Lesson 12. Friction Basic concepts – A Flow Chart

FRICTION

Causes of Friction

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

Causes of Friction

Static Friction

- When a body is at rest, the force of friction is called the static friction and is always equal and opposite to the applied force.
- The force of friction which acts when the body is just at the verge of sliding on the surface is called limiting friction.

Sliding Friction

- The frictional force which opposes the actual relative sliding motion between two contact surfaces.
- Sliding friction is smaller than static friction.

Rolling friction

- The frictional force that exists between two surface when a body rolls over the other.
- Rolling friction is smaller than sliding friction.

Increasing Friction

- By pressing the surfaces together more strongly.
- When brakes are applied on a bicycle or car, the brake pads press against a moving part of the wheel and the force of friction increases
- The tyres of cares are treated for a better grip of the ground.

Increasing Friction

- Polishing
- Lubricating
- Using bal bearings
- Separation of surface by air
- Streamlined shape

Friction by Fluids

- The common name of gases and liquids is fluids .
- Fluids exert force of friction on objects in motion through them.
- Frictional force exerted by fluids is called drag.
- Fluid friction can be minimized by giving suitable shapes to bodies moving in fluids.

Friction is a necessary evil

Necessary

- For walking on the ground.
- For rolling
- For braking
- For writing on a paper
- For lightning a matchbox.

Evil

- Some of the effort (force) applied to machine is wasted in overcoming friction and so the efficiency of a machine decreases due to friction.
- The energy consumed to overcome friction is mainly converted into heat energy. The heat so produced, ralses the temperature of machine and so the machine may be damaged.
- Friction wears out the rubbing surfaces.

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Know the Terms

- **Friction :** The force which opposes the relative motion between two surfaces in contact is called friction. The force of friction always opposes the applied force that may be push or pull.
- **Spring Balance :** It is a device used for measuring the force acting on an object. It consists of a coiled spring, a pointer moving on a graduated scale. When a force is applied. Stretching of spring takes place, The reading on the scale indicated by the pointer gives the magnitude of the force.
- **Static Friction :** The force required to overcome friction at the instant an object starts moving from rest is a measure of static fraction.
- **Sliding Friction :** The force required to keep an object moving with the same speed is a measure of sliding friction. The sliding friction is slightly smaller than the static friction.
- **Lubricants :** The substances which reduce friction are called lubricants

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Objective Type Questions

(1 Marks)

I. Multiple Choice Questions

1. Whenever the surfaces in contact tend to move or move with respect to each other, the force of friction comes into play.

   a) Only if the objects are solid

   b) Only if one of the two objects is liquid

   c) Only if one of the two objects is gaseous.

   d) Irrespective of whether the objects are solid liquid of gaseous.

2. In fig. A boy is shown pushing the box from right to left. The force of friction will act on the box.

   a) from right to left (←) b) from left to right(⟶)

   c) Vertically downwards (↓) d) Vertically upwards(↑)

3. To sharpen the blade of a knife by rubbing it against a surface, which of the following will be most suitable?

   a) Stone b) Plastic block c) Wooden block d) Glass block

4. A toy car released with the same initial speed will travel farthest on :

a) muddy surface b) Polished marble surface

c) cemented surface d) glass block

5. If we apply oil on door hinges, the friction will:

a) increase b) decrease c) disappear altogether d) will remain unchanged

6. Which of the following statement is incorrect?

a) Friction acts on a ball rolling along the ground

b) Friction acts on a boat moving on water

c) Friction acts on a bicycle moving on a smooth road.

d) Friction does not act on a ball moving through air.

7. A boy rolls a rubber ball on a wooden surface. The ball travels a short distance before coming to rest. To make the same ball travel longer distance before coming to rest. To make the same ball travel longer distance before coming to rest, he may :

a) spread a carpet on the wooden surface

b) cover the ball with a piece of cloth

c) Sprinkle talcum poser on the wooden surface

d) sprinkle sand on the wooden surface

8. In a large commercial complex there are four ways to reach the main road. One of the paths has loose soil, the second is laid with polished marble, the third is laid with bricks and the fourth has gravel surface. It is raining heavily and Paheli wishes to reach the main road. The path on which she is least likely to slip is :

a) loose soil b) polished marble c) bricks d) gravel.

1) d	2) b	3) a	4) b	5) b	6) d	7) c	8) d

II. Multiple Choice Questions

1. Friction always

a. Helps the motion b. Opposes the motion

c. Both of these d. None of these

2. Friction is a

a. Contact force b. Non-contact force

c. Magnetic force d. None of these

3. Smooth surface has

a. Less frictional force
b. More frictional force
c. Sometimes less and sometimes more force
d. All the above

4. Substances are called lubricants which are used to

a. Increase friction
b. Decrease friction
c. Increase or decrease friction
d. None of these

5. Fluids are

a. Gases
b. Liquids
c. Gases and liquids both
d. None of these

6. Force of friction depends on

a. Smoothness of surface
b. Roughness of surface
c. Inclination of surface
d. All of above

7. Friction is a /an

a. Evil
b. Foe
c. Both a and b
d. None

8. If a body moves on the sandy surface, its motion will

a. Increase
b. Decrease
c. Neither increase nor decrease
d. None of these

9. Rolling friction is smaller than

a. Sliding friction
b. Static friction
c. Fluid friction
d. All of the above

10. The shape of an aeroplane is like a

a. Bird
b. Car
c. Dog
d. All

1. b	2. a	3. a	4. b	5. c	6. d	7. c	8. b	9. d	10. a

II. Fill in the blanks

1. The friction always _____ the direction of motion.
2. Friction also produces _____.
3. All objects moving in fluids have _____ shape to reduce friction.
4. Smooth surfaces produce _____ friction than rough surfaces.
5. The substances which are used in machines to protect their surfaces from wear and tear caused by friction are called _____.

6. An air cushion between the moving parts is used to _____ friction.

7. Friction can never be entirely _____.

8. Birds and fishes have _____ shaped body.

9. We pour a drop of oil on the hings of door to _____ friction.

10. The force of friction is _____ for different surfaces.

1. Opposes	2. Heat	3. Streamlined	4. Lesser	5. Lubricants
6. Reduce	7. Eliminated	8. Streamlined	9. Reduce	10. Different

I. Match the following

I. Column A		Column B	
(i)	Lubricants	(a)	Heat
(ii)	Friction produces	(b)	Rolling friction
(iii)	Wheels	(c)	Less the friction
(iv)	Ball bearings	(d)	Oil and grease
(v)	Soapy floor	(e)	Ceiling fan

(i) . (d)	(ii) . (a)	(iii) . (b)	(iv) . (e)	(v) . (c)

II. Column A		Column B	
(i)	Spring balance	(a)	Nature of surface
(ii)	Lubricants	(b)	Drag
(iii)	Fluid friction	(c)	Reduce friction
(iv)	Shape of aeroplane	(d)	Measuring force
(v)	Friction	(e)	Bird

(i) . (d)	(ii) . (c)	(iii) . (b)	(iv) . (e)	(v) . (a)

II. Match the following

Column - A		Column - B	
1	Friction Produces	(i)	Sliding friction
2.	Lubricants	(ii)	Heat
3.	Soapy floor	(iii)	Oil and Grease
4.	Ball bearing	(iv)	Rolling friction
5.	Wheels	(v)	Less friction

1. (ii)	2. (iii)	3. (v)	4 . (i)	5. (iv)

III. Match the following

a. Drag	i. reduces friction
b. Streamlined body	ii. is caused due to friction
c. Wear and tear	iii. Opposes motion
d. Friction	iv. substances that reduce friction
e. Lubricants	v. Friction by fluids

a. v	**b. i**	**c. ii**	**d. iii**	**e. iv**

I. True or False

1. Friction increases with a mass of objects in contact.
2. Friction can be entirely eliminated
3. Friction does not cause any wastage of energy
4. Heat is produced due to friction
5. Friction depends on nature of surfaces in contact
6. The friction force on an object in a fluid depends only on its speed.
7. The friction force also depends on the shape of the object and the nature of fluid.
8. Use of ball bearing between the hubs is the example of rolling friction.

9. Use of lubricants increases the friction.

10. Striking a match stick produces fire by friction.

1. True	2. False	3. False	4 . True	5. True
6. False	7. True	8. True	9. False	10. True

II. True or False

1. Friction always works in opposite direction of motion of the surface.

2. Irregularities between two surfaces interlock to produce friction.

3. Friction increases with increase in the smoothness of the surface.

4. Soapy floor is slippery due to increased friction.

5. Friction is a necessary evil.

6. Spring balance is a device used for measuring the force.

7. Sportsmen use shoes with spikes to increase the friction.

8. Smooth surface has less frictional force.

9. Fluids are only liquids.

10. Friction is always harmful for us.

1. True	2. True	3. False	4. False	5. True
6. True	7. True	8. True	9. False	10. False

Quiz Time

1. What is a spring balance measures?

2. Why we fall down when we stop on a banana peel?

3. In which direction frictional force acts on a moving object?

4. Is the friction same for all the surfaces?

5. Which frictional forces is smaller sliding or static friction?

6. What is easier – rolling or sliding?

7. Why the surface of a matchbox should be rough?

8. Why do we use lubricants between the moving parts of a machine?

9. What is drag?

10. What is the shape of an aeroplane, a bird and a fish?

Answers:

1. The magnitude of the force.
2. The banana peel reduces the friction between eh feet and the road.
3. Frictional force acts in opposite direction of a moving object.
4. No, it depends on the roughness/smoothness of the surfaces.
5. Sliding friction is slightly smaller than static friction.
6. Rolling is easier than sliding due to less frictional force.
7. By stricking a matchstick on a rough surface it produces fire by friction.
8. To reduce friction between the moving machine parts.
9. The fractional force exerted by fluids is also called drag.
10. Streamlined shape.

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Intext Questions

1. Why do we slip when we step on a banana peel?

As we step on a banana peel there is a grip between our foot and the banana peel due to very less friction. So we slip accidentally.

2. Why is it difficult to walk on o a smooth and wet floor?

Due to very less friction on wet and smooth floor, our foot cannot make exact grip with the floor. Thus it is very difficult for us to walk on this floor.

3. Is the friction same for all the surfaces?

No the friction depends on the nature of surfaces in contact

4. What is easier – to move the box from rest or to move it when it is already in motion?

When the object is at rest, we have to apply more force to interlock the irregularities. On the other hand, when the object starts moving the contact points on its surface do not get enough time to lock into the contact points on the ground. Do it is easier to move the box when it is already in motion.

5. Can we reduce friction to zero by polishing surfaces or using large amount of lubricants.

Stretch your hand and keep your book on it. You will feel the weight of the book which is due to force of gravity.

6. How can a child pull a heavy luggage fitted with rollers easily?

The roller provides rolling friction instead of sliding friction. Since, the rolling friction is very less than the sliding one, hence, even a child can pull such piece of luggage easily.

Textbook Questions

1. Fill in the blanks :

(i) Friction opposes the ..... between the surfaces in contact with each other.

(ii) Friction depends on .....of surfaces.

(iii) Friction produces .....

(iv) Sprinkling of powder on the carom board .....the friction

(v) Sliding friction is ..... than the static friction.

(i) relative motion (ii) nature (iii) heat (iv) reduces (v) always less

2. Four children were asked to arrange forces due to rolling, static and sliding frictions in a decreasing order. Their arrangements are given below. Choose the correct arrangement:

(i) Rolling, Static, Sliding

(ii) Rolling, Sliding, Static

(iii) Static, Sliding, Rolling

(iv) Sliding, static, Rolling

(iii). Static, Sliding, Rolling

3. Alida runs her by car on the dry marble floor, wet marble floor, newspaper and towel simultaneously. The force of friction between the car and different surfaces in increasing order will be:

(i) Wet marble floor, dry marble floor, newspaper towel

(ii) Newspaper, towel dry marble, wet marble floor

(iii) Towel, Newspaper, dry marble floor, wet marble floor.

(iv) Dry marble floor, dry marble floor, towel , newspaper

Ans. (i) Wet marble floor, dry marble floor, newspaper, towel

4. When your writing desk is tilted a little, a book kept on it stars sliding book. What is the direction of frictional force acting on it.

The frictional force acts in opposite direction of motion. So, on sliding book, the direction of friction force is upwards.

5. **You spill a bucket of soapy water on the marble floor accidently. Would it make easier or more difficult for you to walk on the floor? Why?**

Due to soapy surface, the frictional force, between our feet and surface, reduces due to which the grip of our feet with surface is not enough to walk. So it is difficult to walk on a soapy floor.

6. Explain why a sportsman uses shoes with spikes.

Sportsman uses shoes with spikes in order to avoid getting slipped in the field. The spikes in the shoes increase the friction so he/she can run on the ground easily.

7. Iqbal has to push a lighter box and Seema has to push a similar heavier box on the same floor. Who will have to apply a larger force and why?

The heavy object will be pressed hard against the opposite surface and produce more friction. So, Seema will have to apply a larger force due to more friction.

8. Explain why sliding friction is less than static friction.

The sliding friction is less than static friction because of the interlocking of irregularities in the two surfaces. When the object starts sliding the contact points on its surface, do not get enough time to lock into the contact points on the floor.

9. Give example to show that friction is both a friend and foe.

Friction is both a friend and a foe; it can be explained by following examples

Friction is a friend :

(i) Walking will not be a possible without friction. Our foot pressing he ground will only slip.

(ii) No two bodies will stick to each other if there is no friction

(iii) Brakes of the vehicles will not work without friction

(iv) Writing on blackboard or on paper will also not be possible without friction.

Friction is a foe:

(i) Friction causes wear and tear of the parts of machinery in contact. Thus, their life reduces.

(ii) Frictional forces result in the production of heat which causes damage tot he machinery.

(iii) Friction always opposes the relative motion between any two surfaces, So, extra energy has to be spent in overcoming friction.

10. Explain why objects moving in fluids must have special shapes.

The frictional force exerted by fluids is also called drag. When objects move through fluids. They have to overcome friction acting on them. In this process, they lose energy. Efforts are made to minimize friction. So, objects are given special shapes and this type of shape is known as streamlined shape.

I. Very Short Answer Type Questions.

1. What is force of friction?

The force acting on a moving body which is equal and opposite to the direction of motion is called force of friction.

2. Write two factors on which friction depends.

(i) Shape of objects (ii) Nature of objects

3. Does friction depend on the nature of objects?

Yes, friction depends on nature of objects.

4. Does friction depend on smoothness of the surface?

Yes, friction depends on the smoothness of the surface.

5. Which surface produces more friction?

Rough surface produces more friction.

6. Which type of surface produces less friction?

Smooth surface produces less friction.

7. What is the direction of fractional force?

The direction of fractional force is opposite to the motion.

8. What is the cause of friction between two surfaces?

Friction is caused by the irregularities on the two surfaces in contact.

9. Which surface has more irregularities, smooth or rough surface?

Rough surface has more irregularities.

10. How many types of friction are there?

There are three types of friction;

(i) Static friction (ii) Sliding friction (iii) Rolling friction

11. Which is less, sliding friction or static friction?

Sliding friction is smaller than the static friction.

12. Which force helps to write by chalk on the blackboard?

Frictional force.

13. Which is easier to hold, an earthen pot or a glass tumbler?

Holding earthen pot is easier than holding a glass tumbler.

14. Why is it difficult to move on a wet marble floor?

Wet marble floor has less friction, so it is difficult to move on it.

15. What does friction do to soles of our shoes?

Friction causes wear and tear in soles of our shoes.

16. Why does a matchstick catch fire when it is rubbed on a rough surface?

Matchstick catches fire due to friction.

17. What happens when there is no friction between the chalk and the blackboard?

We cannot write on the blackboard.

18. What would happen when an object starts moving if there is no friction?

The object would never stop if there is no friction.

19. What does friction produce?

Heat.

20. Write one harm of friction.

Friction wears out the materials, like machine parts.

21. Why does jar of a mixer become hot when it is run for few minutes?

The jar of a mixer becomes hot due to friction.

22. Why do the tyres of cars and trucks are treaded?

The treaded tyres of cars and trucks provide better grip with the ground.

23. Why do Kabaddi players rub their hands with soil?

Kabaddi players rub their hands with soil for a better grip of their opponents.

24. Give two examples where friction is undesirable.

(i) We sprinkle fine powder on carom board to reduce friction.

(ii) Drops of oil are poured on the hinges of a door so that the door moves smoothly.

25. What do you mean by lubricants?

The substances which are used to reduce friction are called lubricants.

26. Why are oil, creams and grease called lubricants?

Oil, creams and grease are called lubricants because they are used to reduce friction.

27. How are the shoes made to counter the friction and make better grip?

They have groove son their soles.

28. What is used in cycle brakes to increase friction?

Brake pads.

29. Name the substance which is used in carom board to reduce friction.

Talcum powder.

30. What is avoided between two surfaces to make movement smooth?

Interlocking of irregularities is avoided.

31. Can we eliminate friction completely?

No, we cannot eliminate friction completely.

32. What is used to reduce friction in machines where lubrication are not advisable?

Air cushion.

33. Why do pieces of luggage fitted with rollers?

Pieces of luggage are fitted with rollers to reduce single friction so that children can pull such pieces of luggage easily.

34. Name two methods of reducing friction.

(i) By rolling (ii) By sliding

35. How sliding friction is replaced by rolling in machines?

By using ball bearings.

36. Name any machine in which ball bearing is used to reduce friction.

Ceiling fan.

37. What is drag?

Commonly gases and liquids are called fluids.

38. What are fluids?

Commonly gases and liquids are called fluids.

39. What does frictional force exerted on an object in a fluid depend on?

Friction depends on the speed with respect to the fluid and the nature of fluid.

40. Name the special shape given to objects moving in fluid.

Streamlined shape.

41. Name some objects which have streamlined body.

Boats, aeroplanes and ships.

42. When does rolling friction come into play?

When a body rolls on other body then rolling friction comes into play.

43. Give examples of two lubricants?

(i) Grease (ii) Oils

44. Why are lubricants used?

Lubricants are used to prevent the parts of machine or anything.

45. Why do kabaddi players rub their hands with soil?

Kabaddi players rub their hands with soil for a better grip of their opponents.

II. Very Short Answer Type Questions.

1. Will force of friction come into play, when a rain drop rolls down a glass window pane?

Yes, friction comes into play when two surfaces are in contact, e.g. glass and water in this case.

2.Which surface produces more friction?

Rough surfaces produce more friction

3.Which surface produces less friction?

Smooth surfaces produce less friction.

4. What is the direction of frictional force?

Its direction is always opposite to the direction of motion.

5. Which is less-sliding friction or static friction?

Sliding friction is less than the static friction

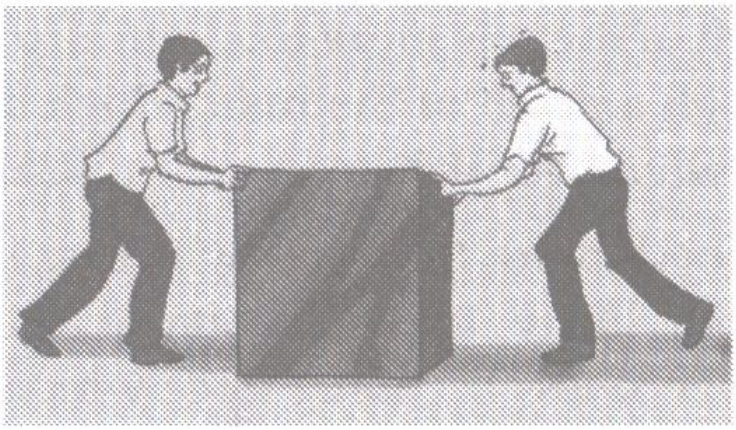
6. What does friction do to soles of shoes?

Friction wears out soles of our shoes.

7. Why does a matchstick catch fire when it is rubbed on a rough surface.

Matchstick catches fire due to friction.

8. Fig. Shows two boys applying force on a box . If the magnitude of the force applied by each is equal, will the box experience any force of friction?



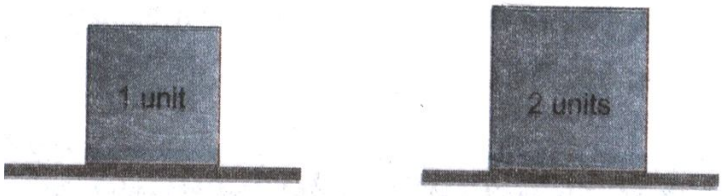
No, the force applied by both boys is equal. So net force will be the zero and hence friction force will not come into play,

9. Fishes move easily in water. How?

Fishes are having streamlined shape, so they can move easily in the water.

III. Very Short Answer Type Questions.

1. Two blocks of iron of different masses are kept on a cemented floor as shown in the figure, which one of them would require a larger force to move it form the rest position?

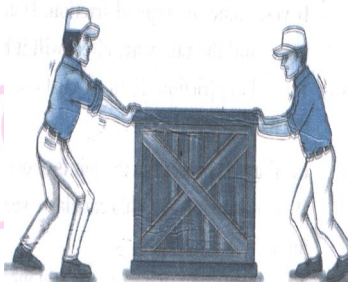


Larger force will be required to move the heavier block.

2. Two boys are riding their bicycles on the same concrete road, one has new tyres on his bicycle while the other has tyres that are old and used, which of them is more likely to skid while moving through a patch of the road which has lubricating oil spilled over it?

The bicycle with worn out tyres is more likely to skid.

3. The figure given alongside shows two boys applying force on a box. If the magnitude of the force applied by each is equal, will the box experience any force of friction?

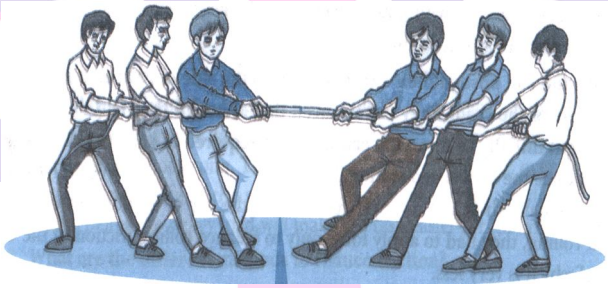


Force of friction will be zero as the net force on the box is zero.

4. Imagine that an object is falling through a long straight glass tube held vertical; air has been removed completely from the tube. The object does not touch the walls of the tube, will the object experience any force of friction?

Yes

5. While playing tug of war, Ravi felt that the rope was slipping through his hands, suggest a way out for him to prevent this.



He may rub soil to increase friction between the rope and his hand.

6. The handle of a cricket bat or badminton racquet is usually rough. Explain the reason.

To increase friction between handle of the bat and hands, to have better grip.

7. Explain why the surface of mortar and pestle (silbatta) used for grinding is etched again after prolonged use.

To increase friction to make it more effective for grinding again.

8. Name the device used for measuring force acting on an object.

Spring balance

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I. Short Answer Type Questions.

1. Cartilage is present in the joints of our body which helps in their smooth movement. Of joints ?

The wearing off of a cartilage will increase the friction. As a result the movement of joints will become difficult which may lead to joint pains.

2. A marble is allowed to roll down an inclined plane from a fixed height, at the foot of the inclined plane, it moves on a horizontal surface (a) covered with silk cloth (b) covered with a layer of sand and (c) covered with a glass sheet. On which surface will be marble move the shortest distance ? Give reason for your answer.

On the surface covered with sand, it will cover the least distance because sand offers maximum friction against its motion.

3. A father and son paused their car to bring it to the side of road as it had stalled in the middle of the road. They experienced that although they had to push with all their might initially to move the car, the push required to keep the car rolling was smaller, once the car started rolling. Explain.

Because initially they had to apply force to set the car in motion but once the car started rolling, they had to apply force only to balance rolling friction of the car, the value of which is very less.

4. When the cutting edge of a knife is put against a fast rotating stone to sharpen it, sparks are seen to fly. Explain the reason.

Friction between grinding stone and the cutting edge of the knife produces heat, As the friction is very large in this case, a large amount of heat is produced and we see sparks flying.

5. Why kabbadi players should rub their hand with soil before they start playing?

To increase friction and to get better grip on their opponent players.

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II. Short Answer Type Questions.

1. What is the cause of friction?

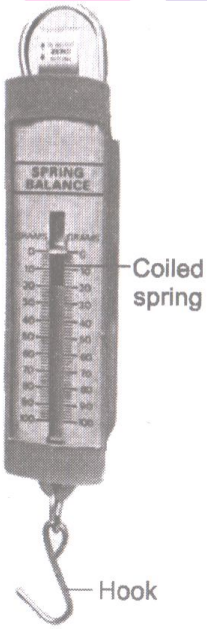
Friction is caused by the irregularities on the two surfaces in contact. The irregularities on the two surfaces lock into one another. Due to the interlocking of two surfaces friction arises.

2. Push the book on a table. You observe that after some time it stops. Explain why?

When we push a book on a table then a force acts on the book which opposes its motion. This force is called force of friction. The friction opposes the movement due to which the book stops.

3. What is a spring balance?

Spring balance is a device used for measuring the force acting on an object. It contains a coiled spring. The spring gets stretched when a force is applied on it. Stretching of the spring is measured by a pointer moving on a graduated scale. The reading on the scale gives the magnitude of force.



4. How does the friction get affected by the nature of surface?

Nature of surface is the major factor which affects the friction. When we attempt to move any surface, we have to apply a force to overcome the interlocking of the surfaces. On rough surfaces, there are a larger number of irregularities. So the force of friction is greater if a rough surface is involved.

5. Take two bricks, one is wrapped in jute while other is wrapped in polythene. Which one

will be easier to drag and why?

It is easier to drag the brick which is wrapped in polythene. Polythene has a smooth surface. It has less friction than the jute. Thus, it requires lesser force to drag it. Jute has rough surface so it needs more force to drag it.

6. Why is it easy to drag a mat from the floor, but it is difficult to drag the mat when somebody is sitting on it?

We know the friction is caused by the interlocking of the irregularities in the two surfaces. It is obvious that the force of friction will increase, if the two surfaces are pressed harder. So it is easy to drag a mat when nobody is sitting on it but when a person is sitting on it then it produces more friction and not easy to drag it.

7. Which is smaller, static friction or the sliding friction and why?

When the object starts sliding, the contact points on its surface, do not get enough time to lock into the contact points on the floor. So the sliding friction is slightly smaller than the static friction.

8. What happens, if the floor we walk on is frictionless?

We would not be able to walk on the surface if there is no friction on the floor. It is the friction which helps us to stand or walk on the surface. The grooves of our feet or shoes are locked into the irregularities of the floor and make us stand.

9. Why is it not easy to move an object from its static position?

When an object is at rest, it has better hold of the surface on which it is placed. In the static position the irregularities of the surface are interlocked properly due to which more force is required to overcome the friction. So it is not easy to move an object from its static position.

10. Why can't we write with a chalk if there were no friction?

We cannot write with a chalk, pen, pencil if there were no friction. If we are writing with a chalk on frictionless surface then no chalk particles stick to the surface. So we cannot write with a chalk if there were no friction. On the other hand when we are writing with a chalk on the blackboard, its rough surface rubs off some chalk particles which stick to the blackboard.

11. The soles of our shoes get worn out after a period of time. Explain why?

The soles of our shoes get worn out after a period of time due to friction. When we walk on the road, then the friction arises. Our shoes have to overcome friction to walk due to which our shoes get worn out slowly.

11. Our hands become warm when we rub them. Why?

When we rub our hands with each other the friction arises between two hands. The friction produces heat, this heat makes our hands warm. This is why our hands become warm when we rub them. We can feel this warmth by touching our hands on our face.

13. Mention three examples which show that friction produces heat.

Some examples which show that friction produces heat are following;

(i) Warming of our palms when we rub them.

(ii) Jar of a mixer become shot when it is run.

(iii) Warming of the parts of a machine when it is operated.

14. We observe that in some cases we want to increase friction. Explain why.

If we do not increase friction, vehicles will slip on the roads and they will never stop. We need to increase friction for better grip and to control the speed of the moving objects. It is not easy to walk and write without friction. We increase friction by making roads with concrete and by applying brakes in vehicles to stop them.

15. Why do we need to decrease friction and how it can be decreased?

Friction is harmful in some of the cases. It causes a lot of wear and tear in objects. It also causes damage to the machine parts. So we need to decrease the friction. It can be decreased by rolling, sliding and lubricating the surface in contact. We use ball bearings, wheels and lubricants like grease, oils and creams to decrease the friction.

16. How do wheels reduce friction?

We use wheels to reduce friction. The wheels reduce the resistance against motion. So it is easy to roll the body over one another than to slide a body. That is the reason that wheels reduce friction.

17. What are the factors on which frictional force depends in fluids?

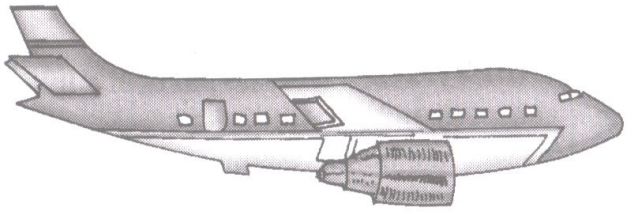
There are following factors on which force of friction depends in fluids;

(i) The frictional force on an object in a fluid depends on its speed with respect to the fluid.

(ii) Frictional force also depends on the shape of the object and the nature of the fluid.

18. Why do we shape aeroplanes like that a bird?

The objects are given special shapes to minimise friction. Aeroplane and birds both fly in the air and have to face friction exerted by air. They are so shaped that they do not have to lose energy while overcoming the frictional force exerted by air to fly. Therefore the aeroplanes are also shaped streamlined, so that they can overcome the frictional force of air.



III. Short Answer Type Questions-I

1. You might have noticed that when used for a long time, slippers with rubber soles become slippery. Explain the reason.

Due to continuous rubbing of soles with the ground , the spikes on the sole get damaged slowly and the soles become slippery.

2. When the cutting edge of a knife is put against a fast rotating stone to sharpen it, sparks are seen to fly. Explain the reason.

Due to the friction between knife and stone, the temperature of the knife and hence stone increases and it increases to such a level that the sparks are produced which can be seen while sharpening it.

3. While travelling on a rickshaw, you might have experienced that if the seat cover is very smooth, you tend to slip when brakes are applied suddenly explain.

If the seat cover of rickshaw is very smooth, then the friction between our body and the seat is very small. Therefore, when brakes are applied, we tend slip.

4. Explain why the surface of mortar and pestle (silbatta) used for grinding is etched again after prolonged use.

After prolonged use, the mortar and pestle loose the roughness, due to which frictional force reduces and it does not work properly . So we have to etch it to make it rough again.

Next Generation School

5. Two boys are riding their bicycle on the same concrete road. One has new tyres on his

bicycle. While the other has tyres that are old and used. Which of them is more likely to slip while moving through a patch of the road which has lubricating oil spilled over it?

The boy having the tyres which are old and used is more likely to slip because these tyres will experience less frictional force which is insufficient to move on the oily road.

6. Imagine that an object is falling through a long straight glass tube held vertical; air has been removed completely from the tube. The object does not touch the walls of the tube. Will the object experience any force of friction?

No, the object will not experience any frictional force because to experience the force of friction two surfaces must be there and there is only one surface in this case.

7. How many types of friction are there?

There are three types of friction:

i) State

ii) Sliding

iii) Rolling

8. Why is it difficult to move on a wet marble floor?

It is difficult to move on a wet marble floor because wet floor reduces the friction and it becomes slippery.

9. Why are the tyres of cars and trucks treated?

The treated tyres of cars and trucks provide better grip on the road.

10. Why do kabaddi players rub their hands with soil

Because their hands become rough with soil and they get better grip on their opponents.

11. Give two examples where friction is undesirable.

(i) We sprinkle fine powder on carom board to reduce friction.

(ii) Drops of oil are poured on the hinges of a door so that the door moves smoothly.

12. What do you mean by lubricants?

The substances which reduce friction are called lubricants e.g. oil creams and grease.

13. Name two methods of reducing friction with examples.

(i) Rolling : The rolling wheels attached to luggage bags make it comfortable for passengers to carry them because rolling reduces friction and is smaller than sliding friction

(ii) By polishing surfaces or by applying a lubricant.

14. What does frictional force exerted on an objects in a fluid depend on ?

Frictional force on an object in a fluid depends on the speed with respect to the fluid and the nature of fluid. It also depends on the shape of the object e.g.. all vehicles are designed to have shapes that reduce fluid friction.

III. Short Answer Type Questions-II

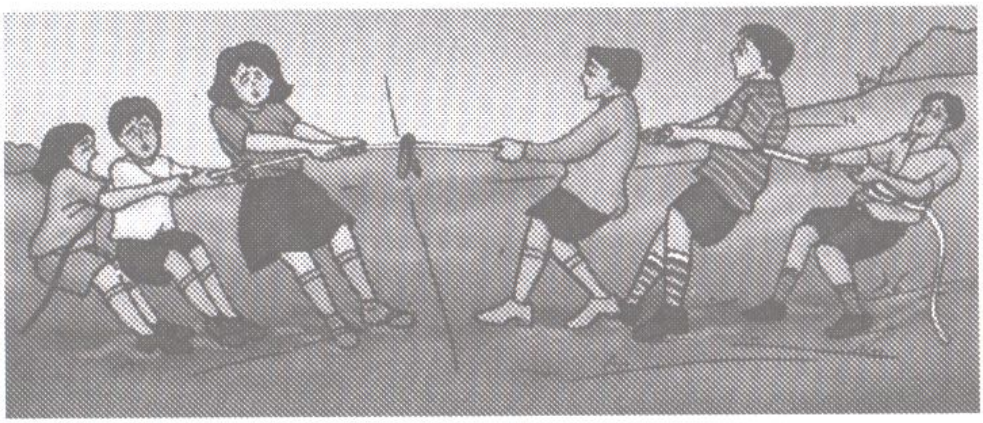
1. Is there a force of friction between the wheels of a moving train and iron rails? If, yes name the type of friction. If an air cushion can be introduced between the wheels and the rail, what effect will it have on the friction?

Yes, there is always a force of friction between the wheels of a moving train and iron rails.

The name of this friction is rolling friction, since the wheels are rolling on the track.

On introducing air cushion, the frictional force becomes less, since there is no contact between rails and wheels.

2. While playing tug of war Preeti felt that the rope was slipping through her hands. Suggest a way out for her to prevent this.



To prevent slipping of the rope from hands, Preeti has to make her hands somewhat non-smooth, so she can rub her hands by introducing the sand between them

3. The handle of a cricket bat or a badminton racket is usually rough. Explain the reason.

The handle of a cricket bat or badminton racket is rough, so that while playing the bat or badminton racket does not slip away from the hands of the players. Roughness is responsible for the frictional force without which gripping is not possible.

4. A father and son pushed their car to bring it to the side of road as it had stalled in

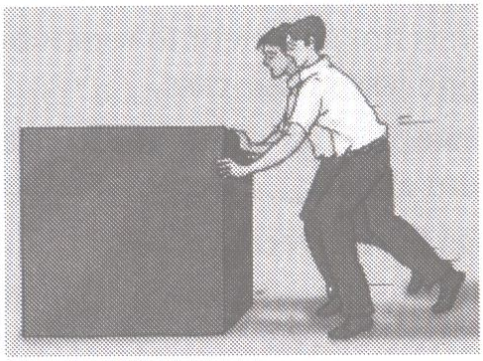
the middle of the road. They experienced that although they had to push with all their might initially to move the car, the push required to keep the car rolling was smaller, once the car started rolling. Explain

When the car is at rest, they need to apply greater force because the value of static friction is more . As the car starts moving, the friction changes into the rolling friction which is always less than the previous one. So, we have to exert the lesser force to keep it in motion.

5. A marble is allowed to roll down an inclined plane from a fixed height. At the foot of the inclined plane, it moves on a horizontal surface (a) covered with silk cloth (b) covered with layer of sand and (c) covered with a glass sheet. On which surface will the marble move the shortest distance. Give reason for your answer?

Marble will move the shortest distance on the layer of sand because it will exert a greater force of friction on the marble and other two surfaces like silk, cloth and glass sheet will exert a lesser friction force comparatively.

6. Two friends are trying to push a heavy load as shown in fig. Suggest a way which will make this task easier for them.



The friends can put rollers below the heavy load, Since the rolling friction is smaller than the sliding friction, therefore, putting rollers below the heavy load will make this task easier for them.

7. What is the cause of friction?

Friction is caused by the irregularities on the two surfaces in contact. Even those surfaces that appear smooth have a large number of irregularity which lock each surface into one another.

8. Mention three examples that show that friction produces heat.

Following exampled show that the friction produces heat:

i) Warming of our palms when we rub them

ii) Rubbing sticks together to produce fire.

iii) Warming of the parts of a machine when it is operated.

9. Why is it easy to drag a mat when nobody is sitting on it but difficult when somebody is sitting on it?

We know that friction is caused by the interlocking of the irregularities in the two surfaces. It is obvious that the force of friction will increase if the two surfaces are pressed harder. So it is easy to drag a mat when nobody is sitting on but difficult when someone is sitting on but difficult when someone is sitting on it.

I. Long Answer Type Questions.

1. We have two identical metal sheets. One of them is rubbed with sand paper and the other with ordinary paper. The one rubbed with sand paper shines more than the other Give reasons.

While rubbing with sand paper, more frictional force is produced between the layers of metal sheet and sand paper which causes more force on dust particles and they are removed easily. So it will shine more. But in case of ordinary paper the force of friction is not sufficient to remove all the dust, so it will shine less in this case.

2. Give example to show that friction is both a friend and a foe.

Friction is friend because:

i) we can not write with pen or pencil, if there is no friction.

ii) we are unable to write on the black board with a chalk

iii) If an object starts moving it would never stop

iv) we cannot fix a nail on the wall or tie a knot without friction.

Friction is foe because:

i) it wears out materials whether they are screws, ball bearings.

ii) the shoes wear out due to friction.

iii) Friction also produces heat. When a machine is operated, heat is generated that causes wastage of energy.

iv) the tyres of cars, buses and trucks etc., also wear out due to friction.

3. Discuss the various ways to reduce the friction

Friction may be reduced in the following ways.

i) Polishing the surface : We polish the rubbing surfaces to reduce their unevenness and make them smooth.

ii) Lubricating the surface : To reduce friction in order to increase efficiency when oil, grease or graphite is applied between the moving parts of a machine a thin layer is formed there and moving surfaces do not directly rub against each other. These substances are lubricants which reduce the friction.

iii) Using wheels and ball bearings: By using wheels and ball bearing we convert sliding friction into rolling friction. This reduces friction between the two contact surfaces and helps us to save energy effort and time.

iv) Streamlining : Objects are given special shapes, such as streamlined body to aeroplanes. Their bodies shapes make them lose less energy in overcoming friction. Hence all vehicles are designed to have shapes that reduce fluid friction.

4. Nmae the factors that affect friction.

Factors affecting friction

i) It depends on the nature of surfaces in contact.

ii) It is more between rough surfaces and less between smooth surfaces.

iii) It depends on how hard the two surfaces press together.

iv) It is independent of the area of contact.

II. Long Answer Type Questions.

1. Explain the advantages and the disadvantages of friction.

(Or)

Explain in details why friction is called necessary evil.

Advantages of friction:

(i) We cannot write with a pen or pencil, if there were no friction.

(ii) We cannot write on the blackboard with a chalk, if there were no friction.

(iii) If an object, started moving, it would never stop, if there were no friction.

(iv) We cannot walk on the road without friction.

(v) We cannot fix a nail in the wall or tie a knot without friction.

Disadvantages of friction:

(i) It wears out the materials whether they are screws, ball bearings or soles of shoes.

(ii) It causes damage to the parts of machines.

(iii) Friction also produces heat. When a machine is operated, heat is generated that causes wastage of energy.

(iv) The tyres of cars, buses and trucks, etc., also worn out due to friction.

(v) Friction reduces the speed due to which more force is required.

In this way, we see that friction is harmful as well as useful so it is called necessary evil.

2. Write some methods used to reduce friction.

Methods to reduce friction:

(i) By using fine powder on the surfaces like on carom board.

(ii) By using oils in the tools or in machine parts.

(iii) By using grease between the moving parts of the machines.

(iv) By using graphite powder between moving parts of a machine.

(v) by using air cushion between the moving parts in some machines where ouls or lubricants may not be advisable.

3. What is fluid friction? Write the factors on which fluid friction depends.

The gases and liquids are called fluids. The friction exerted by fluids on an object is called fluid friction. The fluid friction is also called drag. The factors on which fluid friction depends are as following;

(i) The fluid friction of an object depends on its peed with respect to fluid.

(ii) The fluid friction of an object also depends on the shape of the object.

(iii) The frictional force due to fluids also depends on the nature of the fluid.

III. Long Answer Type Questions.

1. Give reason:

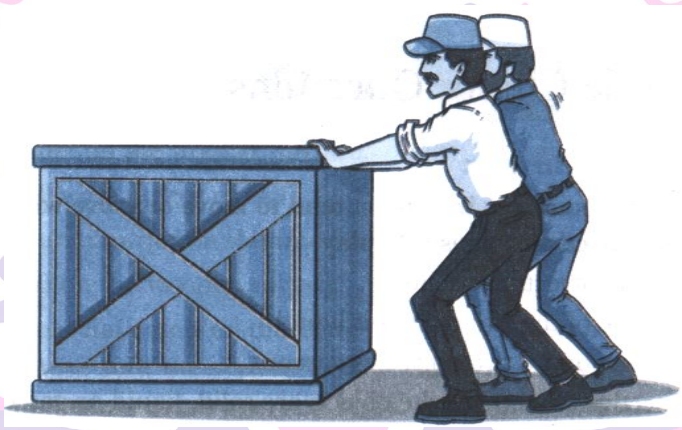
a. We have two identical metal sheets. One of them is rubbed with sand paper and the other with ordinary paper. the one rubbed with sand paper shines more than the other.

b. While travelling on a rickshaw, you might have experienced that if the seat cover is very smooth, you tend to slip when brakes are applied suddenly.

a. The friction between sand paper and metal sheet is very large, compared to that between the ordinary paper and the metal sheet. Thus, the sand paper is able to remove the outer dull layer from the metal sheet more effectively and makes it more shining.

b. if the seat cover is very smooth then the friction between our body and the seat is very small. Therefore. When the brakes are applied we tend to slip.

2. Two friends are trying to push a heavy load as shown in figure. Suggest a way which will make this task easier for them.



They can put rollers below the heavy load, because friction arises when the irregularities in the surfaces of two objects in contact get interlocked with each other. In rolling, the time given for interlocking is very small than sliding. Hence, interlocking is not strong. Therefore , less force is required to overcome it and the task becomes easier. Since, The rolling friction is smaller than the sliding friction, putting rollers below the heavy load will make the task easier for them.

3. What are the different methods to reduce friction?

To reduce friction following methods are commonly used:

a. Polishing : if we polish a surface, it becomes smooth and friction is reduced. Through polishing, unevenness of the surface is reduced.

b. Lubricating : By applying lubricants (like oil) to surfaces, friction is reduced. When we apply lubricant to surfaces, a thin layer of lubricant is formed over there and moving surfaces do not directly rub against each other.

c. Using ball bearing : This way of reducing friction involves the principle that an object is rolled instead of sliding. The use of ball bearing converts sliding friction into rolling fiction.

d. Separation of surface by air : Another way of reducing friction is to separate the surface by air. This is how. A hovercraft works, A hovercraft moves on a layer of air between its hull and the water. The layer of air reduces friction allowing the hovercraft to move easily.

e. Giving a streamlined shape: boat, cars, planes and rockets are streamlined to reduce friction with water or air.

I. High Order Thinking Skills (HOTS) Questions.

1. A jar of a mixer become hot when it is run for few minuets comment.

Due to friction, the jar of a mixer becomes hot when it is run for few minutes.

2. If a body is moving on rough horizontal surface towards east, then in which direction the frictional force will act?

Frictional force always acts in the direction opposite to the direction of motion, so it will act towards west.

3. Why are oil creams and grease called lubricants?

Oil creams and grease when applied on a surface make it smooth, thus reduce friction , so these are called lubricants.

4. There is more drag on an object when it moves through water than when it moves through water than when it moves through air. Explain with the reason.

As the fluid friction depends on the viscosity (or thickness) of fluid, so higher the the viscosity of fluid, greater will be the frictional force acting on an object moving through it. As we know that water is much more frictional force on an object when it moves through air.

5. Explain why:

(i) A pencil will write on paper but not on glass,

(ii) Climbing a greasy pole is very difficult

a) Due to friction, a pencil writes on paper but as there is smoothness on the surface of glass, a pencil cannot write on glass.

b) If a pole is polished with grease, then the surface of pole becomes smoother thus reducing friction. So, Climbing a greasy pole becomes difficult.

II. High Order Thinking Skills (HOTS) Questions.

1. Why do ladies apply soap solution to their hands to put bangles on?

With the soap solution, the thus the friction is reduced.

2. Why is it difficult to balance our body when we accidently step on a peel l of banana?

Because the friction reduces as the surface of the road become slippery.

3. Can we reduce fiction to zero by using lubricants?

No, it is not possible to entirely remove friction.

Value Based Questions

1. In physics period a teacher told his students that when a cricket player wants to catch a ball then first he rubs the hands. Thus, there is less chance of slipping the ball from hands.

(i) Explain the reason of not slipping of ball from hands

(ii) If the player makes his hands oily instead of rubbing them would he be able to catch the ball?

(iii) Mention the types of teaching skills of teacher being represented here?

(i) The player rubs his hands due to which the palms become warm which absorb the moisture from the surface and make the surface rough. So due to roughness of hands, the ball may get a better grip between the hands and does not slip.

(ii) If the player makes the palm surface oily, the number of irregularities decreases and the surface becomes smooth. So, the ball slips off easily from the hand.

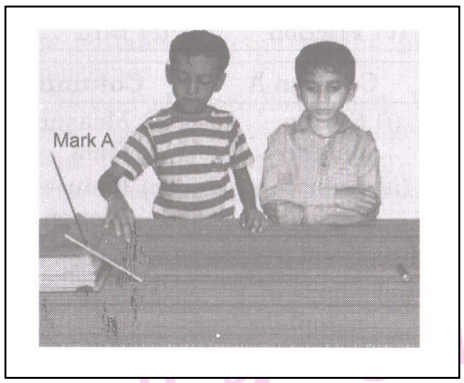
(iii) As teacher wants to teach the students through easy example so this shows that the teacher is experienced and ideal.

Skill Based Questions

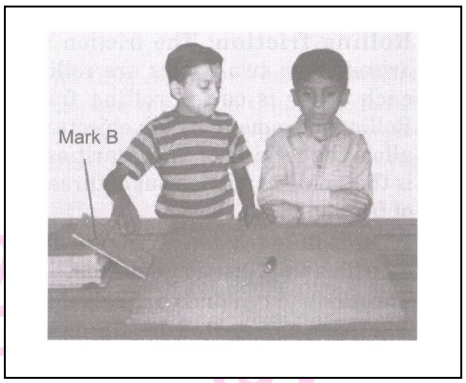
1. Observe the following figures. Fig.12.7 (a) has no cloth on the table while Fig (b) ja cloth on it. Now answer the following questions.

(i) In which case the pencil cell covers more distances?

(ii) Give the reason of covering different distances in both cases.



(a)



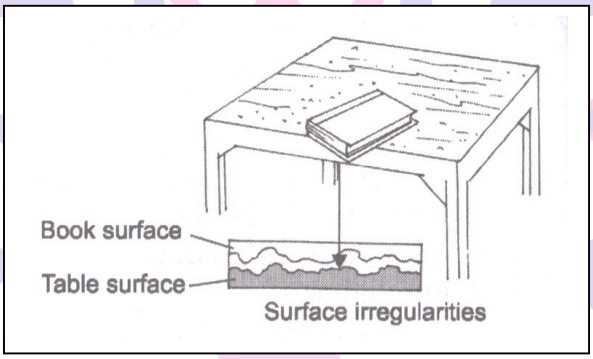
(b)

The pencil cell covers different distance son different surfaces.

(i) In case (a), pencil cell covers more distance than case (b).

(ii) In case (a), there is less friction due to smooth surface, while in case (b), cloth makes the surface rough due to which more frictional force is exerted.

2. Draw a diagram to show the surface irregularities.

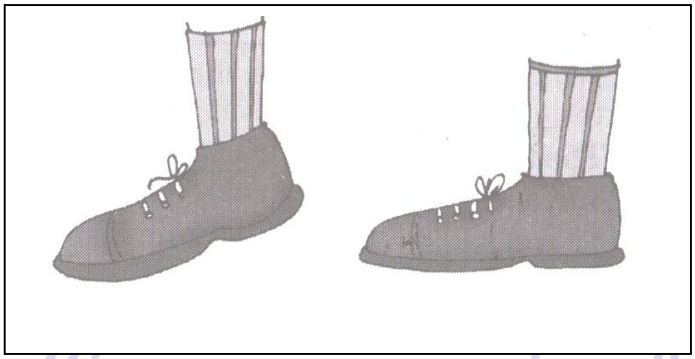


Surface irregularities

3. Observe the following figure and answer the questions.

(i) Why do soles wear out?

(ii) Can it be possible to reduce friction up too zero?



(i) The soles of shoes wear out due to friction.

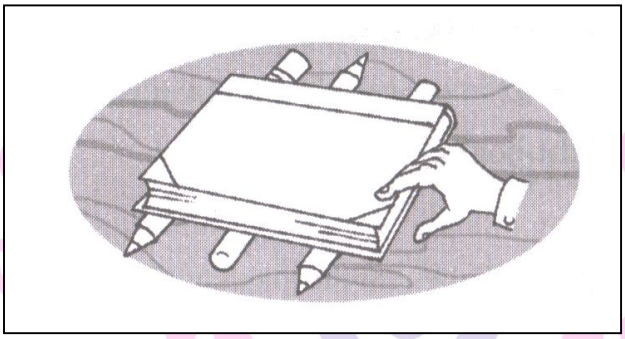
(ii) It is not possible to reduce friction up to zero.

4. (i) Draw a diagram to show the rolling friction.

(ii) How many types of friction are there?

(iii) In which type of friction the force of friction will be less?

(i)

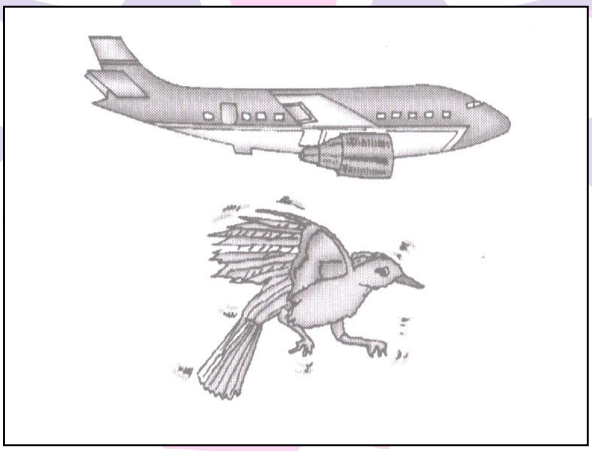


(ii) There are following three types of friction.

(a) Static friction (b) Sliding friction (iii) Rolling friction

(iii) Out of these three types, rolling friction is smallest because rolling decreases the friction.

5. Observe the following figures and answer the questions.



(i) Identify the figures

(ii) What are the similarities in both?

(iii) What is the name of specific shape?

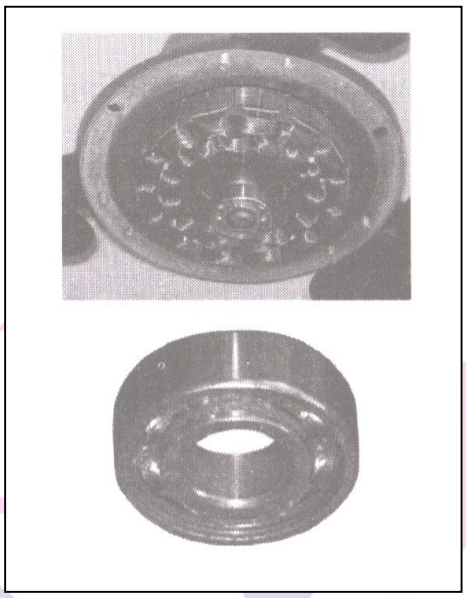
(i) The figures are of an aeroplane and a bird.

(ii) (a) Both aeroplane and bird fly in the air.

(b) Both have a specific shape to reduce friction.

(iii) The name of the specific shape is streamlined.

6. Observe the following figure and answer the questions.



(i) Identify the figure.

(ii) Write the function of device.

(iii) What types of friction is this.

(i) This is the figure of ball bearings.

(ii) It is used to reduce friction.

(iii) It is a rolling friction.

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