Force

- **Synposis**
- A body not changing position with time with respect to a nearby fixed object is said to be at rest.
- A body changing position with time with respect to a nearby fixed object is said to be in motion.
- Force is a push or pull which can change the state of rest or motion of the body or can change the size and shape of the body (i.e. it can deform a body).
- A force applied on a body can
  (a) move it, if it is not in motion
  (b) stop it, if it is moving
  (c) increase or decrease its speed
  (d) change its direction of motion
  (e) change its shape or size if it is not free to move.
- Force is defined as that cause which changes the state of rest or the state of motion of a body and can also deform it.
- A force has both the magnitude and the direction.
- When two forces act in opposite directions, the net force is equal to the difference of these forces, in the direction of the bigger force.
- When two forces act on a body which are equal in magnitude but opposite in direction, the net force on the body is zero.
- Forces are of two types :
  1. contact forces and
  2. non-contact forces (or forces at a distance).
- Contact forces are
  1. the muscular force applied as push or pull,
  2. force of friction
  3. the force of reaction normal to the surface and
  4. the force of tension in a string pulled by a load.
- Non-contact forces are
  1. gravitational force
  2. electrostatic force and
  3. magnetic force
- The weight of a body is the force with which the earth pulls the body.
- The unit of weight (or force) is kgf not kg which is unit of mass.
- Friction is a force that opposes the motion.
- Friction always acts in a direction opposite to the direction of motion.
- The cause of friction is the interlocking of the irregular projections on the two surfaces in contact. ‘
- The force of friction depends on:
  (a) the smoothness (or roughness) of the surfaces in contact, and
  (b) the weight of the sliding (or rolling) body.
- The force of friction does not depend on the area of the surfaces in contact.
- The disadvantages of friction are :
  (a) Friction opposes the motion
  (b) Friction produces heat

(c) Friction causes wear and tear
(d) Friction reduces efficiency

- Friction can be reduced by
  (a) making the surfaces smooth
  (b) the use of lubricants
  (c) the use of ball bearings
  (d) streamlining the shape of the moving body.
- The maximum force exerted by a surface on a body so long as it remains stationary is called the force of static friction.
- The minimum force required to keep the body moving over a surface such that it moves equal distances in equal intervals of time is called the force of sliding friction.
- The minimum force required to roll a body on a surface is called the force of rolling friction.
- Rolling friction is less than the sliding friction and sliding friction is less than the static friction.
- Friction is advantageous to us in almost all activities of our life.

Test yourself

A. Objective Questions

1. Write true or false for each statement

(a) The frictional force acts in the direction of motion of body
Answer. False

(b) The unit of weight is kilogram
Answer. False

(c) A force can change the direction of motion of a moving body.
Answer. True

(d) A force increases the mass of the body when applied on it.
Answer. False

(e) The force of friction is always disadvantageous.
Answer. False

(f) The sliding friction is more than the rolling friction.
Answer. True

(g) Liquids offer more friction than the gases.
Answer. True

(h) A wet oily road offers more friction than a dry rough road.
Answer. False

2. Fill in the blanks

(a) Force is applied as **push** or **pull.**
(b) On squeezing a gum tube, its **shape** changes.
(c) On pulling a string, its **length** increases.
(d) A moving football when kicked, its **direction of motion** changes.
(e) On applying brakes on a moving car, its speed **slows down.**
(f) We use ball bearings to **reduce** the friction.
(g) Friction **opposes** the motion.
(h) Lubricants are used to **reduce** friction.
(i) Friction causes wear and tear of moving parts of machine.

3. Match the following columns

	Column A		**Column B**
(a)	**Non contact force**	**(i)**	**repel**
(b)	**Like poles**	**(ii)**	**kg**
(c)	**Contact force**	**(iii)**	**Gravitational force**
(d)	**Mass**	**(iv)**	**wear and tear**
(e)	**Weight**	**(v)**	**force of friction**
(f)	**Friction**	**(vi)**	**kgf**

Answer.

	Column A		**Column B**
(a)	Non contact force	(iii)	Gravitational force
(b)	Like poles	(i)	repel
(c)	Contact force	(v)	force of friction
(d)	Mass	(ii)	kg
(e)	Weight	(vi)	kgf
(f)	Friction	(iv)	wear and tear

4. Select the correct alternative

(a) A body falls downwards because of

1. electrical force
2. **gravitational force**
3. mechanical force
4. magnetic force.

(b) A force does not change

1. **mass**
2. length
3. shape
4. state of motion.

(c) A force to be expressed correctly requires

1. only the magnitude
2. only the direction
3. **both the magnitude and direction**
4. none of the above.

(d) Friction

1. promotes motion
2. **opposes motion**
3. acts in the direction of motion
4. is always a nuisance.

(e) Friction is reduced by

1. **making the surfaces wet**
2. making the surfaces dry
3. making the surfaces rough
4. sprinkling sand on the surface.

(f) Friction

1. causes wear and tear
2. produces heat
3. stops a moving body
4. **has all the above disadvantages**

(g) Friction is increased if

1. an oil is sprayed
2. the surfaces are made wet
3. **the surfaces are made dry**
4. the surfaces are polished

B. Short/Long Answer Questions

Question 1.
Name the term used for the push or pull ?
Answer:
Force

Question 2.
Give one example each of a force as

1. a push
2. as pull
3. a stretch and
4. a squeeze.

Answer:

1. **a push** — To1 open a door, we push it.
2. **as pull** — To move a grass roller on a lawn, it is pulled by a gardener.
3. **a stretch** — Stretching a rubber string.
4. **a squeeze** —Change in shape of a sponge on squeezing.

Question 3.
Explain the meaning of the term force.
Answer:
Force: Force is a physical cause that changes or may tend to change the state of rest or the state of motion of an object. The S.I. unit of force is Newton.

Question 4.
What effect can a force have on a stationary body ?
Answer:
When a force is applied on a stationary body, it begins to move.

Question 5.
What effects can a force have on a moving body ?
Answer:
When a force is applied on a moving body, it can be made to stop or it can change the direction of motion.

Question 6.
What effect can a force produce on a body which is not allowed to move ?
Answer:
When a force is applied on a body which is not free to move, it gets deformed i. e., the shape or size of the body changes.

Question 7.
Give one example each to indicate that the application of a force

1. produces motion
2. stops motion
3. slows down motion
4. changes the direction of motion
5. deforms a body

Answer:

1. A car originally at rest when pushed, begins to move.
2. A moving bicycle is stopped by applying the brakes.
3. The speed of a moving vehicle is slowed down by applying the brakes.
4. A player kicks a moving football to change its direction of motion.
5. On stretching a rubber string, its length increases.

Question 8.
State the effect produced by a force in the following cases :
(a) The sling of a rubber catapult is stretched
(b) A man pushes a heavy cart
(c) A player uses his stick to deflect the ball .
(d) A cyclist applies brakes
(e) A spring is compressed.
Answer:
(a) The shape and size of catapult changes i.e., its length increases.
(b) The heavy cart begins to move.
(c) The direction of the ball changes.
(d) The speed of the moving cycle is slowed down.
(e) There is change in size and shape of spring.

Question 9.
Name the two kinds of forces in nature.
Answer:
Two kinds of forces in nature are :

1. Contact forces
2. Non contact forces

Question 10.
Name the type of force which acts in the following cases:
Answer:
(a) A coolie lifts a luggage
Answer. Muscular force
(b) A bicycle comes to rest slowly when the cyclist stops pedalling
Answer. Frictional force
(c) A stone falls from a roof
Answer. Gravitational force.
(d) A comb rubbed with silk attracts the bits of paper
Answer. Electrostatic force
(e) A string hangs with a load
Answer. Force of tension.
(f) A horse moves a cart
Answer. Muscular force
(g) A magnet attracts an iron pin
Answer. Magnetic force
(h) A boy opens the door
Answer. Muscular force
(i) An apple falls from a tree
Answer. Gravitational force
(j) A man rows a boat.
Answer. Muscular force.

Question 11.
What do you mean by the gravitational force? Give an example to illustrate it.
Answer:
The force of attraction on a body by earth is called gravitational force.
Example : The leaves and fruits fall from a tree downwards towards the ground, water in a river flows down streams, a ball thrown up goes to a height and then returns back on ground are some examples of motion due to gravitational force.

Question 12.
Define the term “weight of a body”
Answer:
Weight: The weight of the body is the force with which the earth attracts it towards the centre. It depends on acceleration due to gravity.

Question 13.
What do you understand by the term friction?
Answer:
Friction: Friction is that force which opposes the relative motion between the two surfaces that are in contact with each other.

Question 14.
Give an example to illustrate the existence of force of friction.
Answer:
If we stop paddling our bicycle, it gradually slows down and ultimately it stops after travelling a certain distance. This is due to frictional force between bicycle and ground.

Question 15.
What is the cause of friction?
Answer:
The cause of friction is the interlocking of the irregular projections on the two surfaces in contact.

Question 16.
State two factors which directly affect the force of friction.
Answer:
Two factors which directly affect the force of friction are :

1. The smoothness of the surface.
2. The presence of solid, liquid or gas around the moving body.

Question 17.
In which case will there be more friction between the truck and the road : when the truck is empty or when it is loaded ?
Answer:
When the truck is loaded there will be more friction between the truck and the road.

Question 18.
Which offers more friction on a body : a glass surface or a wooden surface ?
Answer:
Wooden surface offers move friction on a body.

Question 19.
Name the three kinds of friction.
Answer:
Friction is of three kinds :

1. Static friction
2. Sliding friction,
3. Rolling friction

Question 20.
List three disadvantages of friction.
Answer:
Disadvantages of friction:

1. Friction produces heat which damages the moving parts of a machine.
2. Friction produces wear and tear on the contacting surfaces. This reduces the life of machine parts, tyres and shoe soles.
3. A lot of energy is wasted due to friction to overcome it before moving.

Question 21.
When you apply the brakes, the bicycle stops and the rim of the wheel becomes hot. Explain the reason.
Answer:
It is due to friction betwen the brakes and the rim of the wheel that it becomes hot.

Question 22.
The eraser gets smaller and smaller as you use it more and more. Explain the reason.
Answer:
The eraser gets smaller and smaller as we use it more and more due to frictional force causing wear and tear of the eraser.

Question 23.
List three ways of reducing friction.
Answer:
Ways to reduce friction:

1. Providing ball bearings or wheels between the moving parts of machine or vehicles reduce friction and allow smooth movement as rolling friction is less than sliding friction.
2. Oiling or lubricating (with graphite or grease) the moving parts of a machine reduces friction. Fine powder like talcum powder also works as a lubricant to reduce friction.
3. Polishing the rough surface reduces friction offered by it.
4. Streamlining (giving special shape to experience minimum drag) the bodies of aeroplanes, cars, boats and ships help reduce drag (fluid friction) while travelling through air or water.

Question 24.
It is difficult to open an inkpot with greasy or oily hands. Explain.
Answer:
When the hands are oily, then the oil acts as lubricant and reduces the friction.
As the friction force is less, it is difficult to get grip of the inkpot and it becomes difficult to open it.

Question 25.
It is difficult to walk on a wet road. Explain.
Answer:
When the road becomes wet after rain, friction is reduced and hence, the road becomes slippery.

Question 26.
Give three examples to illustrate that friction is a necessary evil.
Answer:
The examples to illustrate that friction is a necessary evil are:

1. If friction were absent, we would not be able to walk.
2. Friction is necessary to burn a matchstick.
3. It is due to friction that we can write on a board by a chalk.

Question 27.
Define

1. static friction
2. sliding friction and
3. rolling friction

Answer:

1. The maximum force exerted by a surface on a body so long as it remains stationary is called the force of static friction.
2. The minimum force required to keep the body moving over a surface such that it moves equal distances in equal intervals of time is called the force of sliding friction..
3. The minimum force required to roll a body on a surface is called the force of rolling friction.

Question 28.
Arrange the following in descending order :

1. static friction
2. sliding friction and
3. rolling friction?

Answer:
Static friction > Sliding friction > Rolling friction.

Question 29.
A body needs a force F_1 just to start motion on a surface, a force F_2 to continue its motion and a force F_3 to roll on the surface. What is

1. the static friction
2. sliding friction and
3. rolling friction ? State whether F_2 is equal, less than or greater than (1) F_1 and (2) F_3.

Answer:

1. F_1 = Static friction
2. F_2 = Sliding friction
3. F_3 = Rolling friction
   $F_1 > F_2 > F_3$
   F_2 is less than F_1 but greater than F_3.

ADDITIONAL QUESTIONS

Check in your Progress (FORCE)

Answer the following.

1. What do you understand by a force ?
Answer. Force is a push or pull acting upon an object as a result of its interaction with another object.

2. Define weight.
Answer. The gravitational force acting on an object is called the weight of the object.

Exercises

A. Tick the most appropriate answer.

1. Which of the following is not an effect of force ?

1. Change in the direction of an object
2. Change in the shape and size of an object
3. **Change in the mass of an object**
4. Change in the position of a stationary object.

2. Which of the following is a contact force ?

1. Graviational force
2. **Frictional force**
3. Electrostatic force
4. Magnetic force

B. Fill in the blanks.

1. Newton is the SI unit of force.
2. Magnetic force is a **non-contact** force.
3. The force acting on a mango falling from a tree is an example of **gravitational force.**

C. Match the following.

	Column A	**Column B**
1.	**Non-contact forces**	**a. perpendicular to surface**
2.	**Catapult**	**b. an act of push or pull**
3.	**Force**	**c. unit of force**
4.	**Normal force**	**d. action-at-a-distance forces**
5.	**Newton**	**e. contact force**
Ans.	**Column A**	**Column B**
1.	Non-contact forces	d. action-at-a-distance forces
2.	Catapult	e. contact force
3.	Force	b. an act of push or pull
4.	Normal force	a. perpendicular to surface
5.	Newton	c. unit of force

D. State if the following statements are true or false. Correct the statement if it is false.

1. If two forces acting in opposite directions on a body arc of equal magnitude, then the body will not move.
Answer. True

2. Gravitational force is a contact force.
Answer. False.
Gravitational force is a non-contact force.

3. Like charges always attract each other.
Answer. False.
Like charges always repel each other.

4. It is possible that a force applied to an object may not bring any change in it.
Answer. True

5. Two equal and opposite forces acting on an object balance out each other.
Answer. True

6. Force applied on an object can increase its mass.
Answer. False.
Force applied on an object camiot increase its mass:

7. Friction always acts in the direction of motion of an object.
Answer. False.
Friction always acts in the direction opposite to the direction of motion of an object.

E. Answer the following in a word or two or in a sentence.

Question 1.
Give an example in which a force can change the direction of an object.
Answer:
A moving bicycle changes its direction when a force is applied to steer its handle.

Question 2.
Which force is responsible for supporting the weight of a book placed on a table ?
Answer:
Normal force (contact force)

Question 3.
Which type of force acts on a string pulled from both ends ?
Answer:
Tension (contact force)

Question 4.
Name the force that is responsible for the falling of a stone from a height to the ground.
Answer:
Gravitational force

Question 5.
What do you understand by magnetic force ?
Answer:
The force of attraction that results between a magnet and another object is called magnetic force.

Question 6.
Why does a rolling ball stop after moving some distance?
Answer:
Due to frictional force acting on it which resists/opposes the motion of the object.

F Answer the following in short.

Question 1.
Define force. Write its SI unit.
Answer:
A push or pull acting upon an object as a result of its interaction with another object is called force. Its SI unit is newton (N).

Question 2.
What will happen to an object if two equal forces act on it in opposite directions ?
Answer:
It two equal forces act on an object in opposite direction, they balance out each-other and the object does not move in any direction.

Question 3.
What do you understand by normal force ?
Answer:
A force exerted by a surface to support the weight of a body in contact with it is called normal force. It is always perpendicular (right angles) to the surface. For example, when a book is kept on a table, the table exerts a normal force which acts upward on the book to support its weight.

Question 4.
Why does a charged balloon stick to a wall ?
Answer:
It is due to the electrostatic force betwen the balloon and the wall. Opposite charges attract each other.

Question 5.
Why is magnetic force considered as an action-at-a-distance force ?
Answer:
Magnetic force comes into play even when the magnet and other object (like iron) are kept at a distance and not in direct contact with each other. Hence, magnetic-force is considered as an action- at-a-distance force.

G Answer the following in detail.

Question 1.
What are the various effects of force ? State one example of each.
Answer:
Various effects of force :

1. A force can move a stationary object. **Example :** Pulling a suitcase on its wheels.
2. A force can stop a moving object. **Example :** A ball rolling on rough surface comes to rest after some time due to force of friction.

3. A force can change the speed of a moving object. **Example:** We can increase the speed of a moving swing, we apply a force (push) in the direction of motion to increase its speed.
4. A force can change the direction of a moving object. **Example:** A moving bicycle changes its direction when a force is applied to steer its handle.
5. A force can change the shape and size of an object. **Example:** When we make a chapatti, a small ball of dough is changed to a flat, circular shape of a much bigger size by applying a force with the help of a rolling pin.

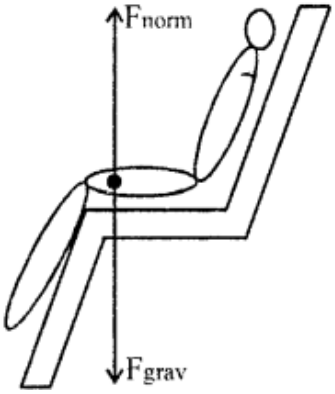
Question 2.
Differentiate between contact and non-contact force. Support your answer with suitable examples.
Answer:

	Contact forces	Non-contact forces
(i)	These are forces which need a physical touch on the object to act upon it.	These are forces which do not need a physical contact to act on an object.
(ii)	These may or may not be natural forces.	These are natural forces.
(iii)	They cannot work from a distance.	They can work from a distance as well.
(iv)	Its various types are applied force, normal force, tension, frictional force.	Its various types are magnetic force, electrostatic force, gravitational force.
(v)	Examples : Player kicking a ball, game of tug-of-war, rolling ball stops, itself, horse pulling a cart, etc.	Examples : Magnet attracting iron nails, mango falling from tree, charged plastic ruler attracts bits of dry-paper, etc.

Question 3.
List all the forces acting on a boy sitting on a chair with the help of a suitable diagram.
Answer:
The forces acting on a body sitting on a chair are

1. Gravitational force (non contact) acting downwards, F_{grav}

2. Normal contact force of the chair acting upwards (F_{norm})
   Both the forces are opposite and equal and balance each other.



Question 4.
Why do all objects have a tendency to fall towards the centre of the earth ?
Answer:
Gravitational force exerted by the earth is very strong. This force attracts all objects on earth towards its centre.That is why all objects on earth have a tendency to fall towards the centre of the earth.

Question 5.
Differentiate between mass and weight of an object.
Answer:
Difference between mass and weight Mass and weight mean completely different things in physics. The amount of matter that an object contains constitutes its mass. The gravitational force acting on this mass is called the weight of the object.
Mass of an object always remains the same, while the weight of the object varies when it is subjected to different gravitational forces. For example, the weight of an astronaut on the earth is six times her/his weight on the moon as the gravitational force of the earth is six times more than the gravitational force of the moon. But the body mass of the astronaut remains the same in both places.

H. Identify the agent exerting the force, the object on which the force is acting and the effect of force in the following situations

Question 1.
Squeezing out the juice from an orange.
Answer:
Agent exerting the force can be a machine (electric power) or human.
The object on which the force is acting is the orange.
The force is moving the orange and changing the shape of it.

Question 2.
Taking out ointment from a medicinal tube.

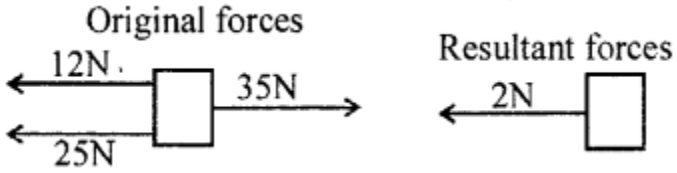
Answer:
Agent exerting the force is human fingers.
The object on which the force is acting is the medicinal tube. The force is changing the shape of the tube and moving the oinment out of the tube.

Question 3.
A child jumping to a height.
Answer:
Agent exerting the force is the child himself (muscle of the child). The object on which the force is acting is the child himself. The force is moving the child from a stationary object.

I. Solve the following numerical problems.

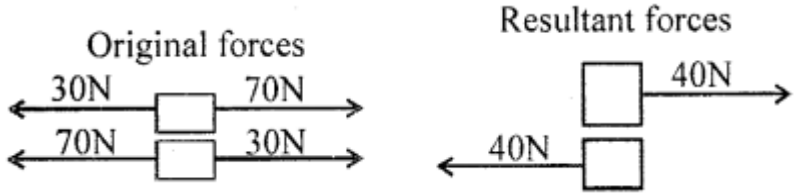
Question 1.
Two horses pull a cart in the same direction with a force of 500 N each. Find the resultant force acting on the cart.
Answer:
The horses pull in the same direction. Therefore, the resultant force acting on the cart = sum of both the forces
= 500 N + 500 N = 1000 N
The resultant force of 1000 N will act in the same direction as the individual forces on the cart.

Question 2.
Two force of 12 N and 25 N act on a body to the left hand side, while another force of 35 N acts on it to the right hand side. Find the resultant of the forces.
Answer:
Total forces acting to the left = 12 N + 25 N = 37 N
Force acting to the right = 35 N
The resultant force on the body = difference between the magnitude of the forces = 37 N – 35 N = 2 N
The object will move in the direction in which the force of 37 N is being applied, i.e., the resultant force of 2 N will act to the left.

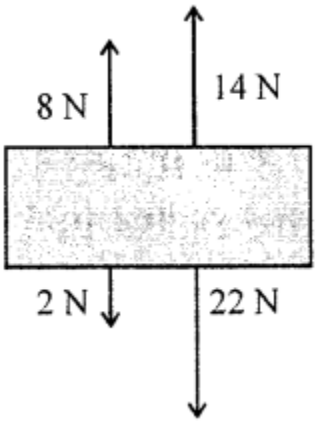


Question 3.
Two persons are pushing a car with a force of 30 N and 70 N in opposite directions. Calculate the resultant force and its direction.

Answer:
Force acting in one direction = 30 N
Force acting in opposite direction = 70 N
Resultant force = Difference between the magnitude of force
= 70 N – 30 N = 40 N
The car will move in the direction in which the force of 70 N is being applied. The resultant force of 40 N will act on the car.



Question 4.
The forces acting on a wooden block are shown in the figure given alongside. Find the resultant of the forces and the direction of the resultant force.



Answer:
Total forces acting downwards = 2 N + 22 N = 24 N
Total forces acting upwards = 8 N + 14 N = 22 N
Resultant force = Difference between the magnitude of forces = 24 N – 22 N = 2 N .
The wooden block will move in the downward direction with the resultant force of 2 N acting on it.

QUESTIONS BASED ON FRICTION

Check Your Progress

Fill in the blanks.

1. More the roughness of a surface, greater is the **friction.**
2. Rolling friction offers **less** resistance than sliding friction.
3. Weight remaining the same, friction is independent of **area** of surface in contact.
4. The force of friction acting between two bodies in contact while at rest is known as **static** friction.
5. Sliding friction and rolling friction are types of **kinetic** friction.

Exercises

A. Tick the most appropriate answer.

1. Force of friction comes into play when a/an

1. object attempts motion
2. moving object tries to stop
3. object is at rest
4. **all of the these**

2. Friction always

1. supports motion
2. starts motion
3. encourages motion
4. **opposes motion**

3. Friction is offered by

1. solids
2. liquids
3. gases
4. **all of these**

4. A car skids on a wet or muddy road due to

1. increased friction between the road and the tyres.
2. lubrication of brakes on a wet road.
3. **reduced friction between the road and the tyres.**
4. streamlined shape of the car

5. Friction for an object can be reduced by

1. providing wheels
2. lubricating

3. streamlining
4. **all of these**

6. Friction produces

1. **heat**
2. change of state
3. electricity
4. pressure

7. If you pour some oil onto a floor, the friction would

1. increase
2. **decrease**
3. remain the same
4. none of these

B. Fill in the blanks.

1. Rolling friction is **less** than sliding friction.
2. Smoother the surface, **lesser** is the frictional force offered by it.
3. Friction depends upon the **weight** of an object.
4. Friction is a type of **contact force.**
5. Bicycles use **ball bearings** to reduce friction between the pedals and the crank.

C. State if the following statements are true or false. Correct the statement if it is false.

1. Friction wears down the parts of machi
Answer. True

2. Friction has no relation with our walking or running.
Answer. False.
Friction helps us with our walking or running.

3. Friction helps us to grip the objects in our hand.
Answer. True

4. Tyres of vehicles are provided with grooved designs to decrease friction.
Answer. False.
Tyres of vehicles are provided with grooved designs to increase friction.

5. Friction is offered by all the three states of matter.
Answer. True

D. Match the following.

Column A	Column B
1. Rolling friction	a. making grooved designs
2. Static friction	b. regular oiling
3. Reducing friction	c. a book placed on a table top
4. Increasing friction	d. wheels of a car

Answer.

Column A	Column B
1. Rolling friction	d. wheels of a car
2. Static friction	c. a book placed on a table top
3. Reducing friction	b. regular oiling
4. Increasing friction	a. making grooved designs

E. Answer the following in a word or two or in a sentence.

Question 1.
A child tries to slide a wooden block on the top of a table, but she is unable to get a smooth movement. What material do you suggest she should use in between the block and the table to get a smooth movement?
Answer:
Can use pencils as rollers under the wooden block.

Question 2.
Why is difficult for a pen to leave a mark on a highly smooth plastic sheet?
Answer:
Because smooth surface has very less friction.

Question 3.
Name the force responsible for opposing the motion between two bodies in contact.
Answer:
Frictional force (friction)

Question 4.
Name a method used to reduce friction.
Answer:
Oiling or lubricating.

F. Answer the following in short.

Question 1.
When you push something heavy, the resistance you feel decreases as soon as the object starts moving. Explain the reason.
Answer:
It is because when the object is at rest, static friction occurs. The static friction is maximum when the applied force is just short of the force required to start motion between the two bodies in contact. Once the object starts moving, friction (resistance) we feel decreases.

Question 2.
Define rolling friction and give an example where rolling. friction comes into play.
Answer:
When we roll an object on a surface, the friction produced between the object and the surface is called rolling friction. Example : when we pull our large suitcases on wheels, rolling friction comes into play. The wheels reduce friction and cut down a lot of effort required to move the suitcase (Rolling friction is less than sliding friction).

Question 3.
How can sliding friction be changed into rolling friction easily ?
Answer:
Sliding friction can be changed into rolling friction easily by providing wheels or ball bearings to the objects to reduce friction and facilitate easy movement.

Question 4.
Why do wrestlers rub powder on their hands before getting into the ring ?
Answer:
In order to prevent their hands from slipping over their opponent's body. The powder increases the friction.

Question 5.
List the various states of matter that offer frictional force.
Answer:
The force of friction is offered by all the three states of matter – solids, liquids and gases.

G Answer the following in detail.

Question 1.
Define friction and explain how it is useful to us.
Answer:
Friction is a force that opposes relative motion between two bodies/surfaces in contact with each other. Although friction opposes motion, it also makes motion possible. Friction helps us do many things like :

1. It helps us in walking. In the absence of friction, we may slip or M.
2. Cars and buses are able to move safely on roads due to the friction between the treaded tyres of these vehicles and the surface of the road.
3. Friction allows us to hold objects with our hands.
4. It allows us to write on a paper. .
5. Friction produces heat. In winter, when we rub our cold hands, the heat produced due to friction makes our hands warm.

Question 2.
Write the characteristics of the force of friction.
Answer:
Characteristics of force of friction are :

1. Friction opposes the direction of motion.
2. It depends on the nature of the surface that are in contact. Rough surfaces offer greater degree of friction as compared to smooth surfaces. More the roughness of a surface, greater is the friction.
3. Friction depends upon the weight of the object – greater is the weight of the object, greater is frictional force it faces.
4. Friction is independent of area of surface in contact, when the weight remains unchanged.

Question 3.
How is friction harmful to us ? Write some ways by which one can reduce friction.
Answer:
Disadvantages of friction:

1. Friction produces heat which damages the moving parts of a machine.
2. Friction produces wear and tear on the contacting surfaces. This reduces the life of machine parts, tyres and shoe soles.
3. A lot of energy is wasted due to friction to overcome it before moving.,

Ways to reduce friction :

1. Providing ball bearings or wheels between the moving parts of machine or vehicles reduce friction and allow smooth movement as rolling friction is less than sliding friction.

2. Oiling or lubricating (with graphite or grease) the moving parts of a machine reduces friction. Fine powder like talcum powder also works as a lubricant to reduce friction.
3. Polishing the rough surface reduces friction offered by it.
4. Streamlining (giving special shape to experience minimum drag) the bodies of aeroplane, cars, boats and ships help reduce drag (fluid friction) while travelling through air or water.

Question 4.
Describe three different ways by which friction can be increased to help us in various situations.
Answer:
Ways by which friction can be increased are :

1. Tyres of all vehicles have grooved designs or treads to make their surface rough. Roughness of a surface increases friction and prevents vehicle from slipping or skidding on a wet or muddy road.
2. Spikes in the shoe soles used by players and athletes increase friction and they get firm grip on the ground. The soles of footwear are also provided with grooved designs to increase friction and avoid slipping.
3. The handles of motorbikes are covered with spiked rubber to provide a good grip and have better control in holding the handles.

H. Give reasons for the following.

Question 1.
Vehicles skid on muddy and wet roads. Suggest what type of tyres can prevent skidding of vehicles.
Answer:
Vehicles slip/skid on muddy and wet roads as the roads become smooth and offqr less friction to the tyres. Tyres are therefore grooved or treaded to make their surface rough so that the friction between the tyres and the road increases and vehicles may stop easily when desired.

Question 2.
Boats and ships have streamlined shapes.
Answer:
Streamlined shapes experience minimum drag (fluid friction) while travelling through air and water. Hence, boats and ships are given streamlined shape.

Question 3.
Brake handles of motorcycles are generally covered with a towelled cloth.
Answer:
Rough towelled cloth on the handles of motorbike provides good grip increasing the friction and we have better control in holding the handles.

I. Solve the crossword puzzle.

Across

3. The force of friction caused due to fluids
4. Type of friction acting between two bodies at rest
5. Type of friction which occurs when applied force overcomes static friction
6. A special body design to enable minimum drage Down
1. Type of force which depends upon the roughness of a surface
2. An effect of friction

Answer.