MATRIX OLYMPIAD

The Most Innovative Talent Recognition Exam

PHYSICS

Class - VIII

MATRIX

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Few words for the Readers

Dear Reader,

"*Matrix Olympiad is established to encourage school students to go a step further than their regular studies, and get a chance and exposure to competition on a wide scale. It also helps students enhance their learning of basic cognitive skills and deeper knowledge of subjects like Science, Mathematics, English, Mental Ability, Social Studies. "Matrix Olympiad helps students nurture their minds for higher targets of tomorrow and enables them to study School for JEE, NEET, CLAT, NDA, Olympiads , NSEJS, NTSE , STSE etc.*"

The above thought has been our guiding principle while designing and collating the study material for **Matrix Olympiad** . And hence, we hope that this particular material will be helpful towards your preparation for **Matrix Olympiad**.

Our team at **MATRIX** has put in their best efforts for making this particular module interesting and relevant for you. Additional efforts have been made to ensure that the content is easy to understand and error free to the extent possible. However, there might remain some inadvertent errors in answer keys and theoretical portion and we would welcome your valuable feedback regarding the same.
If there are any suggestions for corrections, please write to us at **smd@matrixacademy.co.in** and we would be highly grateful.

Finally, we would like to end this message by a famous quote by Ernest Hemingway - "*There is no friend as loyal as a book.*" So, please give your study material the time and attention it deserves, and it will surely help you reach newer heights in your fight with competition examinations.

With love and best wishes !
Team MATRIX

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FORCE AND PRESSURE

1 INTRODUCTION

We use force all the time. We use force to open a door, to pick up the school bag, to brush our teeth, to squeeze out toothpaste from a tube, to turn on a tap and so on. Even the earth is exerting a force on us all time.It is pulling all of us and all things on earth towards it.In fact we use force for every single action of ours! You have studied about force in previous classes. Do you remember what a force is ?

2 FORCE

A push or a pull on an object is called force

Unit of Force

(i) The SI unit (in standard international system) of force is called Newton and its symbol is **N** (kg × m/sec^2)

(ii) C.G.S unit of force is dynes (gm cm/s^2)

1 Newton = 10^5 dynes,

1 N = kg-m/s^2

= 1(1000 gm) (100 cm/s^2)

= 10^5 gm-cm/s^2

So that 1 N = 10^5 dyne

2.1 FORCE DUE TO INTERACTION

When does a force come into play ?

Let use consider a man standing behind a stationary car. [See fig. 1(a)]. Now, if the man begin to push the car, that is, he applies a force on it, the car may begain to move in the direction of the applied force [see fig.1(b)]. The man 'pushes' the car to make it move.

(a) (b)

Figure 1: A car being pushed by a man.

From this example, we can conclude that at least two objects must interact for a force to come into play. Thus, an interaction of one object with another object results in a force between the two object. Some other examples of interaction between two objects are given in fig. 1(c) and fig.1(d)

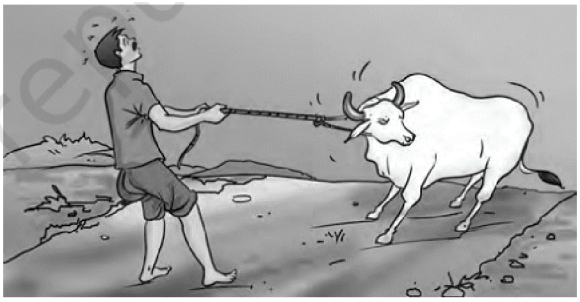


Fig.1(c) Interaction between man and cow both trying to pull each other

Fig. 1(d) Interaction between two girls both trying to pull each other

2.2 MAGNITUDE & DIRECTION OF FORCE

A force can be described completely by stating its magnitude and the direction in which its acts.

Magnitude : It is a measure of how strong a force is.

Direction of force : When forces are applied on an object in the same dierection, we get the net force by adding the magnitude of forces. When two forces are applied on an object in the opposite direction the net force is the difference in the magnitude of forces and acts in the direction of larger force.

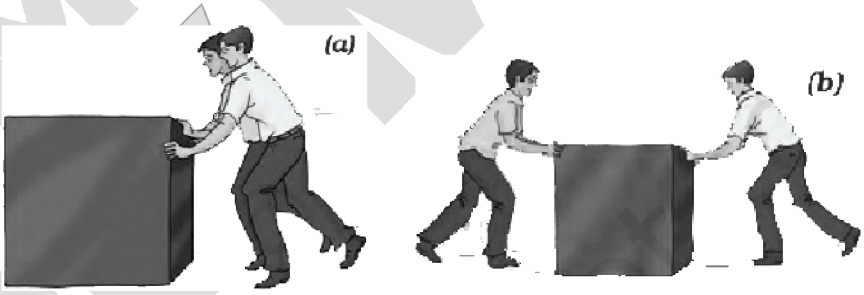


Fig. 2 : Two friends pushing a heavy load (a) in the same direction, (b) in opposite direction

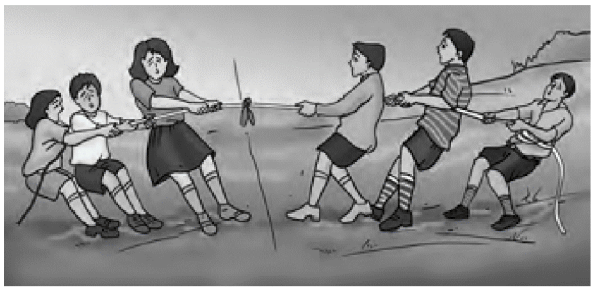


Fig 2(c): The rope may not move if the two teams at it with equal force

BALANCED AND UNBALANCED FORCE

A number of force acting on an object may either be balanced or unbalanced.

(i) Balanced Forces : If a number of forces acting on an object does not produce any change in its state of rest or uniform motion or direction of motion then, they are called as balanced forces.

Example :

(a) A person holding a briefcase in hand

(b) A book resting on table

(c) Squeezing a lemon etc.

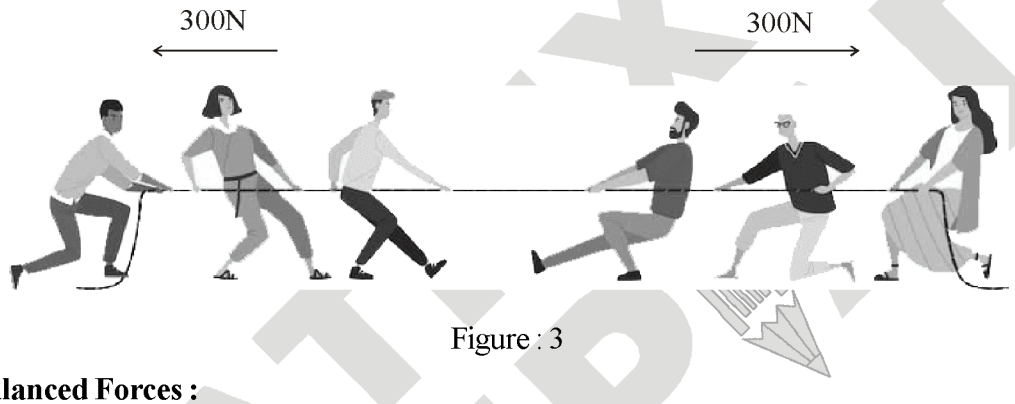


Figure : 3

(ii) Unbalanced Forces :

If a number of forces acting on an object produce a change in its state of rest or uniform motion or direction of motion, then they are termed as unbalanced forces.

Example :

(a) A briefcase released from a person's hand

(b) A stone dropped etc.

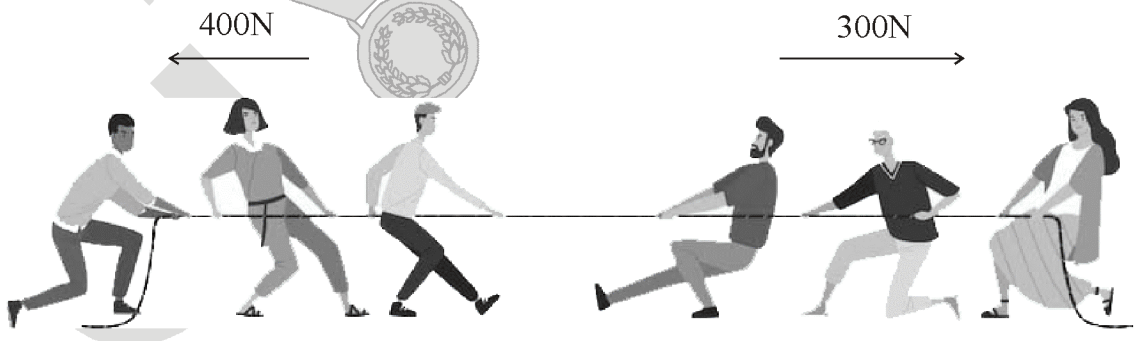


Figure : 4

BUILD THE CONCEPT

Q. 1. How can two forces of 3N and 4N combine to give forces of (a) 7N (b) 1N ?

Ans. By applying both forces in same direction we get 7N force and by applying both forces in opposite direction we get 1N force.

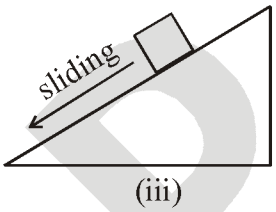
Q. 2. Two men can apply 100 N force each then in the following situation would you prefer both men to apply forces in same direction or opposite direction ?

(i) To lift up the block from ground.

(ii) To seperate magnet stuck to each other.

(iii) In figure to stuck the block from sliding on the inclined surface

(iv) To stick two blocks using fevicol.



(iii)

Ans. (i) same direction (ii) opposite direction (iii) same direction (iv) opposite direction

3. EFFECT OF FORCE

3.1 FORCE CAN CHANGE THE STATE OF MOTION

Force can move a stationary object

Example :

(a) A football player kicking a stationary foootball.

(b) A man lifting a book kept on the table.

(c) A man hitting a stationary ball with a bat.

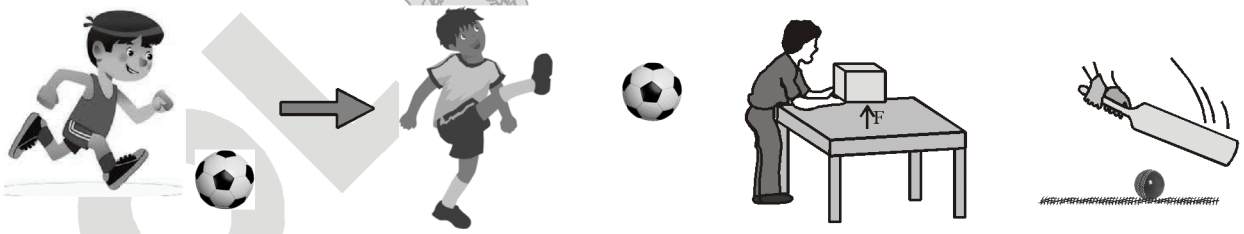


Figure 5 : Force exerting on bodies to move them from rest

However, it is not necessary that force always makes a stationary body move.

For example : If you try to push the wall of your classroom, it will not move. For that matter even if all the boys in your class push the wall, it will not move. The reason is that the force applied by all of your is not sufficient to move the wall.

Force can stop a moving body

Example :

(a) A goalkeeper stopping a football moving towards the goal post.

(b) When we apply breaks to a moving bicycle, its first slow down then stops.

(c) We ourselves have to apply force to stop our bodies while running.

(d) A cricket ball is stoped by a player by applying a force in the direction opposite to that of the ball.

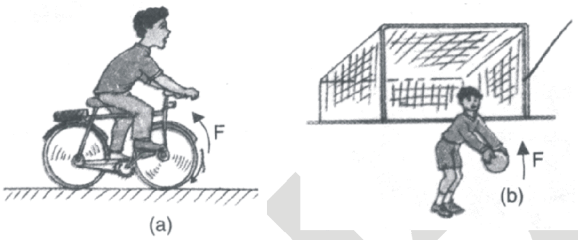


Figure 6 : Force exerted to stop a moving body

Similarly, if we apply brakes to a moving bicycle, it first slows down and then stops. We ourselves have to apply force to stop our bodies while running. A cricket ball is stopped by a player by applying a force in the direction opposite to that of the ball.

From the above examples, it is clear that a force may stop a moving body or may reduce the speed of the moving body.

Force can change the speed of a moving body

Example :

To decrease speed, force is applied in a direction which is opposite to the motion of the body. If we apply force in the direction of motion of the body, it tends to increase the speed of the body.

Example :

(a) if your friend is riding a bicycle and you push the bicycle in the same direction. The speed of bicycle will increase.

(b) On the other hand if you pull the bicycle, i.e., you apply force against the direction of motion, the speed of bicycle decreases.

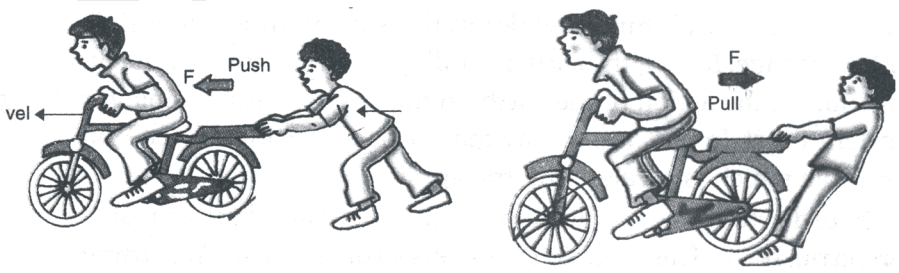


Figure 7 (a) Force exerted in the direction of velocity (b) Force exerted in opposite direction of velocity

Force can change the direction of a moving body

Example :

(a) A carrom striker changes its direction after a collision.

(b) When a batsman hits a ball, he changes the direction of the ball.

(c) When a stone is rotated in a circular path, the direction of motion of the stone change continuously. The force acting on the stone towards the centre of the circular path is responsible for changing the direction of the stone.

(d) A football player changes the direction of a moving ball by angling his foot.

(e) We can change the directions of our moving bicycle by applying force on its handle in desired direction.

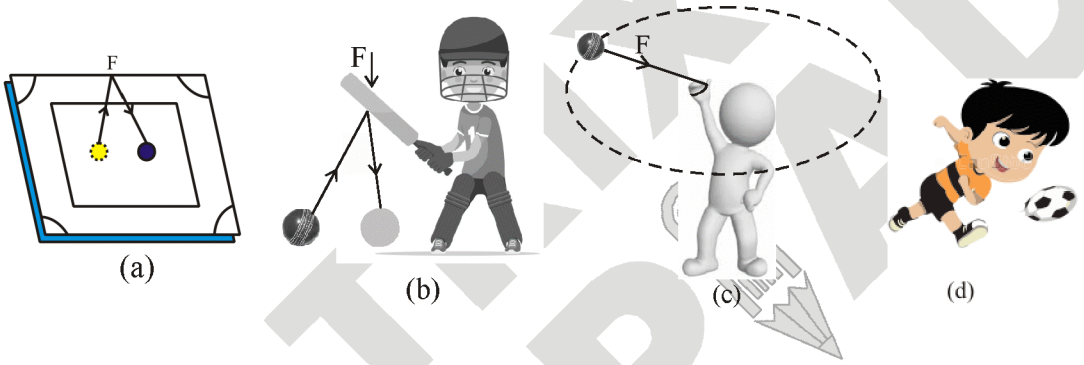


Figure 8 : Force exerted to change the direction of a moving body

Force can rotate an object

Example :

(a) When electric current is passed through a motor of a ceiling fan, forces are produced in the dynamo (or motor) which makes the fan to rotate.

(b) For closing a door you apply a push.

3.2 FORCE CAN CHANGE THE SHAPE AND SIZE OF AN OBJECT

Example :

(a) When we squeeze a toothpaste tube, it gets flattened.

(b) When we stretch a rubber band, its shape and size changes.

(c) On stretching and compressing a spring, its length changes.

(d) When we crumple a paper, it shape changes.

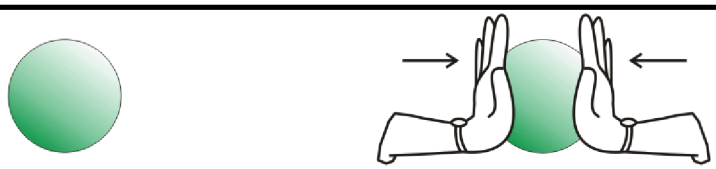


Figure 9

4. TYPE OF FORCE

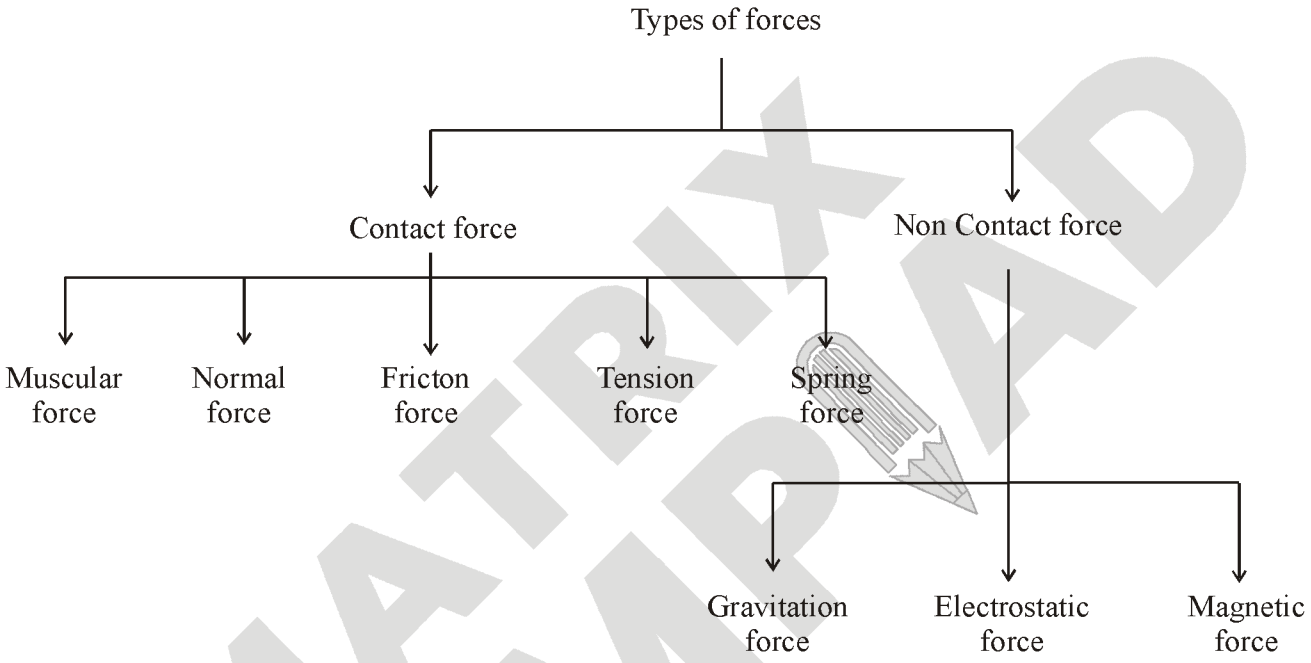


Figure 10

4.1 CONTACT FORCES

Forces that act only when there is physical contact between two interacting objects are known as contact forces. that means contact force involves only when two bodies are directly contact to each other.

MUSCULAR FORCE

This is the force we can exert with our bodies by using our muscles, e.g. pull, push, kick etc.

Such forces are also called muscular forces. These are contact forces.

Figure 11

NORMAL FORCE

The force acting on a body perpendicular to the surface of contact is called a normal force.

Eg. Consider a book on a table. The table pushes the book upwards and book pushes the table downwards, these forces are perpendicular to the surfaces of book and table. Thus the table applies a normal forces on book in the upward direction and book applies a normal force on table in downward direction.

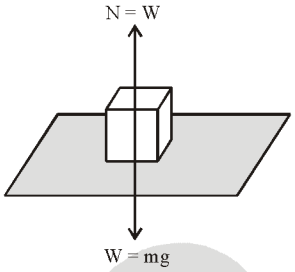


Figure 12

FRICTION FORCE

The force which acts to reduce relative motion between the surface of contact is called the frictional force. Suppose block is moving on a horizontal surface with a velocity υ. The darkned line at the bottom of the block is the surface of contact of the block with floor. We notice that this surface of contact is moving towards right with respect to the horizontal surface. To reducing this relative motion, frictional force acts. Frictional force is exerted by the floor on the block in a direction opposite to velocity.

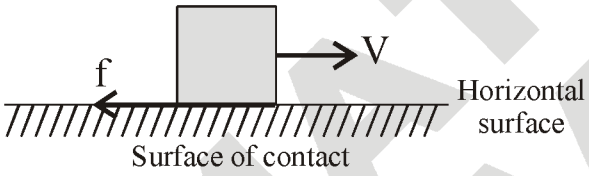


Figure 13

Focus Point

(i) Frictional force acts in a direction opposite to that of the motion
(ii) The smoother the surface the lesser is the frictional force.

TENSION FORCE

Whenever we try to stretch a string, a force develope in the string which is caled tenstion force.

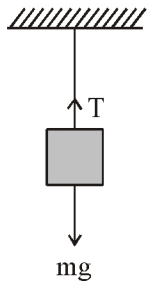


Figure 14

SPRING FORCE

(i) The length of spring at which spring applies no force is called its natural length.

(ii) Whever spring is extended or compressed from its natural length then spring applies a force which is called spring force.

(iii) Spring force act in such a way that it tries to bring the spring back to its natural length or unstreached state.

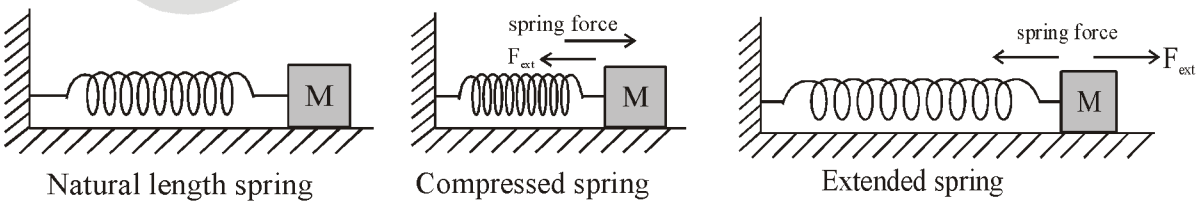


Figure 15

ACTIVITY BASED LEARNING

Making of a spring balance :

▸▸ Take a spring and hand it from a stand. Attach a pointer near the free end of the spring. Fix a strip of cardboard by the side of the spring and mark '0'. Now suspend a 10g load from the lower end. Mark 10g force against the new position of the pointer. Add another 10g load to the lower end of the spring. The length of the spring increases. Mark 20g against the new position of the pointer on the strip. Go on adding loads in steps of 10g and mark the new position of the pointer on the cardboard as 30, 40, 50. Your spring balance is now ready for use.

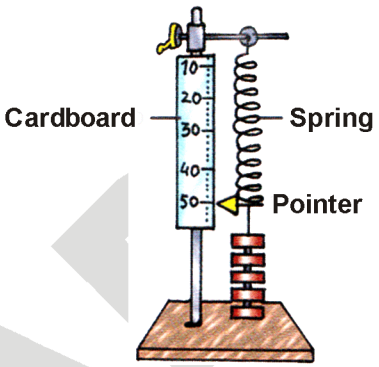


Figure 16

4.2 NON-CONTACT FORCES

The force which a body applies on another body when the two bodies are not in contact with each other is called non-contact force.

GRAVITATIONAL FORCE

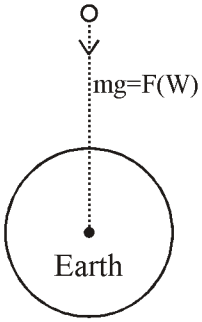
Gravitational Force : The force which a body applies on another body when the two bodies are not in contact with each other is called non-contact force. Gravitational force is the weakest force in nature and still this force is responsible for the revolution of earth around the sun.

Force of gravity due to earth :

The earth attracts all the bodies towards its centre. The force exerted by the earth on the body is known as weight of the body of force of gravity. It acts in vertically downward direction.

If mass of the body is m and acceleration due to gravity is g. Then force of gravity of weight = mg

The value of g is 9.8 m/s^2. The value of g does not depend on the mass of the body.



Earth exerting gravitational force on mass m

Figure 17

Focus Point

The value of g change slightly from place to place but for most of the purpose it is taken as 9.8 m/s^2.

Gravitational unit of force :

The S.I. unit of force is newton symbol (N) another unit of force, called the gravitational unit is kilogram force.

1 Kg-f = 9.80 N. (Kg-f = kilogram force) means force applied by earth on a mass of 1kg.

1gf = 980 dyne means force applied by earth on a mass of 1gm.

DIFFERENCE BETWEEN MASS AND WEIGHT

S. NO.	Mass	Weight
1.	It is the quantity of matter possessed by a body. It is represented by m.	It is the force with which a body is attracted towards the centre of the earth. It is represented by W = mg.
2.	A mass is a constant quantity and is same (for a body) everywhere.	It varies from place to place due to variation in value of g.
3.	Mass is never zero.	The weight of an object can be zero. For example. In the interplanetary space, where g = 0, the weight of an object becomes zero.
4.	Its unit is kg.	Its unit is Newton.
5.	It is a scalar quantity.	It is a vector quantity.

CONCEPT APPLICATION

Q. 1. Mass of a body is 5 kg. What is its weight ? [Take g = 9.8 ms^{-2}]

Ans. Mass(m) = 5 kg

Acceleration due to gravity (g) = 9.8 ms^{-2}

We know that W = mg = 5×9.8 = 49N.

Q. 2 What is the mass of an object whose weight is 98 newton ? [take g = 9.8 ms^{-2}]

Ans. Weight (W) = 98 N

Acceleration due to gravity (g) = 9.8 ms^{-2}

Mass(m) = ?

We know that

$$W = mg \Rightarrow m = \frac{W}{g}, m = \frac{98}{9.8} = 10 \text{ kg}$$

ELECTROSTATIC FORCE

The force exerted by a charged body on another charged or uncharged body is know as electrostatic force. Two similar charged body repeal and two opposite charged body attract each other also due to electrostatic force

When a plastic comb is rubbed with silk, it can pick up small bits of paper. This is because the comb acquires an electric charge because of which it can exert a force called electrostatic force. Electrostatic force can also act from a distance and is therefore a non contact force. A body with electrostatic charge can either attract or repel another charged body. Electrostatic force is used to separated solid pollutant particles from smoke given out from factories.

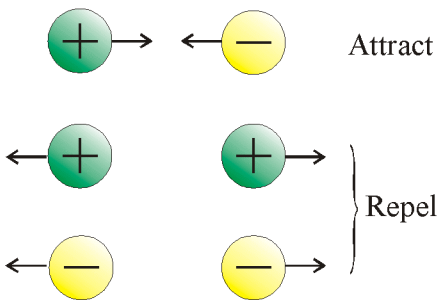


Figure 18

MAGNETIC FORCE

This is the force exerted by magnets on each other and on some metals like iron and nickel. Since magnets attract iron, magnets are used to separate waste iron object from garbage dumps so that they can be recycled. Magnetic force and electrostatic force are inter-related and are together called electro-magnetic force.

5 PRESSURE

The effect that a force has when it acts on a surface depends on two factors :

(i) The amount of force applied.

(ii) The area in contact over which the force is applied

Pressure is defined as the force acting per unit area.

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

CONCEPT APPLICATION

Q. 1. If a force of 2N is applied over an area of 2 cm^2, calculate the pressure produced.

Ans. To get the pressure in Pa, we have to make sure that the force is in Newton and the area in m^2. Here, the area is in cm^2. To convert this to m^2, we have to divide the given are a by 10,000

$$\text{Thus, area} = \frac{2}{10000} = 0.002\ m^2 \ ; \text{Now, Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{2N}{0.0002m^2} = 10000Pa$$

Q. 2 Calculate the pressure exerted by a brick, which applies a force of 2.5N, when (a) it is placed upright on the soil, (b) when it is placed on its widest base. The dimensions of the brick are 25cm×10cm×5cm.

Ans. (a) when the brick is placed up right :

$$\text{Area in contact with soil} = 10cm \times 5cm = \frac{10}{100}m \times \frac{5}{100}m = 0.005m^2$$

$$\therefore \text{ Pressure exerted} = \frac{F}{A} = \frac{2.5}{0.005m^2} = 500\ Pa$$

(b) When the brick is placed on its widest base :

$$\text{Area in contact with soil} = 25cm \times 10cm = \frac{25}{100}m \times \frac{10}{100}m = 0.025m^2$$

$$\therefore \text{ Pressure exerted} = \frac{F}{A} = \frac{2.5N}{0.025m^2} = 100Pa$$

5.1 VARIATION OF PRESSURE WITH AREA

The same force, increasing the area over which it acts decreases the pressure applied. The inverse is also true : decreasing the area of application increases the pressure produced for the same force.

(i) A wide strip school bag is more comfortable to carry :

Children daily carry school bags from home to school and school to home on shoulder. You hang your bag on right shoulder and after some time you happen to hang it on your left one; because your shoulder tired. What makes your shoulder get tired ? Of course, it is the force exerted by the strip of the school bag which you put over your shoulder.

The entire weight (force) of the bag is balanced by the strip. But if you notice, if you choose a bag with broader strip, you feel comfortable and do not get tired easily. So bag A and bag B with equal number of books exert equal weight or force on the shoulder. But bag B with broader strip (larger area) gives you less feel of effort to carry the bag. So here comes the concept of effect of force, which in some way depends upon the area over which it acts. More is the area, lesser is the effect of force.

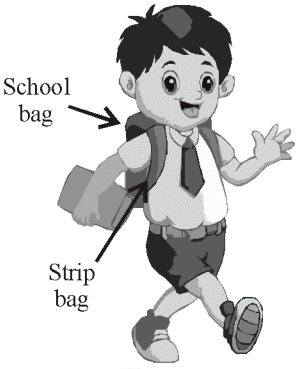


Figure 19

(ii) It is more difficult to fix a blunt nail than a sharp nail :

We all know that it is more difficult to fix a blunt nail than a sharp nail. Why ? It is because the sharper is on it.

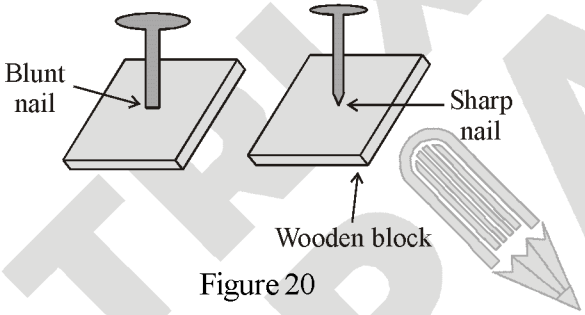


Figure 20

(iii) It is easy to cut fruits and vegetables with a sharp knife :

Daily experience tells us that it is easy to cut fruits and vegetables with a sharp knife than with a blunt one. Why ? The reason is the same that the area of contact of a sharp knife with fruit is less than that of a blunt knife. Therefore, the effect of force applied by a sharp knife is more.

Increasing Pressure :

(i) Sewing needles have pointed tips :

A small force of fingers makes the needle piece into the cloth easily and sewing becomes quicker.

(ii) The studs on football boot have only a small area of contact with the ground. The pressure under the studs is high enough for them to sink into the ground. Which gives extra grip.

Reducing Pressure :

(i) Vehicle breakes have flat surface : This reduces pressure on the vehicle's tyres and avoid their tearing.

(ii) Broad sole shoes : make walking easier on a soft land.

(iii) Wide steel belt over the wheels of an army tank makes its movement easier over marshy land.

(iv) Tractor tyres are broad : Tractors do not sink in the soft land of the field while operating them.

(v) Camel's foot are broad and soft : They walk swiftly on sand.

(vi) Hanging bags have wide strips : They reduce pressure on the shoulders.

(vii) Skis have a large area to reduce the pressure on the snow so that they do not sink in too far.

5.2 PRESSURE EXERTED BY LIQUIDS

When an object is immersed in a liquid, the liquid exerts a net upward force on the object. This upward force determines whether an object will float or sink in a liquid. If the upward force exceeds the weight of the object, the object will float, if the weight of the object exceeds the upward force, the object will sink.

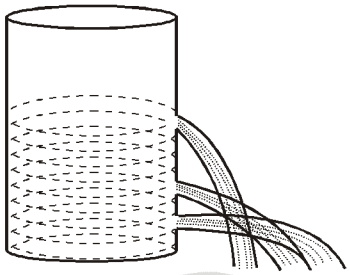


Figure 21

Pressure in a liquid increases with depth because the further down you go down greater the weight of liquid above.

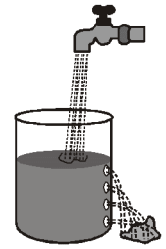
(i) The pressure experienced by deep-sea divers is so great that they have to wear specially designed suits to protect themselves. They use special suits called diving suits and buoyancy compensators to combat the weight of their diving equipment and the water pressure at great depth.

(ii) Dams are made stronger and thicker at the bottom than at the top to withstand the high pressure at greater depths.

ACTIVITY BASED LEARNING

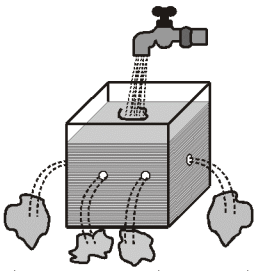
To show that liquid pressure varies with depth :

- Take a plastic container and make four holes in it at different heights. Fill the container with water, and let water keep flowing into it from a tap (figure a)
- Notice the force with which water comes out of the holes.
- You will find that water comes out with greater force from the holes at greater depth. Water from the botom most hole will be spurted out the farthest from the container. This shows tha the pressure in a liquid increases with increasing depth.



(a) Water pressure increases with depth

Figure 21 (a), (b)



(b) Pressure at the same depth is the same in all directions

BUILD THE CONCEPT

Q. 1. The dams of water reservoir are made thick near the bottom. Why ?

Ans. Pressure exerted by a liquid column = $h\rho g$ so as 'h' increases P increases. So to withstand high pressure dams are made thick near the bottom.

Q. 2. The blood pressure in human is greater at the feet than at the brain. Why ?

Ans. The height of blood column is quite large at feet than at the brain, hence blood pressure at feet is greater.

5.3 PRESSURE EXERTED BY GASES

All the gases exert pressure on the walls of container because gases are made of tiny particles called molecules which move around quickly in all directions that collide with one another and with the walls of the container that gives rise to pressure due to constant collision of the tiny molecules of the gases with the walls of the container

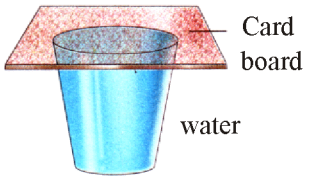
ATMOSPHERIC PRESSURE

A layer of air called the atmosphere surrounds the earth. As you know, air is also matter and has weight. The weight of the atmosphere exerts a pressure on the surface of earth. This pressure is called atmospheric pressure. Its magnitude is around 100 kilo pascals (100 kPa) at sea level. However, as we go upward, the magnitude of atmospheric pressure decreases gradually. The following activity will show the magnitude of atmospheric pressure on the earth's surface.

ACTIVITY BASED LEARNING

The magnitude of atmospheric :

▶▶ Take a glass tumbler and fill it with water to the brim. Cover it with a thick sheet of paper (or cardboard). Press your palm over the sheet and quickly invert the tumbler. Slowly remove your palm supporting the piece of paper. What do you observe ? Surprised ?



A glass with water covered with a sheet

Figure 22 (a)

You have seen that the paper did not fall (as one expected it to) This is because the atmospheric pressure provides enough force to push the piece of paper unward.

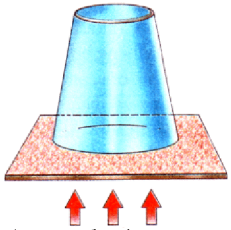


Figure 22 (b)

5.4 APPLICATION OF PRESSURE

(i) Pressure due to liquids in blood vessels helps blood to move throughout the body.

(ii) We use rubber suckers for installing hooks in the kitchen. As the air between wall and sucker is sucked out, it is held firly against the wall.

(iii) We enjoy cold drinks with a straw. This happends when air of straw goes into lungs and forces liquid from straw to come out.

(iv) Vaccum cleaner - Low pressure is created inside the cleaner which sucks dirt into the device.

(v) Squeezing of tooth paste, lemon, spray bottle, perfume bottle, etc. are some activities which are not possible without understanding pressure.

SOLVED EXAMPLES

SE1. How much would a 70 kg man weight on the moon? What will be his mass on the earth and on the moon? [g on moon = 1.7 m s^{-2}]

Ans. Mass of the man, m = 70 kg

Acceleration due to gravity on moon.g_m=1.7 ms^{-2}

Weight of the man on the moon, W = ?

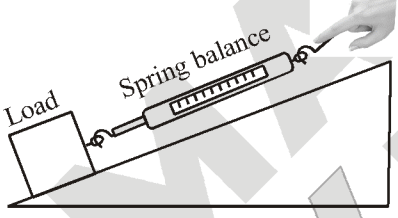
From relation, W = mg

Putting values, we get, W = 70 × 1.7 = 119 i.e. W=119.N.

The weight of the man on the moon will be 119 N

The mass will remain same (70 kg) on earth and the moon.

SE2. A student is pulling a load up an inclined plane. What are the forces the student has to overcome?



Ans. (a) Frictional' force (b) Gravitational force

SE3. Why carts with rubber tyres are easier to ply, than those with iron tyres ?

Ans. The friction between rubber and road is less, than between iron and road. Therefore, it is easy to ply a cart with rubber tyres, than with iron tyres.

4. A person weight 600 N. He is wearing shoes with a total area of 0.02 m^2. What pressure do they exert on the floor ?

Ans. $\text{Pressure} = \frac{\text{Force}}{\text{Area}}$

Given, weight = mg = F = 600 N and A = 0.02 m^2

$\therefore$ $\text{Pressure} = \frac{600}{0.02} = 30000$ N

SE5. Why are all the things attract towards the earth?

Ans. Because, the huge mass of the earth and its gravity.

SE6. What is the effect of force on the shape of an object?

Ans. A force can change or try to change the shape of an object. When a force is applied on an object then change in shape takes place. It may be smaller or greater. At last we can say that the application of force on an object may change its shape.

SE7. If several forces act in different direction on a body, in which direction will the body move?

Ans. When several forces act on a body in different directions, the effect on the object is due to the magnitude and direction of the net force acting on it.

SE8. Why do the school bags have broad shoulder straps ?

Ans. School bags and shopping bags have broad belts or straps as handles. Narrow handles cause pain in the hand because the weight of the bag acts on a small area, so the pressure will be higher.

SE9. What do you mean by state of motion of a body.

Ans. The state of motion of a body is described by its speed and direction of motion. The state of motion of an object at rest is the state of zero speed.

SE10. What happens to the pressure when area on which it is applied increases?

Ans. Pressure = Force/Area on which force acts. The pressure is inversely proportional to the area on which force is applied. As the area in which force is increases, the pressure decreases.

SE11. How do we feel force in our daily life?

Ans. Various big or small actions make us feel the force. We hit or catch many objects in our daily life. We see that a moving ball stops of its own. The ball changes the direction of its motion when hits with a bat. These are many actions which help us to feel that a force is exerted.

SE12. What are the effect of force?

Ans. A force changes or tries to change

(i) Speed of a moving body

(ii) Direction of motion of a body

(iii) Shape of a body.

SE13. A force 20 N acts over an area of 4 cm^2. Find the value of pressure? [in N m^{-2}]

Ans. Pressure = $\frac{\text{Force}}{\text{Area}}$

Given F = 20 N

and A = 4 cm^2 = 4 × 10^{-4} m

$\therefore$ Pressure = $\frac{20}{4\times10^{-4}}$ = 50000 Nm^{-2}

SE14. Can you separate two hemispheres, if all the air is suck out from them?

Ans. If there is no air inside the two hemispheres, then only outer surface is in contact of atmospheric pressure and atmospheric pressure acts on it. We cannot separate them in that case.

EXERCISE-I

ONLY ONE CORRECT TYPE

1. Pressure is also measured in :
(A) joule
(B) mm of Hg
(C) mm of Ag
(D) meter

2. When an object undergoes acceleration :
(A) Its speed always increases
(B) Its velocity always increases
(C) It always falls towards the earth
(D) A force always acts on it

3. External forces are :
(A) Always balanced
(B) Never balanced
(C) May or may not be balanced
(D) None of these

4. The net force acting on a body of mass 1kg moving with a uniform velocity of 5 ms^{-1} is :
(A) 5N (B) 0.2N
(C) 0N (D) None of these

5. How many dynes are equal to 1 N :
(A) 10^6 (B) 10^4
(C) 10^5 (D) 10^3

6. A force can :
(A) Change the direction of a moving body
(B) Change the state of rest or uniform motion of a body
(C) Change the shape of a body
(D) All of the above

7. The S.I. unit of pressure is :
(A) Newton (B) Dyne/cm^2
(C) Pascal (D) Joule

8. Which among the following will exert maximum pressure when pushded with the same amount of force :
(A) An eraser of area 2 cm^2
(B) A sharpened pencil tip
(C) The blunt end of a pencil
(D) The rear portion of a closed safety pin

9. Force per unit area is called :
(A) Energy (B) Work
(C) Pressure (D) Thrust

10. How does pressure vary as we come from mountain top to sea level
(A) Increases (B) Decreases
(C) Remains same (D) Depends on weather

11. As we go deeper beneath the surface of liquid, the pressure :
(A) Remains same (B) Increase
(C) Decreases (D) Depends on weather

12. The S.I. unit of force is :
(A) metre (B) Newton
(C) Pascal (D) Second

13. A contact force cannot act through
(A) Empty space
(B) Touching
(C) Touching with a metal rod
(D) Touching with a wooden rod

14. A body is moving with certain velocity towards right. A force of 5N is applied on it towards right and a force of 6N is applied on it towards left then:
(A) Speed of body increases towards right
(B) Speed of body increases towards left
(C) Speed of body remains the same
(D) Speed of body decreases

15. Deep-sea diving vessels have to withstand pressure from the crushing effect of sea water acting
(A) Upwards (B) Downwards
(C) Side ways (D) In all directions

16. Which of these is not a contact force :
(A) Friction
(B) Muscular force
(C) Magnetic force
(D) None of these

17. A force has :
(A) Magnitude only
(B) Direction only
(C) Both magnitude and direction
(D) None of these

18. When a force is applied on a body it may change its :
(A) Speed only
(B) Direction only
(C) Both magnitude and direction
(D) None of these

19. Gravitational force acts
(A) Only between the sum and the planets moving around it
(B) Only between the earth and bodies on it
(C) Between all bodies in the universe
(D) Only between the sun and the earth

20. The relation between the S.I. unit of force and the weight of a 1kg mass is :
(A) 1 kg of = 1N
(B) 1 kg of = 0.98 N
(C) 1 kg of = 9.8 N
(D) 1 N = 9.8 kg

21. If a force of 100 N acts on an area of 10 m^2, the pressure eaual :
(A) 100 N/m^2
(B) 10 N/m^2
(C) 1000 N/m^2
(D) 1000 Nm^2

22. Which of the following class of force is different from others ?
(A) Magnetic force (B) Electrical force
(C) Gravitational force (D) Stretching of a spring

23. When a force is applied over a larger area, the pressure produced will
(A) Increase (B) Decrease
(C) Both (A) and (B) (D) None of these

24. For a fixed area of contact, the pressure exerted
(A) Increases with increase in force
(B) Increases with decrease in force
(C) Is independent of force
(D) None of these

25. Sharper knives cut fruits easily because :
(A) The area of conact is more
(B) The area of contact is less
(C) It shines more
(D) None of these

26. A force of 50 N is applied normally on a table top of area 2 m^2. Then the pressure exerted on the table top is :
(A) 25 Nm^{-2} (B) 50 Nm^{-2}
(C) 10 Nm^{-2} (D) 100 Nm^{-2}

27. Pressure in solids :
(A) Increases with increase in area of cross section.
(B) Increases with decrease in area of cross section
(C) Independent of area of cross section
(D) None of these

28. Atmospheric pressure,
(A) Increases with height
(B) Decreases with height
(C) Remains constant
(D) None of these

29. Amount of pressure of liquid increases with :
(A) Volume (B) Base area
(C) Mass (D) Depth

30. Which one of the following physical quantities increases as we go deeps into the sea.
(A) Temperature (B) Gravity
(C) Pressure (D) Upthrust

FILL IN THE BLANKS

(i) The pressure exerted by a force of 1N acting normally on unit area of $1m^2$ is called .....
(ii) Sharp knives cut fruit easily as area of contact ..... .
(iii) Hanging bags have ..... strips which ..... the pressure.
(vi) The ..... or push acting on a body is commonly called force
(v) A charged body ..... an uncharged body towards it.
(vi) Pascal (Pa) is the unit of .....
(vii) The north pole of a magnet ..... the north pole of another magnet.

TRUE / FALSE TYPE

(i) Atmospheric pressure increases with altitude
(ii) Pressure increases with depth
(iii) Pressure of water is equal to pressure of kerosene.
(iv) The atmospheric pressure on moon is double of Earth.
(v) Pressure is inversely proportional to the area.

MATCH THE COLUMN TYPE

1. Match the column

Column A	**Column B**
(A) Broad sole shoes	(P) Reduced pressure
(B) 1 atm	(Q) 1.01×10^5 Pa
(C) 1 pascal	(R) Thrust
(D) Normal force	(S) $1\ N/m^2$

2. Match the column

Column A	**Column B**
(A) Magnetic force	(P) Non-contact force
(B) A physical quantity that determines the pressure in liquids	(Q) Depth
(C) Force	(R) $N\ m^{-2}$
(D) Pressure	(S) Newton

3. Match the column

Column A	**Column B**
(A) Electrostatic force	(P) Spring balance
(B) Frictional force	(Q) Pascal
(C) Weight	(R) Contact force
(D) Pressure	(S) Non-contact force

EXERCISE-II

VERY SHORT ANSWER TYPE

1. Is weight a force? Write the SI unit of force.
2. What are different types of forces?
3. Define 1 kgf.
4. Name two units of force.
5. Write the SI unit of pressure.
6. Name the natural force that show down a moving body.

SHORT ANSWER TYPE

7. Skis have a large area of contract with snow.
8. A needle has a pointy tip.
9. It is easier to use a sharp knife as compared to a blunt one.
10. Dams are made stronger and thicker at the bottom that at the top.
11. Deep sea divers have to wear specially designed suits.
12. Building foundations have a large horizontal area of contact with the ground.
13. Athletes wear specially designed shoes with spikes on the soles.
14. A woman walking across a lawn in high heeled shoes would leave a deeper impression on the ground than an elephant
15. It is easier to sew with a pointed needle than with a blunt needle.
16. It is necessary to keep the bathroom floor clean and free of oily substances.
17. What is the main use of a spring balance?
18. What do you mean by thrust?
19. Give two advantage of friction.
20. Give two disadvantages of friction.
21. Define weight of a body. Name the unit used to measure it
22. What are the factors on which the pressure of a liquid depends?
23. Why do we feel pain when we walk on a ground having small pebbles?

LONG ANSWER TYPE

24. What are electrostatic forces?
25. Distinguish between mass and weight.
26. Explain how it is possible to drink a liquid by using a straw?
27. Why are dams made broader at the bottom than at the top?
28. Explain in suitable detail, the effect of force on a body.
29. Explain the basic principle of gravitational force. How will you measure it? Write its SI unit.
30. Define force. Briefly explain different units of force.
    (i) What do you mean by atmospheric pressure?
    (ii) Why does a fountain pen start leaking at higher altitudes?
31. Why is one end of a drawing pin kept wide, but the other end very sharp?
32. What is force? Explain the four effects a force can produce, giving relevant examples.
33. Explain contact and non-contact forces by giving suitable examples.
34. Distinguish between thrust and pressure. Write their units. What is the relation between them?
35. Define pressure. Name the unit used to measure it.

NUMERICAL PROBLEMS

36. In a game of tug of war, three girls of team A pull the rope with forces of 100N, 120N and 170N. In team B, the three members pull the rope with force of 130N, 150N and 155N. Who will win the tug of war ? What is the resultant force ?

37. A horse pulls a cart with a force of 1500 N. The force of friction between the cart and the ground is 1500 N. The cart does not move. Why ?

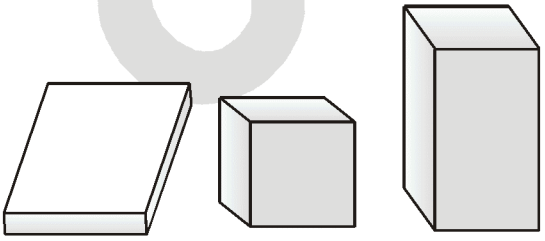
38. A force of 500 N acts on a square piece of plywood, each of whose sides is 5m long. Calculate the pressure acting on the piece of plywood

39. A body stands on the ground. The area below his feed is 70 cm^2. The pressure he exerts on the ground is 7N/cm^2. Calculate the total force acting on the ground.

40. A force exerts a pressure of 45 N/m^2 when it acts on an area of 10m^2. Calculate the total force.

41. A force of 400 N exerts pressure of 20 N/cm^2. What is the area on which the force acts.

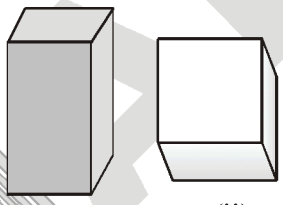
42. The picture shows a heavy box placed on the floor in three different ways. In which case would the pressure on the floor be the least ? When would it be the most ? Why ?



(i) (ii) (iii)

43. You want to lift a heavy box. The force of gravity pulls it down wards with a force of 500 N. Your father applies an upward force of 280 N form below. How much force will you have to apply to lift it upwards ?

44. The surface area of the end of a brick 50 cm^2. The surface area of the base brick is 200 cm^2. Each brick weighs 50N. What pressure is exerted on the ground by the brick in the two cases shown here ?



(i) (ii)

EXERCISE I ANSWER KEY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B	**D**	**C**	**C**	**C**	**D**	**C**	**B**	**C**	**A**	**B**	**B**	**A**	**D**	**A**
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
C	C	C	C	C	B	A	B	A	B	A	B	B	D	C

FILL IN THE BLANKS

(i) 1 pascal (ii) Reduces (iii) Broad, reduces (iv) pull (v) attract

(vi) Pressure (vii) repel

TRUE / FALSE

(i) F (ii) T (iii) F (iv) F (v) T

MATCH THE COLUMN

1. (A)-P, (B)-Q, (C)-T, (D)-S **2.** (A)-P, (B)-Q, (C)-S, (D)-R

3. (A)-S, (B)-R, (C)-P, (D)-Q

EXERCISE II

NUMERIC PROBLEMS

36. Team B will win, 45N

37. Same force applied in opposite direction so resultant force zero

38. 20N

39. 490N/cm^2

40. 450 N/m^2

41. 20 cm^2

42. Fig(i) least pressure because is area is minimum

43. More than 220 N

44. (i) for standing brick 1N/cm^2 (ii) For the brick lying on its box = 0.25 N/cm^2

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : NUTRITION IN ANIMALS)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
Solved Examples			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

NOTES :

1. In the status, put "completed" only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.

FRICTION

1. INTRODUCTION

Friction is found every where in the world. You can feel the effects of friction when you ride a bicycle, while walking, and even when you sit on a sofa, without it we could not walk, drive cars, climb ropes etc. Friction is a contact force that opposes the relative motion of two bodies. It is natural to assume that friction is caused by roughness of the surface in contact.

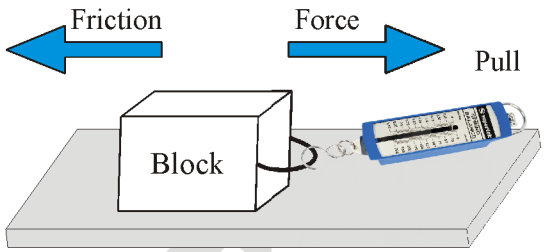


Figure 1

2. FRICTION

The force which opposes the relative motion between two surfaces in contact is called friction. The force of friction always opposes the applied net force that may be push or pull.

The magnitude of the frictional force depends on the types of surfaces in contact. The frictional force is usually larger on the rough surfaces and smaller on the smooth surfaces.

2.1 CAUSE OF FRICTION

The friction between any two sufaces is mainly caused by the following factors :

(a) Due to the interlocking of surfaces :

No solid surface is perfectly smooth. This means all solid surfaces are rough. The degree of roughness varies from surface to surface. Some are more rough, while some others are less. Even a surface which looks smooth to the naked eyes is actually rough. In the case of highly rough surfaces, the surface roughness can be seen, felt easily.

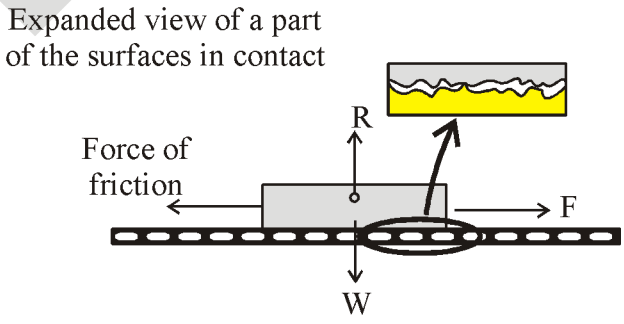


Figure 2

Roughness of the surfaces in contact can be seen as the presence of hills and valleys in expanded view of a part of the surface is shown in figure.

In the case of surfaces which appear to be smooth, the surface roughness can be seen only with the help of a microscope. A magnified view of the surface roughness is shown alongside.

When a body (say, a wooden block) is pulled over another, these 'hills' and Valleys' interlock with each other and oppose the relative motion between the two bodies. This gives rise to a frictional force. Thus, friction is due to the roughness of the two surfaces in contact.

(b) Due to force of adhesion between the two surfaces :

Two rough surfaces when placed together meet only at certain points. The atoms or molecules present at such points of contact attract each other due to electrostatic attractions. These attractions are called forces of adhesion. When one body is made to move over the other, the force of adhesion opposes the motion. This force which opposes the motion also gives rise to frictional force. So, the force of adhesion between the two surfaces gives rise to friction.

2.2 DIRECTION AND MAGNITUDE OF FRICTIONAL FORCE

When a block is pulled by force F towards the right, the force of friction acts towards the left and when the block is pulled by force F towards the left, the force of friction acts towards the right.

So we can say that force of friction always acts in the direction opposite to that of motion or intended motion.

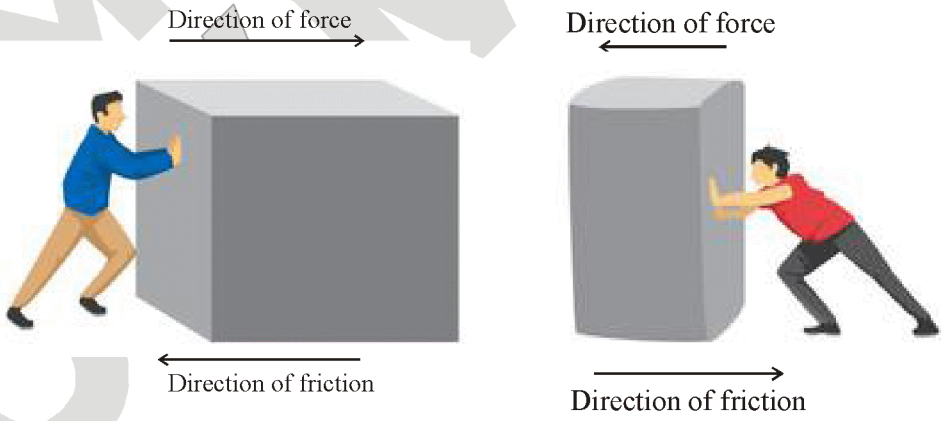


Figure 3

2.3 FACTORS ON WHICH FRICTION FORCE DEPENDS

The force of friction depends upon the following factors.

(i) On a horizontal surfaces, the force of friction is directly proportional to the weight of the body which moves.

(ii) The force of friction depends on the nature of surface in contact. For example, the force of friction between a pair of polished surfaces is very small as compared to the force of friction between two rough surfaces.

(iii) The force of friction does not depend upon the area of the surfaces in contact till weight remains the same.

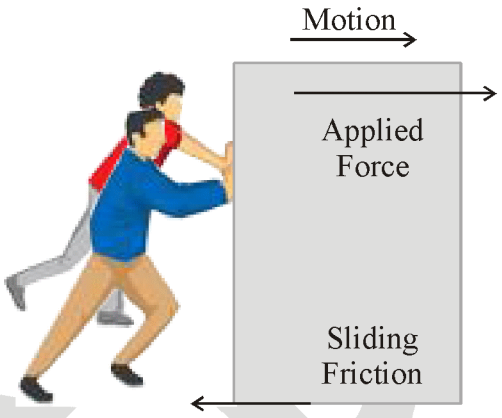


Figure 4

BUILD THE CONCEPT

A boy falls down when he steps on a banana peel. Why ?

Explanation :

When a boy walks on a road, the friction between soles of his shoes and the road surface is quite large. Thus, he has an adequate grip on the road surface and he can walk easily. When he steps on a banana peel, a smooth layer of banana peel between his shoes and the road reduces the friction significantly. This causes the boy to slide easily see figure.

3. TYPES OF FRICTION

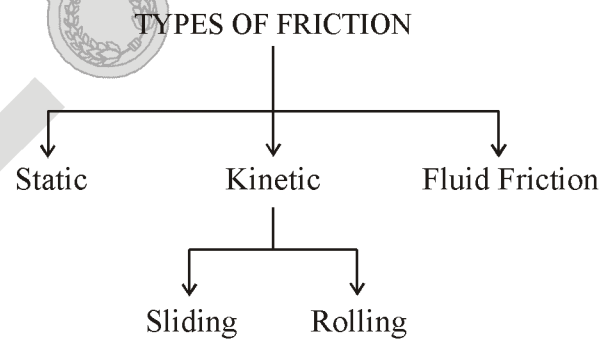


Figure 5

3.1 STATIC FRICTION

Friction is a self-adjusting force. Thus, when the applied force is gradually increased, the force of friction also increases at the same rate and the body remains stationary. This force of friction is called force of static friction (f_s) or simple static friction. If the applied force is increased further, a stage reaches when the body begins to just move. At this stage the force of static friction is maximum ($f_{s\,max}$). The maximum force of friction when the block just starts moving is called the limiting value of the static friction, or limiting friction.

For example : Place a rectangular block with a hook on one side on a table. Attach a spring balance to the hook to measure the least horizontal force needed to make the block move.

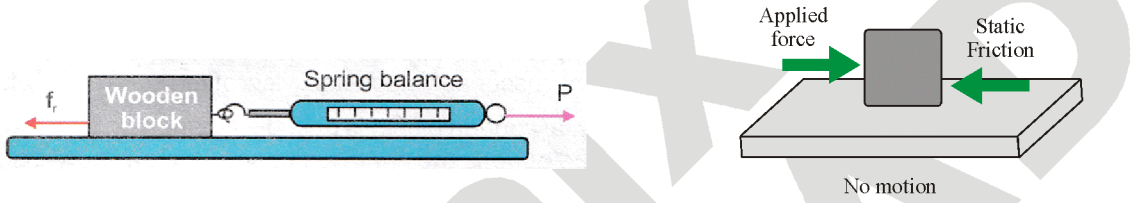
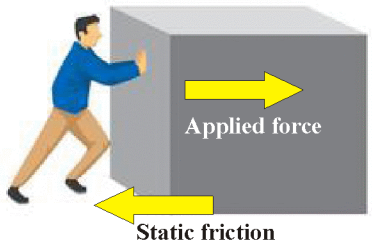


Figure 6 : Static Friction

Apply a small force on the block by pulling the spring balance. The block remains at rest because a force of friction, f_r, equal but opposite to the applied pull comes into action between the surfaces. Increase the force a little, the block does not move. This means that the force of friction has increased to balance the pulling force on the block. If the pulling force P is increased further, at a certain stage for the block static friction will be maximum.

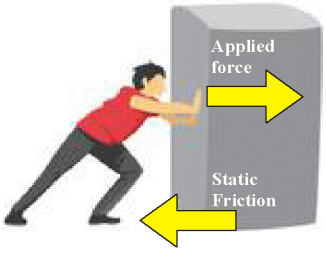
Focus Point

Static Friction is greater than sliding friction. This is because it takes more force to break the interlocking between two surfaces than it does to keep them sliding once they are already moving.



Static friction balances,
the force applied to the box

Figure 7 (a)



Static friction increases to balance
the greater force applied to the box

Figure 7 (b)

3.2 KINETIC FRICTION

It is the friction experienced by a body, when it is in motion. The Kinetic friction is also called Dynamic friction, and is less than the static friction. It includes sliding friction & rolling friction.

(A) Sliding Friction : The force of friction between the two surfaces in contact when one surface slides over the other is called sliding friction.

For example : Continue pulling the block with the spring balance, so that it slides at a steady speed. The reading on the spring balance is also steady. Kinetic or sliding friction between the two surface is acting.

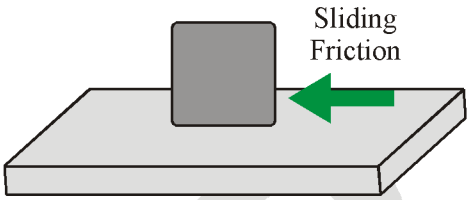


Figure 8 : Sliding Friction

The force required to keep a body in motion is less than the force required to start the motion. Therefore sliding (kinetic) friction is less than the limiting

Focus Point

The direction of sliding friction is opposite to the applied force. Also, the direction of sliding friction is always opposite to the motion of the sliding object.

(B) Rolling Friction : The force of friction between the two surfaces in contact when one of them is rolling on the other is called rolling friction.

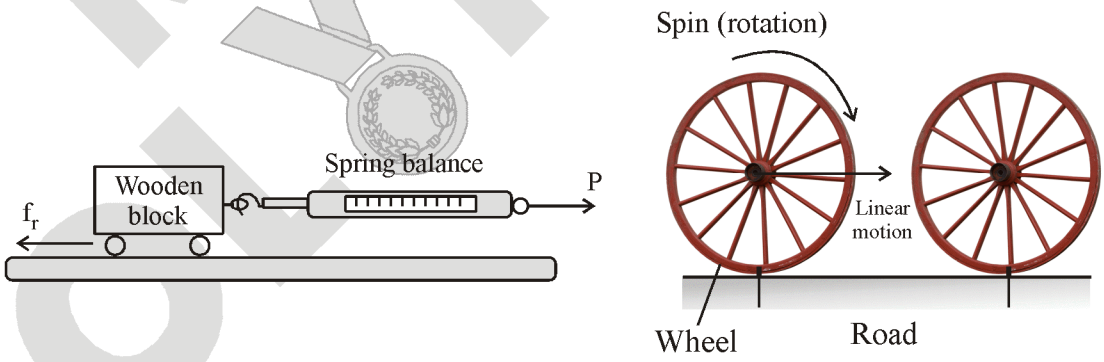


Figure 9

Provided with wheels on either side, the reading on the spring balance when the block moves with a steady speed is much less than the sliding friction measured above. Rolling friction is less than sliding friction.

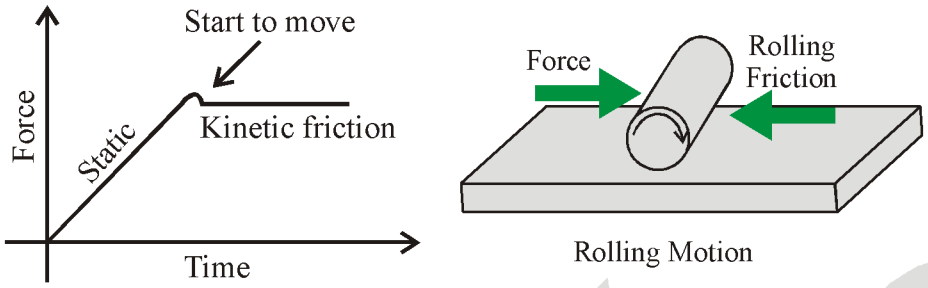


Figure 10

3.3 FLUID FRICTION

Fluids are the substances which can flow an application of force or pressure on them. Gases and liquids are fluids. The force of friction exerted by the fluids on the objects moving through them is called fluid friction.

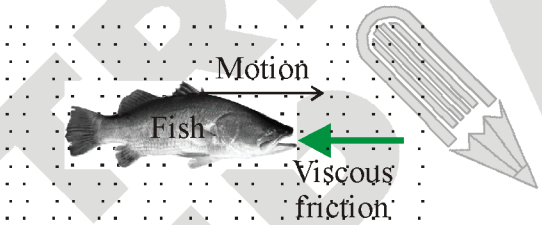


Figure 11

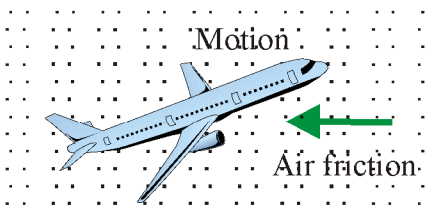
⇒ The frictional froce exerted by fluids is also called drag. Fluid friction affects a boat moving through water and an aeroplane flying through air.

⇒ Air is a mixture of gases and it is also a fluid. Though air is very light, yet it exerts frictional force on objects moving through it. This friction is called air resistance.

⇒ Air resistance is a form of friction that acts to slow down any object moving in the air.

Similarly, water and other liquids exert force of friction when objects move through them. This friction is called viscous friction.

⇒ The resistance offered by the liquids to the motion of the object moving through them is called viscous friction.



Motion through air

Figure 12

Factors that affect fluid friction :

The fluid friction (air resistance or viscous friction) on an object moving in a fluid depends on:

(i) Speed of the object in the fluid : The faster an object moves in a fluid the greater is the fluid friction acting on it.

(ii) Shape of the object moving in the fluid : For example, a piece of paper falls. Here, the force of friction on the flat piece of paper is more than the piece of paper crumpled into a ball.

(iii) Nature of the fluid : This means a given object experiences different amounts of friction is different fluids. For example, an object moving with a certain speed experiences a greater friction in water than that experienced in air.

4. ADVANTAGES AND DISADVANTAGES OF FRICTION

4.1 ADVANTAGES OF FRICTION

Friction plays an important role in our daily life :

(a) Without friction we would slip and fall every time we attempt to walk or run. There is very little friction on a wet polished floor. That is way it is easy to slip on such a floor.

Figure 13

(b) Friction causes nails and screws to hold on to walls.

(c) It would not be possible to light a matchstick without friction between its head and the side of the match box.

(d) Cars and buses are able to run or roads because of friction between the tyres and the road.

(e) Without friction writing on paper would be impossible as the tip of the pen will slip on paper.

(f) It is because of friction between the brake 'shoes' and wheels that bicycles and automobiles stop when brakes are applied.

4.2 DISADVANTAGES OF FRICTION

Friction is a demerit too in some circumstances :

(a) The heat produced in the moving parts of machinery due to friction results in wear and tear of the parts.

(b) Forest fires are caused due to friction between branches of trees rubbing against each other.

(c) Tyres of vehicles and soles of footwear wear out because of friction.

(d) Energy is wasted in overcoming the force of friction.

5. WAYS TO REDUCE AND INCREASE FRICTION

The friction between two surfaces can be reduced by the following methods,

5.1 WAY TO REDUCE FRICTION

(i) By Polishing the Surfaces :

Rough surfaces can be made smooth by polishing. Polishing removes 'hills' and 'valleys' from the surfaces. Therefore, polishing of the surfaces reduces the friction.

(ii) By Applying Oil or Grease on the Surfaces (or by Lubrication):

Oil/grease forms a thin layer between the two surfaces. Thus, a lubricant separates the two surfaces. This reduces the changes of interlocking of the two surfaces and thus reduces the friction.

Soap solution also acts as a lubricant. That is why we tend to slip on the floor if it is covered with soap solution.

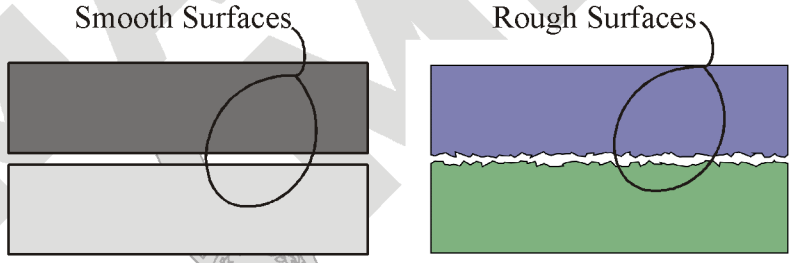


Figure 14

(iii) By Sprinkling a Soft, Slippery Fine Powder on the Surfaces :

A small quantity of talcum powder on a wooden surface or floor etc. reduces friction. This is why a small quantity of talcum powder is applied on carrom board. Graphite powder is used in machines to reduce friction.

(iv) By Using Bail-Bearings or Roller-Bearings :

When a body rolls over a surface, the force of friction is much less. That is why, friction can be reduced by using ball bearings or roller bearings in machines.

(v) By streamlining the body of an object:

Properly shaped bodies (called streamlined) experience less friction from air or water. Bodies of cars, aeroplanes, rockets, ships, etc. are streamlined. Birds and fishes also have streamlined bodies.

5.2 WAY TO INCREASE FRICTION

The friction between two surfaces can be increased by the following methods.

(i) By making the surface rough :

Friction can be increased by increasing the roughness of the surfaces in contact. For example, the surface of the head of a matchstick and the sides of the matchbox are deliberately made rough to increase the friction to produce more heat because of which the matchstick lights up easily.

(ii) By making grooves :

We can increase the friction in case of tyres of bicycles, cars, buses, etc. by making grooves in them. Due to greater friction, the tyres get a better grip on the road which prevents skidding of the vehicles.

6. FRICTION DUE TO LIQUID AND GASES

It has been found that when a solid moves in a liquid or a gas the surface of the solid experiences friction. However, it is found that liquids exert less force of friction as compared to the solids. Similarly, the gases exert least force of friction as compared to the solids or liquids. As the most common liquid is water and most common gas is air, therefore, we will discuss friction due to water and friction due to air. The frictional force exerted by fluids is also called drag.

The force of (fluid) friction on an object, in a fluid, depends on -

(i) Nature of fluid.

(ii) Shape of the moving object (the area of contact).

(iii) Speed of the moving object with respect to the fluid.

6.1 FRICTION DUE TO WATER

Before we discuss the friction due to water, let us know about the "streamlined shape". The special shape of a body or an object around which a fluid (air or water) can flow easily offering minimum amount of friction is called streamlined shape.

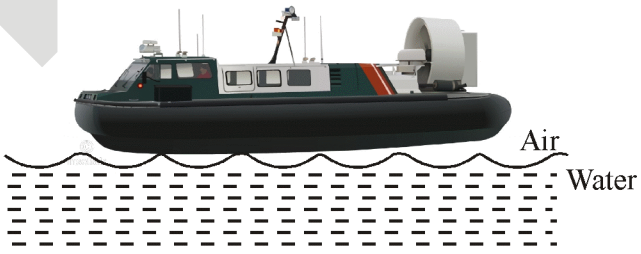


Figure 15 : Hovercraft moving just above water. Air cushion present between hovercraft and water reduces friction. This gives a smoother and faster drive as compared to a boat

Examples:

(A) The body of ships and boats is streamlined so that they experience minimum amount of friction while moving through water.

(B) In nature the body of fishes is streamlined, such that they experience least amount of friction in water.

(C) When a swimmer swims in water he tries to streamline his body as far as possible so that he experiences least friction due to water.

6.2 FRICTION DUE TO AIR

Friction due to air is so small that we hardly feel it. However following activity will show the friction of air.

ACTIVITY BASED LEARNING

Take a full sheet of paper and allow it to fall down from the level of your head. Record the time in which the sheet of paper reaches the ground level. Now crumple the sheet in the form of a ball and allow it to fall down from the level of your head. You will notice the crumpled ball quickly reaches the ground level. Why?

It is because when the sheet is flat, it has a large surface area which experiences a large force of friction due to air and hence slows down. However, when the sheet is crumpled in the form of ball, it has very small surface area. The small surface area experiences less force of friction due to airand hence reaches the ground level quickly.

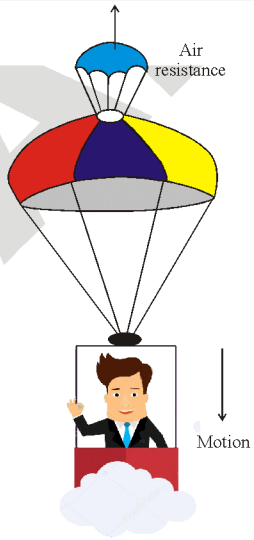


Figure 16 : This parachutist need not worry he will land safely on the ground as friction offered by air slows down his speed

Examples:

(A) Nature has shaped the body of birds in such a way that air offers least resistance and hence they can fly with good speed.

(B) The body of aeroplanes is streamlined so that the air offers least possible friction.

(C) The body of automobiles (cars, buses, motorcycles, etc.) is streamlined so that air offers least possible friction.

(D) The meteors (shooting stars) enter the atmosphere of the earth at a very high speed. At such speeds the friction due to air is extremely high. Due to this high friction the temperature of meteors rises to such a high degree that they catch fire.

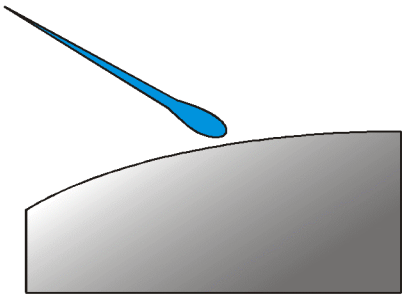


Figure 17

7. CONCEPT OF MAP

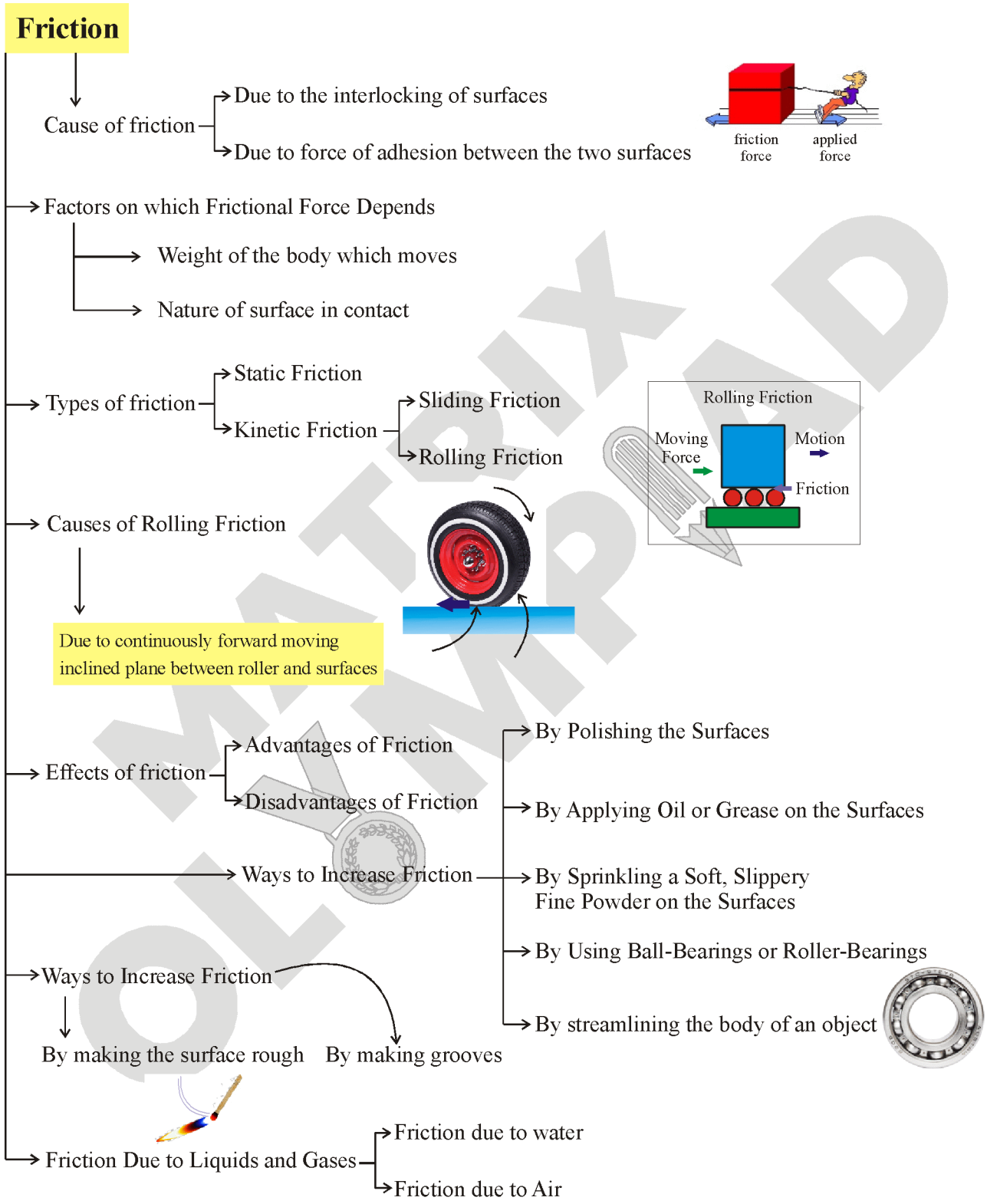


Figure 18

SOLVED EXAMPLES

SE1. Give two positive effects of friction.

Ans. Positive effects of friction are as follows:

(a) Friction is needed for walking or holding a pair of chopsticks.

(b) Friction is used in braking pads to slow down cars.

SE2. A force of 50 N is needed to keep a trolley of mass 60 kg moving at a uniform velocity of 2 m s^{-1}. What is the frictional force on the trolley?

Ans. The frictional force on the trolley is 50 N. Because the force applied here is used to over come the frictional force at the surfaces in contact.

SE3. Give two ways to increase friction?

Ans (a) Sand and gravel is strewn on slippery ground during the rainy season to increase friction,

(b) Gymnasts apply a coarse substance on their hands to improve their grip.

SE4. Why do we shape aeroplanes like that of a bird?

Ans. The moving 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 over coming the frictional force exerted by air to fly. Therefore aeroplanes are also shaped streamlined, so that they can overcome the frictional force of air.

SE5. Mention three examples which show that friction produces heat.

Ans. Some examples are following which show that friction produces heat:

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

(b) Jar of mixer becomes hot when it is run.

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

SE6. Why we could not write with chalk if there were no friction?

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

SE7. What is fluid friction? Write the factors on which fluid friction depends.

Ans. The gases and liquids are called fluids. The friction exerted by fluids on objects is called fluid friction. The fluid friction is also called drag. The fluid friction of an object depends on its speed with respect to fluid, shape of the object and the frictional force due to fluids also depends on the nature of the fluid.

SE8. A large size brake on bicycle is as effective as small one. Comment.

Ans. Action of brakes is based upon friction. But the friction is independent of the area of surfaces in contact as long as the normal reaction remain the same. Hence, large size brakes and normal size brakes will be equally effective if the material of brakes remains unchanged.

SE9. Proper inflation of tyres of vehicles saves fuel. Why?

Ans. When the tyre is properly inflated, the area of contact between the tyre and the ground is reduced. This reduces rolling friction. Consequently, the automobile covers greater distance from the same quantity of fuel consumed.

SE10. How does friction affected by the nature of surface?

Ans. Nature of surface is the major factor which affect 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.

EXERCISE-I

ONLY ONE CORRECT TYPE

1. A force that opposes the motion of one surface over another is called :
(A) Lubrication (B) Ball bearing
(C) Friction (D) Polishing

2. Which of the following is the greatest :
(A) Limiting friction (B) Sliding friction
(C) Rolling friction (D) Can not say

3. What type of frictional force comes into play when wheat is grinded in floor mill :
(A) Rolling friction (B) Sliding friction
(C) Static friction (D) None of these

4. What type of frictional force comes into play in case of car moving on a straight road :
(A) Rolling friction
(B) Sliding friction
(C) Static friction
(D) Both (A) & (B) are correct

5. Name the force responsible to fall down a boy when he steps on a banana peel.
(A) Force of friction
(B) Gravitational force
(C) Both A & B
(D) None of these

6. An object is at rest on a floor, a force is applied to move that object which friction force will comes into an action at this moment ?
(A) Sliding friction (B) Static friction
(C) Rolling friction (D) Fluid friction

7. Which of the following statement is not true ?
(A) Friction makes the things slow down
(B) Friction produce heat
(C) Friction can stop the moving object
(D) Friction is not useful

8. Friction is most often experienced when :
(A) When two object are in contact
(B) When two object are not in contact
(C) Both A and B
(D) None of these

9. Examples of dry lubricants are :
(A) Finely grinded graphite
(B) Talcum powder
(C) Boric acid
(D) All are correct

10. Ball bearing are used to
(A) Decrease friction
(B) Decrease surface area
(C) Increase friction
(D) Increase surface area

11. Lubricants are used to :
(A) Reduce friction
(B) Increases friction
(C) Make a surface oily
(D) Make a surface shiny

12. Friction can be increased by :
(A) Making the surface rough
(B) Increasing the mass of object
(C) Both (A) and (B)
(D) None of these

13. When a bicycle travels on a rough surface, its speed
(A) Increases
(B) Decreases
(C) Remains the same
(D) None of these

14. If we polish the two surfaces which are in contact with each other, the frictional force acting on them will be :
(A) Increases (B) Decreases
(C) Remains same (D) Nothing can be said

15. If we apply oil on door hings, the friction will :
(A) Decreases (B) Increases
(C) Neither a nor b (D) None of these

16. The friction offered by wheels while applying brakes is called
(A) limiting friction (B) rolling friction
(C) sliding friction (D) All of these

17. We slip in rainy day because water
(A) acts as a lubricant
(B) increase the roughness of the surface
(C) both (A) and (B)
(D) none of these

18. A matchstick lights due to :
(A) Pressure (B) Friction
(C) Smoothness (D) None of these

19. Fluids are :
(A) gases (B) liquids
(C) gases and liquids (D) none of these

20. Smooth surfaces has
(A) Less friction force
(B) More frictional force
(C) Sometimes less and sometime more force
(D) All of these

21. The force of friction between two bodies is :
(A) Parallel to the contact surface
(B) Perpendicular to the contact surface
(C) Inclined at 30° to the contact surface
(D) Inclined at 60° to the contact surface

22. The easiest way to move a heavy wooden crate is to
(A) tie a rope on one end and pull
(B) get friends to help push it
(C) place it in trolley
(D) none of these

23. Ball rolling on the floor stops due to :
(A) gravitational force (B) magnetic force
(C) muscular force (D) frictional force

FILL IN THE BLANKS

1. A frictional force is an example of a ..... force
2. When two bodies are made extra smooth the force of friction .....
3. Friction arises due to the interlocking of hills and ..... present in a body.
4. ..... is a self adjusting force.
5. Friction depends upon ..... of surfaces.
6. Sliding friction is ..... than rolling friction.
7. The friction that exists between a surface sliding over another is called .....
8. Limiting friction is ..... of the area of contact.
9. Friction is responsible for ..... of machine parts.
10. Boat and aeroplanes are ..... so as to reduce fluid friction.

TRUE / FALSE TYPE

(i) Friction always support the motion.
(ii) Can we reduce frition to zero by polishing surface.
(iii) Streamlined shape reduces fluid frition.
(iv) The maximum force of friction which appears when one body just slides over another is called sliding friction.
(v) Limiting friction is greater than sliding friction.
(vi) The frictional force is always in a direction opposite to the direction in which the body tends to move relative to the other.
(vii) The force of friction on a body may be zero even if it is on a rough surface.
(viii) Sliding friction is another name for static friction
(ix) Limiting friction is directly proportional to the normal reaction.
(x) Air resistance is also a form of friction.

MATCH THE COLUMN TYPE

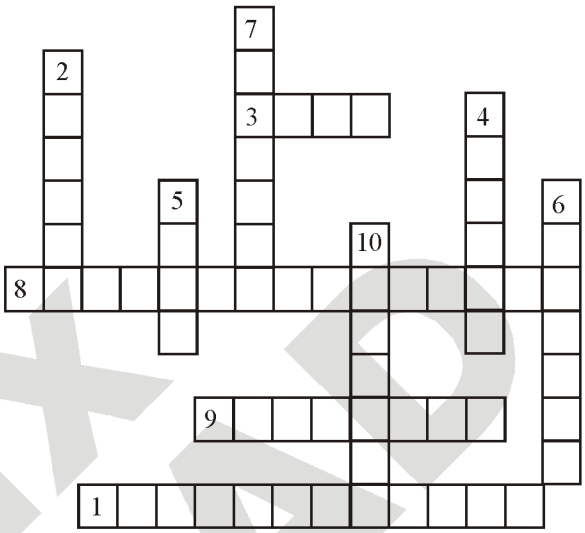
1.

Column I	Column II
(A) Friction	(P) Streamlined shape
(B) Reduces friction	(Q) Self adjusting force
(C) Grooves	(R) Special shape of body in order to experience less friction
(D) Streamlining	(S) Rolling friction
(E) Ball bearing	(T) Increases friction

2.

Column I	Column II
(A) Sparks are produced when a pair of scissors is sharpened against a grinding wheel.	(P) To make them rough and increase friction
(B) A piece of chalk wear out as it is used on a blackboad.	(Q) Friction produces heat
(C) Trolleys have wheels	(R) Friction causes wear and tear.
(D) The leather soles of new shoes are rubbed on a rough surface	(S) Rolling reduces friction

CROSS WORD PUZZLE



Across :

1. The force of friction arises due to ..... of the depression and elevations.

3. Magnitude of rolling friction is much ..... than the sliding friction.

8. Which friction is present when a body slides on the surface ?

9. The maximum static friction is also called .....

Down :

2. ..... reaction is the force exerted by the surface against the body along the direction perpendicular to the surface.

4. Which friction is present if there is no relative motion between the surfaces in contact ?

5. Friction is necessary .....

6. The sliding friction is also called ..... friction

7. ..... friction is present when a body rolls on the surface.

10. ..... friction experienced by a body, when it is in motion.

EXERCISE-II

VERY SHORT ANSWER TYPE

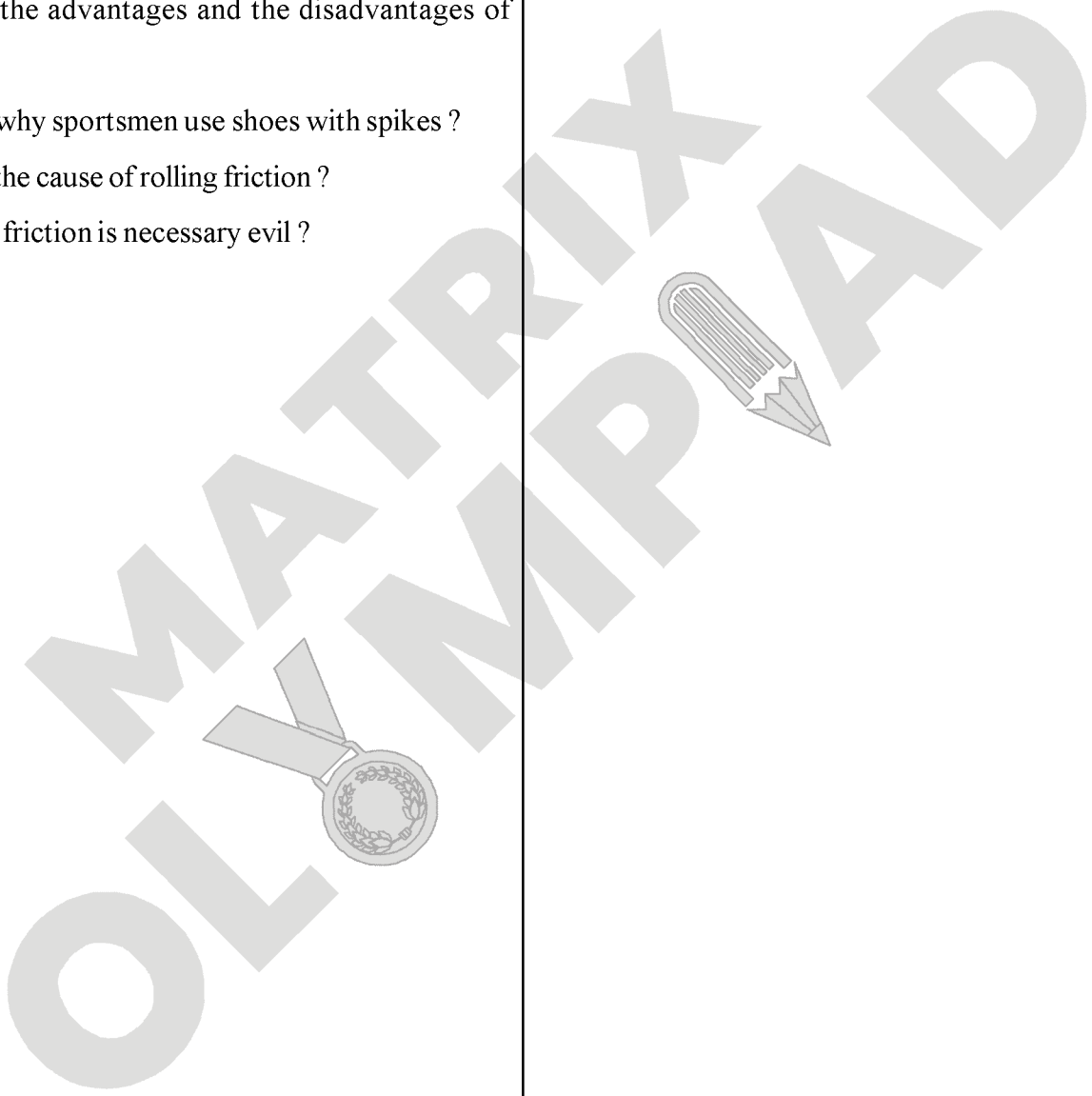
1. Define friction
2. Is frictional force a contact force ?
3. What happens to the force of friction if the surface of contact is polished ?
4. What is the direction of friction force ?
5. Does friction depend on smoothness of the surface?
6. Friction is considered as necessary Evil. Why ?
7. How many types of friction are there ?
8. Is friction force is a contact force ?
9. Why is it difficult to move on a wet marble floor ?
10. Why does a match stick catch fire when it rubbed on rough surface ?
11. What is avoided between two surfaces to make movement smooth ?
12. Why do Kabaddi players rub their hands with soil ?
13. Why are oil, creams and grease called lubricants ?
14. Name the substance which is used in carrom board to reduce friction
15. Can we eliminate friction completely ?
16. What is drag ?
17. Why do pieces of luggage fitted with rollers ?
18. What does frictional force exerted on an object in a fluid depend on ?
19. When does rolling friction come in play ?

SHORT ANSWER TYPE

1. What is the cause of friction ?
2. Push the book on a table. You observer that after sometime it stops. Explain why.
3. Why do painters use send paper in white washing the walls and in polishing doors ?
4. What are the main factors on which friction depends?
5. How does the friction affected by the nature of surface ?
6. Why is it easy to drag a mat from the floor, but it is difficult to drag the mat when some body is sitting on it ?
7. Give some methods of increasing friction.
8. Why is it not easy to move an object from its static position ?
9. We observe that in some cases we want to increase friction. Explain why ?
10. What do you mean by lubricants ?
11. Why do need to decrease friction and how it can be decreased ?
12. How do wheels reduce friction
13. Which force is responsible for slowing down a moving bicycle when we stop paddling ?
14. What are the factors on which frictional force depends in fluids.

LONG ANSWER TYPE

1. What is fluid friction ? Write the factors on which fluid friction depends ?
2. Write some methods used to reduce friction ?
3. What are the ways to reduce Friction ?
4. Explain the types of friction ?
5. Explain the advantages and the disadvantages of friction ?
6. Explain why sportsmen use shoes with spikes ?
7. Explain the cause of rolling friction ?
8. Why the friction is necessary evil ?



EXERCISE I					ANSWER KEY									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
C	**A**	**B**	**A**	**A**	**B**	**D**	**A**	**D**	**A**	**A**	**C**	**B**	**B**	**A**
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**							
C	A	B	C	A	A	C	D							

FILL IN THE BLANKS

1. Contact **2.** Decreases **3.** Valleys **4.** Friction

5. Mass and nature of the body **6.** Greater **7.** Sliding friction

8. Independent **9.** Wears **10.** Streamlined

TRUE / FALSE

(i). False (ii). False (iii). True (iv). False (v). True (vi) True

(vii) True (viii) False (ix) True (x) True

MATCH THE COLUMN

1. A-Q, B-P, C-T, D-R, E-S **2.** A-Q, B-R, C-S, D-P

CROSSWORD PUZZLE

Across :

1. Interlocking **3.** Less **8.** slidingfriction **9.** limiting

Down :

2. normal **4.** static **5.** evil **6.** dynamic **7.** rolling **10.** kinetic

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : FRICTION)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Test Examples			
Solved Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Exercise III			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

NOTES :

1. In the status, put "completed" only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.

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