becomes more difficult to hold it.This is because the presence of a film of oil on the outer surface of glass tumbler reduces the friction between glass tumbler and our hands.Due to less friction the oily glass tumbler tends to slip from our hand and it becomes more difficult to hold.

It is easier to hold a kulhar in our hands than a glass tumbler.This is because due to the rough surface of the kulhar the friction between Kulhar and our hand is much more which makes it easier to hold it.

Due to the smooth surface of glass tumbler the friction between glass tumbler and hand is much less which makes it comparatively difficult to hold it.

**6)Nails can be fixed in a wall due to friction**

When we hammer a nail into the wall, it is the friction between the surface of nail and wall which holds the nail tightly in the wall.Without friction ,nails could not be fixed in a wall to hold things.

Friction enables knots to be tied in the strings(ropes).Knots in ropes are held together by friction.Friction enables a person to climb a tree or pole without sliding down all the time.

An oily or greasy pole has much less friction due to which it becomes difficult to climb up a greasy pole.

Friction enables a ladder to be leaned against a wall and do not slip down to the floor.

Friction helps in the construction of building.

Friction enable the belts to drive machines in factories.  
**7)Friction enables us to light a matchstick**

When we rub a matchstick against the left side of a match box ,then friction between the head of matchstick and rough left side of matchbox produces heat. This heat burns the chemical present on the head of matchstick due to which the matchstick lights up.

The matchstick catches fire and starts burning. The burning of a matchstick would not be possible without friction.It is difficult to light a matchstick by striking it on the smooth surface because enough friction is not provided by a smooth surface to produce sufficient heat.  
**8)We are able to cut wood** because there is friction between the blade and log of wood.

1. What makes the steps of foot over bridges at railway station to wear out slowly?
2. Which part wear away first in shoe?Give a reason for your answer?
3. Why do brake pads of bicycles have to be replaced quite often?
4. A pencil eraser loses tiny pieces of rubber each time you use it.Why does this happen?
5. What happen when you rub your hands vigorously for few seconds.Why does this happen?
6. Explain why soles of shoes wear out gradually?
7. Why tyres of vehicles wear out gradually?
8. State few disadvantages of friction?
9. Why brake pads wear out gradually?
10. How friction reduces the efficiency of machines?
11. How friction damages the machine parts?

**1)Friction wears away the soles of our shoes**

When we walk on the road ,there is friction between the soles of our shoes and the surface of road. When the soles of shoes rub against the rough surface of road, then tiny pieces of the soles keep on breaking off slowly due to which the soles of our shoes wear out gradually.The wear and tear of the soles of our shoes ultimately causes holes in the soles.The shoes get damaged and become unfit to wear.

**2)The tyres of vehicles wear out gradually due to friction**

When the vehicles run on the road ,there is a friction between the surface of tyres and the surface of road.The rubbing of tyres with road keeps on breaking tiny pieces of rubber from the tyre’s surface gradually. All the treads present on the surface of a tyre are worn out and the tyre becomes baldy.Such baldy tyres have to be replaced by new tyres.

**3)Friction wears out the rubbing machine parts**

Due to friction the rubbing parts of a machine wear out gradually. Friction also wears out moving parts like ball bearing of bicycles.

**4)Friction wears out the brake pads of vehicles gradually**

When the brakes of a vehicles are applied, a lot of friction is produced between the brake pads and moving part of the wheel.This friction wear out the brake pads gradually. Due to this the brake pads of vehicle have to be replaced quite often. The brake pad gets worn out due to friction between brake pad and moving rim of bicycle wheel.

**5)Friction wears out steps of staircases in buildings and foot over -bridges**

When a lot of people use the staircase in a building everyday, the friction between soles of their shoes and the stone steps wears away hard stone steps very very slowly. The steps of foot over bridges at railway station wear out due to the friction caused by the shoes of extremely large number of people who use these over bridges all the time.

**6)Friction produces heat which may damage machines**

If we rub our hands together quickly for few second ,they feel cold. This is because friction between the hands produce heat.

When we operate a mixer and grinder for few minutes, its jar becomes hot.Heat is produced by friction.

When the moving parts of a machine rub together, a lot of heat is produced due to friction between them.This heat may damage the machine gradually.

**7)Friction reduces the efficiency of Machines**

Some of the energy supplied to run a machine is wasted in overcoming friction between its moving parts and some of the energy is wasted in heat generated by the machine.This wastage of energy reduces the efficiency of a machine.

**8)Friction slows down motion**

Friction reduces the motion of moving parts of a machine. All the moving things are slowed down by friction.

1. What is a groove?
2. What is a tread?
3. Why do gymnasts apply a coarse substance to their hands?
4. What is done to increase friction between the tyres and road?
5. Why do kabaddi players rub hands with dry soil?
6. Why grooves are made in the soles of shoes?
7. Explain why sportsmen use shoes with spikes?
8. Why treads are made in the tyres of vehicles?
9. State few methods of increasing friction?

A long and shallow cut or depression in the surface of a hard material is called **groove.**

A series of patterns made into the surface of a tyre  is called **tread.**

**1)Grooves are made in the soles of shoes to increase friction and prevent slipping**

Some grooves have been made in the Soles by the makers of shoes.The grooves are made in the soles of shoes to increase friction with the ground so that the shoes get a better grip even on a slippery ground and we can walk safely.

**2)Treads are made in the tyres of vehicles to increase friction and prevents skidding of vehicles on wet road**

When a road is wet, there is a layer of water on the roads.The presence of water on the surface of road reduces friction between the tyres of vehicle and the surface of road due to which tyres lose their grip on the road.It  increases the chances of skidding of vehicle on wet road. Due to this it becomes difficult to control the running vehicles on a wet road.The treads on the surface of tyres are designed in such a way that they push away water from under the tyre.When water is pushed away from the surface of road beneath the tyre, friction between road and tyre increases and improves the tyre grip on the wet road.The treaded tyres of cars,  buses, trucks ,motorcycle ,scooter and bicycles provide better grip on the road.

**3)Spikes are provided in the shoes of players and athletes to increase friction and prevent slipping**

The players and athletes have to run fast. Greater friction is required between the soles of their shoes and ground to prevent slipping. To increase friction, Spikes are provided in the soles of shoes worn by players and athletes.This prevents the slipping of player or athlete on running.

Spikes are the pointed nails which get into the ground and increase friction between shoe and the ground.

**4)Gymnasts apply some coarse substance on their hands to increase friction for better grip**

Kabaddi players rub their hands with dry soil to increase friction and get a better grip on their opponents players.

**5)Machine belts are made of special materials to increase friction and drive machine wheels properly**

Belts are used to drive wheels for running the machines. Greater friction is required between the belts and machine wheels so that the belts can drive machine wheels properly without slipping off the wheels. To increase friction the machine belts are made of special materials having rough surfaces.

1. What are fluids.Give example?
2. What is fluid friction?
3. What is the special name of frictional force exerted by fluids?
4. What is a streamlined shape?
5. Explain why a speedboat has a streamlined shape?
6. Why are cars, aeroplanes and rockets streamlines?
7. Give two examples of drag force?
8. How can you reduce the drag on something moving through the air?
9. On what factors does drag force depends?
10. State few disadvantages of fluid friction?

Those substances which are able to flow easily are called **Fluids.** Water and air are the most common fluids.

There is a friction whenever an object moves through a fluid.It is called **fluid friction.**

Air is very light and thin, yet it exerts frictional force on objects moving through it.When an object moves through the air ,it pushes the air out of the way and air pushes back on the object. This push of air on the moving object creates fiction which tends to slow down the moving object.Air exerts frictional force on cars, buses ,aeroplanes ,rockets and birds moving through it. Water exerts force of friction on object which move through them and opposite their motion.When an object moves through water, it pushes the water out of the way and the water pushes back on the object.This push of water on the moving object creates fiction which tends to slow down the moving object.Water exerts frictional force on objects like boats, speed boats ,ships ,submarines and fishes which Move through it.

**The frictional force exerted by a fluid is called drag**.

Drag is a kind of frictional force exerted by fluid which opposes the motion of an object through that fluid.

Drag force acts in direction opposite to the direction of motion of the object.

**Examples of drag forces** are the air resistance force experienced by a car or an aeroplane when they move at high speeds, and the water resistance force experienced by a speedboat moving rapidly in the sea.

The magnitude of frictional force or drag exerted by a fluid on an object moving through it depends on

1) speed of the object

2)shape of the object

3)size of the object

4)nature of the fluid or viscosity of the fluid

1)Higher the speed of an object moving to a fluid ,greater will be the frictional force acting on it .

**For example** An aeroplane flying at the highest speed of 1000 km/hr will face a greater fictional force or drag of air than another similar aeroplane which is flying at a speed of 600 km/hr.

2)The objects having streamlined shape face much less frictional force or drag when moving through a fluid than the objects which do not have streamlined shape.

For example A car has a streamlined shape due to which it faces much less frictional force of air while running at high speed.A bus does not have a streamlined shape so it encounters a much greater frictional force from air while running at the same speed.

3)larger the size of an object moving through a fluid, greater will be the frictional force or drag acting on it

For example A big aeroplane flying at a particular speed will face more frictional force of air than a small aeroplane flying at the same speed.

4)Higher the viscosity or thickness of fluid, greater will be the frictional force or drag acting on an object moving through it

For example Water is much more viscous than air, so there will be much more frictional force or drag on an object when it moves through water than when it moves through air.

**Disadvantages of fluid friction**

The main disadvantages of fluid friction are:

1)It reduces the speed of objects moving through the fluids.It makes speeding up harder.

2)When objects move through fluids, they lose some of their energy in overcoming the fluid friction. This decreases their efficiency.

When a car is running on the road ,then some of the energy of the car is used up or lost in overcoming this friction of air which opposes its motion. When a speed boat rushes through water, then some of its energy is used up or lost in overcoming the friction of water.

A body shape which offers very little resistance to the flow of air or water around it is called **streamlined shape.**

A streamlined shape is like thin wedge or triangular objects lying on its base and sloping upwards gradually.

**Methods of reducing fluid friction**

The fluid friction or drag can be reduced are minimised by giving special shape called streamlined shape to the objects which Move through fluids like air or water .

When an object having a streamlined body shape moves very fast, then the fluid can flow past the moving objects smoothly, reducing the fluid friction or drag.

For example: 1)Cars are built with streamlined body shape to reduce air resistance or drag caused by a air.A car with streamlined shape moves through the air easily and hence consume less petrol than another car of same size running at the same speed that has a shape which gives it more air resistance or drag.

2)An aeroplane has a streamlined shape to reduce air friction that it encounters when flying at high speed through the sky.

3)The rockets are also build with streamlined shape so that they encounter the minimum air resistance or drag due to air when they fly off at extremely high speed.

4)Most of the fishes have streamlined body shape which help them to move through water easily without facing much friction from water.

5)Dolphins are streamlined by nature to reduce friction with water in which they move.

6)The objects such as boats, speed boats ,ships and submarines which move in water are also build with a streamlined body shapes to reduce the frictional force of water and make the move easily through water.

1. Why is the surface of slide polished to make it smooth?
2. Name 2 lubricants?
3. Why do we sprinkle fine powder on carrom board?
4. Which force gets reduced when two surfaces in contact are polished to make them smooth?
5. State one way in which the friction between wheel and axle can be reduced?
6. Why does oiling the axles of a bicycle make the bicycle move more easily?
7. Name one example from every day life where wheels are used to reduce friction?
8. Name device which is attached to heavy luggage to move it easily by pulling?
9. What is lubrication?
10. Why are lubricants applied to rubbing surfaces of machines?
11. Explain why wheels are so useful?
12. Why is lubrication important?
13. How will you reduce friction between those machine parts which rub against each other?
14. What is ball bearing?

**1)Friction can be reduced by making the surface smooth by polishing**

The friction is due to the roughness of surface. If we make the surfaces smooth by polishing ,then friction will be reduced. For example a slide in the park is polished to make its surface smooth and reduce friction. Due to reduced friction of a polished ,smooth slide, children can slide down easily.

**2)Friction can be reduced by applying lubricants (like oil or grease) to the rubbing surface**

When oil or grease is applied between the moving parts of a machine ,a thin layer of oil or grease is formed between the two rubbing surfaces. This layer of oil separates the two rubbing surfaces a little bit due to which their interlocking is reduced to a large extent.This friction is reduced and movement becomes smooth.When oil or  grease is applied to the moving parts of a machine, then their surfaces do not rub directly against each other, they rub through a layer of oil and grease .

The substance which reduce friction are called **lubricants**

Oil ,grease ,graphite and fine powder are **lubricants.**

The applying of lubricants to a machine is called **lubrication**.

Friction can be reduced by lubrication.

A well lubricated machine runs more smoothly and lasts longer.

1)A bicycle mechanic and motor mechanic uses grease between the moving parts of these machines to reduce friction and increase efficiency.

2)When a few drops of oil are poured on the hinges of a door, the friction is reduced and the door smoothly.

3)We Sprinkle fine powder as dry lubricant on carrom board to reduce friction.

4)In some machines an air cushion between the moving parts is used to reduce friction.For example the frictional drag from the sea on hovercraft is reduced by a cushion of compressed air.(A vehicle or craft which travels over land or water on a cushion of air provided by a downward blast is called **hovercraft**)

**3)Friction can be reduced by using wheels to move objects**

It is quite difficult to move a heavy suitcase by dragging it on the ground because the sliding friction between the heavy suitcase and the ground is very large. If this heavy suitcase is fitted with small wheels then it can be pulled very easily. Because when we attach wheels then sliding friction is converted into rolling friction. And rolling friction between the wheels of suitcase and ground is much less.

Friction can be reduced by attaching wheels to move the objects.

**4)Friction can be reduced by using ball bearing between the moving parts of machine**

**Ball bearing** is a device which consists of a ring of small metal balls. The small metal balls of a ball bearing can roll freely.They are designed to make the moving parts of a machine to roll over each other rather than slide. The ball bearing is introduced between the two surfaces which have to rotate over each other. The axle is fixed on the inner side of a ball bearing and wheel is fixed to the outer side of the ball bearing the ball bearing.They  reduces friction by making the two surfaces (axle and wheel) to roll over each other. This happens due to the rolling action of small metal balls present inside the ball bearing.

Even a wheel produces some friction where its central hole rubs with the axle.To reduce friction still further,  wheels are mounted on ball bearing. The ball bearing is fixed between the hub of wheel and axle.When the wheel revolves the balls of ball bearing roll and reduce friction. The use of ball bearing makes the wheel roll smoothly over the axle. In most of the machine friction is reduced by using ball bearing.The Wheels of the bicycle turn on sets of ball bearing. These ball bearings reduce friction because they roll rather than slide.