



MATRIX OLYMPIAD

The Most Innovative Talent Recognition Exam

PHYSICS

Class - VII



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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MOTION AND TIME

(MEASUREMENT OF TIME AND MOTION)

1

Concepts

Introduction

1. **Different types of Motion**
 - 1.1 **Translatory motion**
 - 1.2 **Rotatory motion**
 - 1.3 **Oscillatory Motion**
2. **Distance and Displacement**
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Solved Examples

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Exercise – I (SCQ Type)

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Answer Key

INTRODUCTION

Motion is one of the more common events in your surroundings. You can see motion in natural events such as clouds moving, rain and snow falling and streams of water moving etc. Motion can also be seen in the activities of people who walk, jog or drive various vehicles from place to place. The study of motion is called ‘mechanics’ It is broken down into two parts, kinematics and dynamics. Kinematics is the “how” of motion, that is, the study of how objects move, without concerning that why they move. Dynamics is the “why” of motion. In dynamics, we are concerned with the causes of motion, which is the study of forces.

Consider a ball that you notice one morning in the middle of a lawn. Later in the afternoon, you notice that the ball is at the edge of the lawn, against a fence and you wonder if the wind or some person moved the ball. You do not know. If the wind blew it at a steady rate, or even if some children kicked it all over the yard. All you know for sure is that the ball has been moved because it is in a different position after some time passed. These are the two important aspects of motion :

- (i) A change of position
- (ii) The passage of time

Moving involves a change of position during some time period. Motion is the act or process of something changing position. The motion of an object is usually described with respect to a stationary object. Such a stationary object is said to be at ‘**Rest**’

⇒ **Motion** is a change in an object’s position with respect to time compared to a fixed object. If you ride in a car, your position changes compared to a tree or an electric pole.

⇒ An object is said to be at **Rest** if it does not change its position with time.

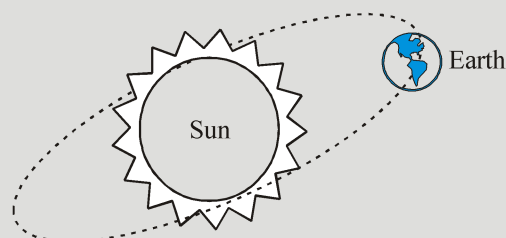


Focus Point

REST AND MOTION ARE RELATIVE TERMS

Imagine that you are traveling in an automobile with another person. You know that you are moving across the land outside the car since your location on the highway changes from one moment to another. Observing your fellow passenger show that there is no change of position.

You are in motion relative to the ground but you are not in motion relative to your fellow passenger. The motion of any object or body is the process of a change in position ‘relative’ to some reference object or location.



When sitting on a chair, your speed is zero relative to Earth but 30 km/s relative to the Sun.

Reference Point

A reference point is a starting point used to describe the position of an object. A reference point is also called the origin.

To describe an object's position, three things must be included in the description :

(i) a reference point (ii) a direction from the reference point (iii) distance from the reference point (the length of the line segment joining the reference point and the object).

1. DIFFERENT TYPES OF MOTION

1.1 TRANSLATORY MOTION

A bus moving on a road, the motion of a rising balloon, the free fall of a stone under gravity, the motion of a cricket ball when it is hit by a batsman are examples of translatory motion. Translatory motion is further classified into rectilinear motion and curvilinear motion. When an object moves along a straight path, its motion is said to be rectilinear. The marching of soldiers on a straight road, the motion of a car on a straight road, the motion of carrom board coin are examples of rectilinear motion. When an object moves along curved path, its motion is called curvilinear. A bus moving on a flyover bridge, a car taking a turn, a football kicked from the ground into the air all have curvilinear motion.

1.2 ROTATORY MOTION

In this type of motion, the object rotates about a fixed axis. The motion of blades of a ceiling fan, the spin motion of a top, the motion of turbine, the motion of the earth about its axis, all have circular or rotatory motion. In some cases, the rotatory and translatory motions take place simultaneously. When a bicycle moves, its wheels undergo translatory and rotatory motion.

1.3 OSCILLATORY MOTION

A boy on a swing moves to and fro (back and forth). The motion, such as above, where an object moves to and fro is called oscillatory motion. Other examples of oscillatory motion are the motion of the pendulum of clock, the motion of a needle of a sewing machine, the motion of a piston of an engine etc.

A metallic wire fixed at its ends, when plucked starts moving up and down. This is also an example of oscillatory motion where an object moves to and fro at faster rate. This type of motion is called **Vibratory Motion**. In the stringed instruments, such as guitar, veena, violin etc., the motion of a string is vibratory. The motion of membrane of a drum is also a vibratory motion. It must be noted that during vibratory motion, a change in size and shape takes place.

A motion that repeats itself at regular intervals of time is called **Periodic Motion**. All oscillatory motions are periodic motions. Some rotatory motions are periodic motions. The motion of earth around the sun, the motion of the pendulum of a clock, the rotation of earth about its own axis, the motion of a swing are periodic motions.

A motion repeats itself but not at fixed interval of time is called **Non-Periodic Motion**. A ceiling fan when it is switched off, a drum rolling up or down on an inclined plane, the motion of a wheel of bicycle when brakes applied are all examples of non periodic motion.

2. DISTANCE AND DISPLACEMENT

Distance and displacement are two most commonly used terms that have same dimensions and units. These two terms are often confusing but have entirely different meanings.

2.1 DISTANCE

Distance is defined as the length of the actual path covered by a particle in motion. The unit of distance is centimetre in C.G.S. system and metre in M.K.S. or S.I. system. Following points to remember related to distance.

- (i) Distance is a scalar quantity
- (ii) Distance depends on the path
- (iii) Distance is always taken positive

2.2 DISPLACEMENT

Displacement is defined as the shortest distance between the initial and final positions of a body. **It is a vector quantity**, whose magnitude is equal to the length of the straight line path from the initial position to the final position and the direction is along the straight line drawn from the initial to the final position.

The distance travelled by a particle depends on the path traced by the particle, whereas the displacement of a particle in motion is independent of the path traced and depends only on the initial and final positions of the particle.

Consider a particle moving along the path ABCD as shown below :

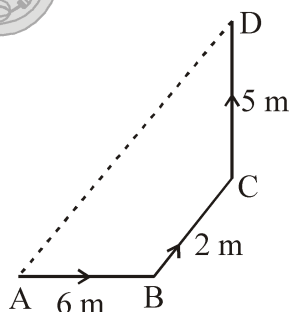


Figure : Displacement of a particle

The distance travelled by the particle = $6 + 2 + 5 = 13$ m

The displacement is the vector \overrightarrow{AD} , whose magnitude is the length of the line segment AD.



Focus Point

- Distance is always greater than or equal to the magnitude of displacement. Distance is exactly equal to displacement
 - When it follows a straight path without changing its direction.
 - When it is in uniform motion.
- Whenever a particle changes its direction or follows a curved path, distance is always greater than or equal to the magnitude of displacement.

3. SPEED

The distance covered by a body in unit time. It is the rate at which the body is moving. It means how fast or slow the body is moving

Mathematically,

$$\text{Speed (v)} = \frac{\text{Distance covered by the body (s)}}{\text{Time taken to cover the same distance (t)}}$$

Important points related to speed :

- Speed is a scalar quantity
- Speed depends on the path
- Speed gives no idea about the direction of motion of the object.
- Speed can never be negative. In motion, it is taken positive ; at rest, it is zero.
- Speed is measured in S.I. units, as mps (meter per second) or m s^{-1} .

$$\text{Now, } \frac{1\text{km}}{1\text{h}} = 1 \times \frac{1000\text{m}}{60 \times 60}$$

$$= 1 \times \frac{1000}{60 \times 60}$$

$$= 1 \times \frac{10}{36} = \frac{5}{18} \text{ m/s}$$

Example 1

Suppose an insect crawls and covers a distance of 10m in a time interval of 5 seconds, the speed of the insect

Solution :

$$\text{Speed (V)} = \frac{s}{t} = \frac{10}{5} = 2 \text{ m s}^{-1}$$

Example 2

A car travels at 20 m/s. Express the same speed in km/h.

Solution :

Convert 20 m into km $\left(20\text{m} = \frac{20}{1000}\text{km}\right)$

Convert 1s into hour $\left(1\text{s} = \frac{1}{60 \times 60}\text{h}\right)$

$$\text{Speed} = \left(\frac{\frac{20}{1000}}{\frac{1}{60 \times 60}}\right) = \frac{20 \times 3600}{1000} = 72 \text{ km/h}$$

Example 3

A bus leaves Sikar at 7 PM and reaches Jaipur at 10 PM. The speed of the bus is 40 km/h. What is the distance between Sikar and Jaipur ?

Solution :

$$\text{Distance} = \text{Speed} \times \text{Time} = 40 \times 3 = 120 \text{ km (Time } 10 - 7 = 3 \text{ hour)}$$

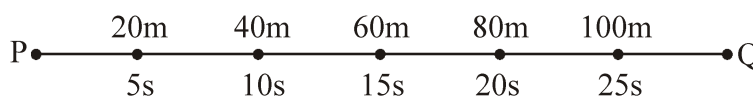
4. TYPES OF SPEED

4.1 UNIFORM SPEED (CONSTANT SPEED)

If a body covers equal distances in equal intervals of time however small these intervals may be, the body is said to be under uniform speed or constant speed.

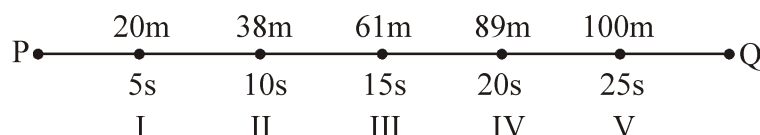
For example : A body start at ‘P’ and travels 20 m in every 5 seconds, then

$$\text{Uniform speed} = \frac{20}{5} = \frac{40}{10} = \frac{60}{15} = \frac{80}{20} = \frac{100}{25} = 4 \text{ m s}^{-1}$$



4.2 NON UNIFORM SPEED (VARIABLE SPEED)

When a body covers either unequal distances in equal intervals of time or equal distances in unequal intervals of time or both, the body is said to be under nonuniform or variable speed. For example : A body starts at a point 'p' and travels as shown in figure.



Speeds at different intervals

$$I = \frac{20}{4} = 4 \text{ m s}^{-1} ; \quad II = \frac{38}{10} = 3.8 \text{ m s}^{-1} ; \quad III = \frac{61}{15} = 4.07 \text{ m s}^{-1} ;$$

$$IV = \frac{89}{20} = 4.45 \text{ m s}^{-1} ; \quad V = \frac{100}{25} = 4 \text{ m s}^{-1}$$

It can be noticed here, though the average speed is same, the speed itself is not uniform but varying

4.3 AVERAGE SPEED

When a body starts with certain speed and changes its speed after some time and completes the journey. Then the average speed implies the overall rapidity or speed of the body.

$$\text{Mathematically, Average speed} = \frac{\text{Total distance covered by the body}}{\text{Total time taken by the body}}$$

5. VELOCITY

Rate of change of displacement or rate of change of position of a body in a specific or given direction
Mathematically,

$$\text{Velocity (V)} = \frac{\text{Displacement}}{\text{Time}}$$

If someone states that speed of a running boy is 2 m s^{-1} , it is very clear that he covers 2 m in one second. Now the question arises in which direction he is running then only it makes a complete sense and meaning. Therefore, it can be stated he is running with 2 m per second from say 'A' to 'B' or say eastwards.

Important points related to Velocity :

- (i) Velocity is a vector quantity
- (ii) Velocity can be negative, positive or zero.
- (iii) Velocity does not depend on the path, it depends only on the initial position and final position of an object.
- (iv) Velocity gives the direction of motion of an object.

- (v) Magnitude of the velocity is known as **speed** i.e. $1 \text{ km/hr} = \frac{5}{18} \text{ m/s}$.

Example 4

An object travels with a velocity of 1.5 m/s eastwards for 2s and then with a velocity of 4 m/s northwards for 1s. What is its final displacement at the end of 3s?

Solution :

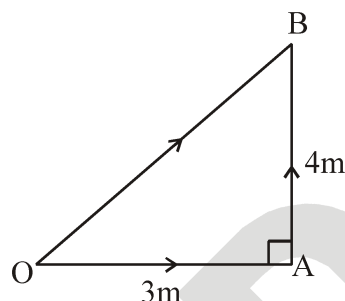
Displacement along OA = velocity × time = 1.5 × 2 = 3 m

Displacement along AB = velocity × time = 4 × 1 = 4m

Final displacement at the end of 3 s (OB)

$$OB = \sqrt{OA^2 + AB^2} = \sqrt{3^2 + 4^2}$$

$$= \sqrt{9+16} = \sqrt{25} = 5\text{m (in the direction of O to B)}$$



6. TYPES OF VELOCITY

6.1 UNIFORM VELOCITY

When a body covers equal distances in equal intervals of time in a specified direction, however small these time intervals may be, the body is said to be moving with a uniform velocity.

Imagine a car is moving along a straight road towards east, with a velocity 60 kmph. Here the uniform velocity implies per each minute it covers a distance of 1 km and for each second it covers a distance of 1/60th km.



Figure : Uniform velocity of a car

A body will have a uniform velocity only if:

⇒ It covers equal distances in equal intervals of time, i.e., the magnitude does not change.

⇒ Its direction remains the same. If any of the two conditions is not fulfilled, then the body will not be moving with a uniform velocity, but with a variable velocity.

6.2 VARIABLE VELOCITY

When a body covers unequal distances in equal intervals of time in a specified direction or equal distances in unequal intervals of time, but its direction changes then the body is said to be moving with a variable velocity.

Now imagine a car is moving along a circular path with the same velocity, 60 kmph (16.67 m s⁻¹). Here the magnitude of the velocity i.e., 60 kmph is constant but direction is continuously changing. In this case (on circular path) the car is only under uniform speed but not under uniform velocity.

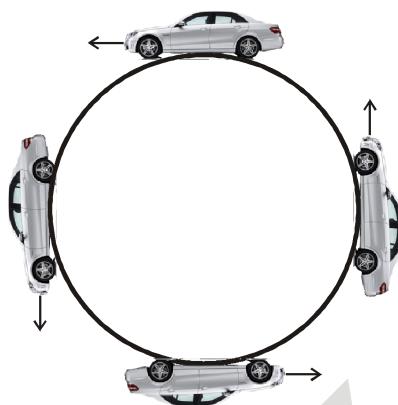


Figure : Motion of a car in circle showing variable velocity

Hence, when the car is covering equal distances in equal intervals of time, in the circular path the car is moving with a variable velocity, as the direction changes continuously.

6.3 AVERAGE VELOCITY

The average displacement of a body per unit time, when the body is actually moving with variable velocity, is called average velocity.

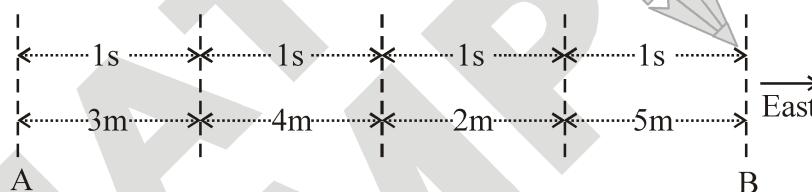


Figure : Average displacement of an object

In the above figure, the total displacement (total distance travelled) of a body towards east is $3\text{m} + 4\text{m} + 2\text{m} + 5\text{m} = 14\text{m}$. The total time is 4 s.

$$\therefore \text{Average velocity} = \frac{\text{Total displacement}}{\text{Total time taken}} = \frac{14\text{m}}{4\text{s}} = 3.5 \text{ m s}^{-1}$$

NOTE : It is possible to have a moving body with average velocity zero but not with average speed to be zero.

7. ACCELERATION

Mostly the velocity of a moving object changes either in magnitude or in direction or in both when the object moves. Then the body is said to have acceleration. So it is the rate of change of velocity i.e. change in velocity in unit time is said to be acceleration (it is a vector quantity).

Its S.I. unit is m/s^2 and C.G.S. unit is cm/s^2

$$\text{Acceleration, } a = \frac{\text{change in velocity}}{\text{time}} = \frac{v - u}{t} = \frac{\text{final velocity} - \text{initial velocity}}{\text{time}}$$

$$a = \frac{v - u}{t} \Rightarrow v = u + at$$

7.1 TYPES OF ACCELERATION

Positive acceleration

If the velocity of an object increases in the same direction, the object has a positive acceleration.

Eg. A freely falling body.

Negative acceleration (retardation)

If the velocity of a body decreases in the same direction, the body has a negative acceleration or it is said to be retardation.

Eg. A train slows down.

8. MEASUREMENT OF TIME

Time is a phenomenon by which human beings observe and record changes in the environment and in the universe. For example : The time between one sunrise and the next is called a day, a month is measured from one new moon to the next, and a year is fixed as the time taken by the earth to complete one revolution of the sun.

Often we need to measure intervals of time which are much shorter than a day. Clocks or watches are the most common time measuring devices.

One of the earliest means of measurement of time was with the help of movement and change in the position of the sun during the day, and the moon during the night. The position of stars also helped in estimating time during night. Jantar Mantar located in Central Delhi is an advanced form of a Sundial. The device used to measure time is known as a **Clock**. The older clocks like the sand clock, the water clock, were some what crude types of clocks. They only gave an approximation of a duration of time. Sundials were more accurate than the sandclocks and the water clocks. Now a days we use a wrist watch or quartz clock. A mechanical wrist watch is provided with a balance wheel which oscillates like a pendulum. In quartz clock, fast vibrating crystals of quartz oscillate at a very precise rate and hence measure time more accurately. The atomic clock is the most scientifically developed clock and therefore, is the most accurate of all. It is the atomic clock maintained at National Physical Laboratory (NPL) at Delhi, which is used to provide beeps before the morning news. These beeps indicate the standard time. This atomic clock is accurate upto a millionth part of a second.



Focus Point

- A body cannot occupy two different positions at the same instant of time.
- **Greenwich Mean Time (GMT)** : It is the time in Greenwich, England. Each time zone was described by how many hours away from GMT it was.
- Sailors used hourglasses filled with sand or powered eggshells to tell time. The powder would take one hour to flow from the top bulb to the bottom bulb.

8.1 SIMPLE PENDULUM

The working of clocks is rather complex. But all of them make use of some periodic motion. One of the most well-known periodic motions is that of a simple pendulum.

A simple pendulum consists of a small metallic ball or a piece of stone suspended from a rigid stand by a thread [see fig. (a)]. The metallic ball is called the bob of the pendulum. Fig. (a) shows the pendulum at rest in its mean position. When the bob of the pendulum is released after taking it slightly to one side, it begins to move to and fro [see fig. (b)]. The to and fro motion of a simple pendulum is an example of a periodic or an oscillatory motion.

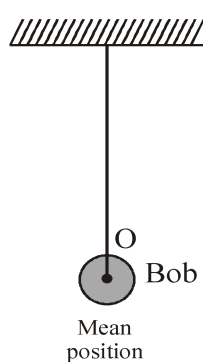


Figure (a)

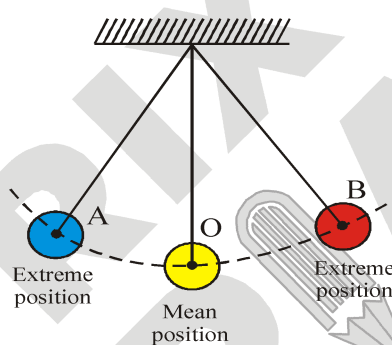


Figure (b)

Figure : Oscillatory motion of a pendulum (a) and (b)

The pendulum is said to have completed one oscillation when its bob, starting from its mean position O, moves to A, to B and back to O. The pendulum also completes one oscillation when its bob moves from one extreme position A to the other extreme position B and comes back to A.

The time taken by the pendulum to complete one oscillation is called its time period.

$$\text{Time Period} = \frac{\text{Total time taken}}{\text{No. of oscillations}}$$



Focus Point

Unit of time : The S.I. of unit of time is second (s). Some common used units of time are minute and hour.

1 minute = 60 s ; 1 hour = 60 minutes ; 1 hour = 3600 s

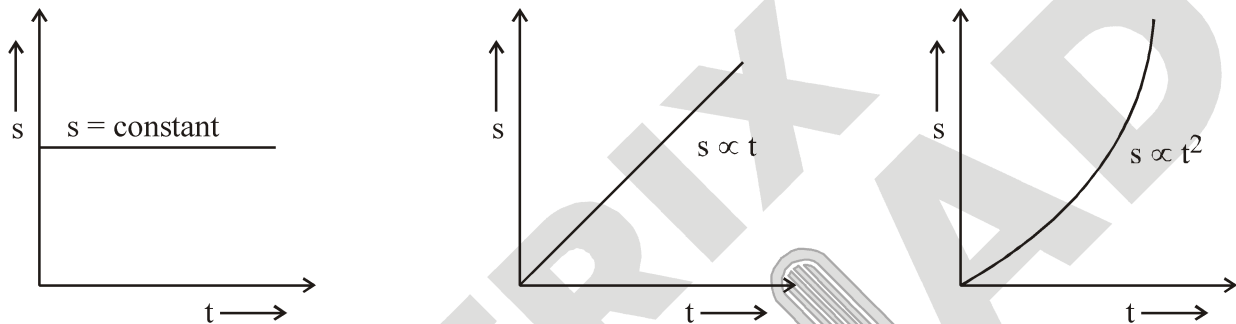
9. GRAPHICAL REPRESENTATION OF MOTION

9.1 DISTANCE TIME GRAPH

A moving body changes its position continuously with time. The simplest way to describe the motion of a moving body is to draw its distance – time graph.

⇒ Distance is taken on y-axis and time is taken on x-axis.

⇒ Distance time graph is always positive, it is always increasing NEVER decreasing.



A body at rest ($s = \text{const.}$)

A body in uniform motion

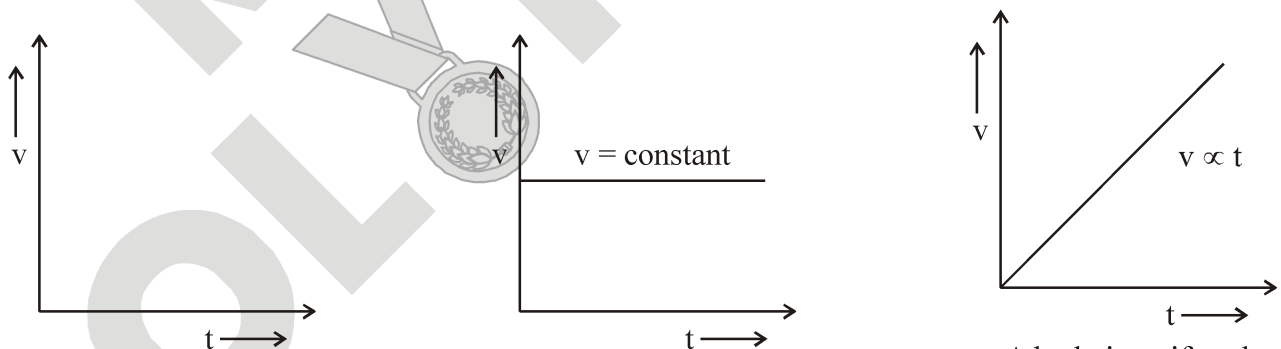
A body in uniformly accelerated motion

Figure : Distance - Time graph in different types of motion

9.2 SPEED TIME GRAPH

⇒ Speed is taken on y-axis and time is taken on x-axis.

⇒ Speed-time graph is always positive, it can be increasing or decreasing.



A body at rest
($v = 0$)

A body in uniform
motion ($v = \text{constant}$)

A body in uniformly
accelerated motion
($v = u + at$)

Figure : Speed - Time graph in different types of motion

9.3 VELOCITY TIME GRAPH

⇒ Velocity is taken on y-axis and time is taken on x-axis.

⇒ Velocity time graph can be positive or negative, it can be increasing or decreasing.

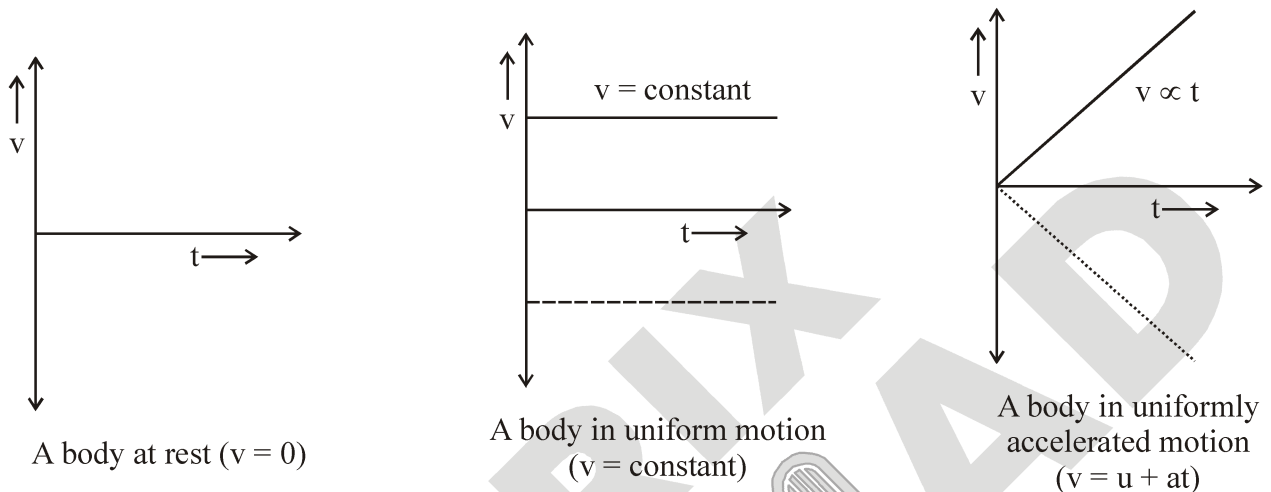


Figure : Velocity - Time graph in different types of motion

9.4 ACCELERATION TIME GRAPH

⇒ Acceleration is taken on y-axis and time is taken on x-axis.

⇒ Acceleration-time graph can be positive or negative, it can be increasing or decreasing.

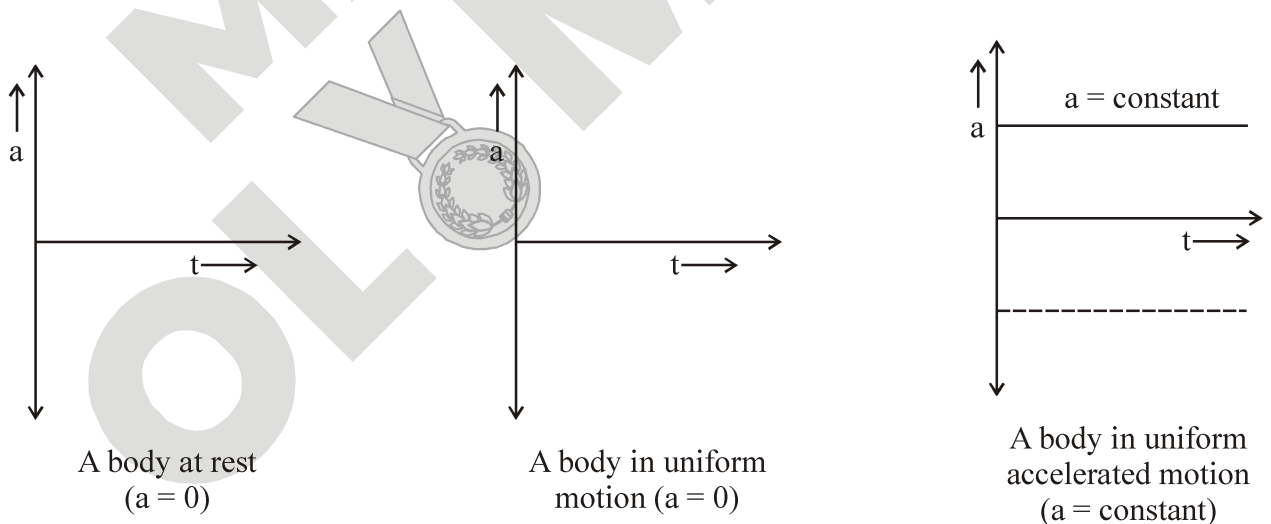


Figure : Acceleration - Time graph in different types of motion

SOLVED EXAMPLES

SE. 1

What is the difference between translatory and rotatory motion? Give their examples.

Ans. The motion of an object is said to be translatory, if the position of the object is changing with respect to a fixed point or object with time.

For e.g.– a car moving along a road.

The motion of an object is said to be rotatory if the motion of all the particles of the body is circular (i.e., along a circular path) with respect to an imaginary line called the axis of rotation.

For e.g.– A spinning top or hands of a clock, etc.

SE. 2

Which type of motion is periodic as well as oscillatory?

Ans. In case of oscillatory motion, a body as a whole moves back and forth. The motion of a pendulum is an oscillatory motion. Any motion that repeats itself at regular interval of time is called periodic motion. Clock pendulum, repeats its motion after a fixed interval of time. So, motion of pendulum is both periodic as well as oscillatory.

SE. 4

How much distance is travelled by an object if it travels at a constant speed of 60 km/h for 2 hours?

Ans. Time = 2 hours

Speed = 60 km/h

Distance = ?

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

$$60 = \frac{\text{Distance travelled}}{2}$$

$$\text{Distance travelled} = 60 \times 2 = 120 \text{ km}$$

SE. 4

Find the speed of an object which has travelled 3600 m in 1 minute.

Ans. Distance = 3600 m

Time = 1 min = 60 s

Speed = ?

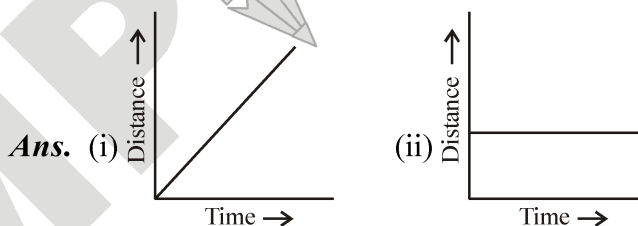
$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}} = \frac{3600}{60} = 60 \text{ m s}^{-1}$$

SE. 5

Show the shape of the distance-time graph for the motion in the following cases :

(i) A boy running with a constant speed.

(ii) A boy standing on a side road.



SE. 6

What was a year as per our ancestors?

Ans. A year was fixed as the time taken by earth to complete one revolution of the sun.

SE. 7

What are x and y-axis in a graph?

Ans. The horizontal line in a graph is called x-axis and vertical line is called y-axis.

SE. 8

On which axis are dependent variables represented?

Ans. The dependent variables are represented on y-axis.

SE. 9

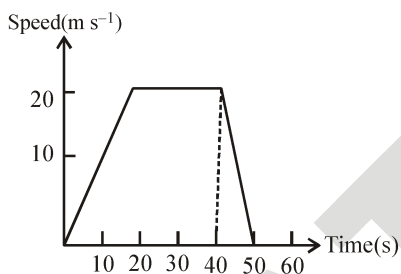
A horse runs a distance of 200 m in 10 s. What is the speed of the horse in (i) m/s (ii) km/hr.

Ans. Speed = $\frac{\text{distance}}{\text{time}} = \frac{200}{10} = 20 \text{ m/s}$

$\frac{200/1000}{10/3600} = \frac{2}{10} \times \frac{3600}{10} = 72 \text{ km/hr}$

SE. 10

The graph in figure shows the movement of a car over a period of 50 s. What distance was travelled by the car while its speed was decreasing?



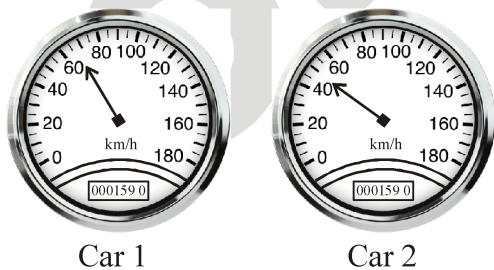
Ans. The speed was decreasing in the time interval between 40 s and 50 s.

Distance travelled = area under the graph between 40 s and 50 s

$= \frac{1}{2} \times 20 \times 10 = 100 \text{ m}$

SE. 11

Look at the two car speedometers drawn below. Which one is travelling faster?



Ans. The first car is moving faster than second car.

SE. 12

A train travels at 180 km/h. In one hour the train travels ___ km. In four hours it will travel ___ km.

Ans. In one hour the train travels 180 km. In four hours it will travel $180 \times 4 = 720 \text{ km}$.

SE. 13

The Rajdhani express travels at a speed of 80 km/h. The distance between Delhi and Chennai is 2200 km. If it starts from Delhi at 3.00 p.m., what time does it reach Chennai?

Ans. Speed = 80 km/h; Distance = 2200 km.

It covers 80 km in one hour. Therefore, it covers 2200 km in $(2200 \div 80) = 27.5$ or $27 \frac{1}{2}$ hours.

It reaches Chennai at 6.30 p.m. the next day.

NS. 1

Classify the following as motion along a straight line, circular or oscillatory motion:

- (i) Motion of your hands while running.
- (ii) Motion of a horse pulling a cart on a straight road.
- (iii) Motion of a child in a merry-go-round.
- (iv) Motion of a child on a see-saw.
- (v) Motion of the hamper of an electric bell.
- (vi) Motion of a train on a straight bridge.

- Ans.** (i) Oscillatory motion
 (ii) Rectilinear motion
 (iii) Circular motion
 (iv) Oscillatory motion
 (v) Oscillatory motion
 (vi) Rectilinear motion

NS. 2

Which of the following are not correct?

- (i) The basic unit of time is second.
- (ii) Every object moves with a constant speed.
- (iii) Distances between two cities are measured in kilometres.
- (iv) The time period of a given pendulum is not constant.
- (v) The speed of a train is expressed in m/h.

- Ans.** (ii), (iv) and (v)

NS. 3

A simple pendulum takes 32 s to complete 20 oscillations. What is the time period of the pendulum?

Ans. Time period of pendulum = time taken to complete

$$1 \text{ oscillation} = \frac{32}{20} = 1.6 \text{ s}$$

NS. 4

The distance between two stations is 240 km. A train takes 4 hours to cover this distance. Calculate the speed of the train.

$$\begin{aligned} \text{Ans. Speed} &= \frac{\text{Distance covered}}{\text{Time taken}} = \frac{240}{4} \text{ km/h} \\ &= 60 \text{ km/h} \end{aligned}$$

NS. 5

The odometer of a car reads 57321.0 km when the clock shows the time 08:30 AM. What is the distance moved by the car, if at 08:50 AM, the odometer reading has changed to 57336.0 km? Calculate the speed of the car in km/min during this time. Express the speed in km/h also.

$$\begin{aligned} \text{Ans. Distance moved by the car} \\ &= 57336.0 - 57321.0 = 15 \text{ km} \end{aligned}$$

$$\text{Speed} = \frac{15 \text{ km}}{20 \text{ min}} = \frac{3}{4} \text{ km/min}$$

$$\text{Also, Speed} = \frac{15 \text{ km}}{\frac{1}{3} \text{ hr}} = 45 \text{ km/h}$$

NS. 6

Salma takes 15 minutes from her house to reach her school on a bicycle. If the bicycle has a speed of 2 m/s, calculate the distance between her house and the school.

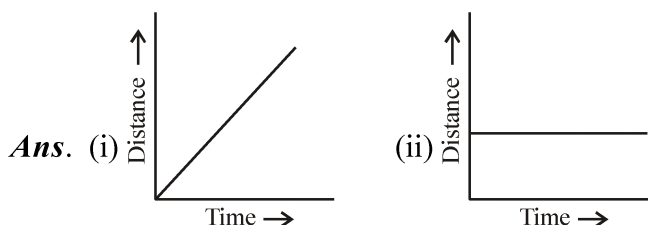
$$\text{Ans. Speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\begin{aligned} \Rightarrow \text{distance travelled} &= \text{speed} \times \text{time taken} \\ &= 2 \text{ m/s} \times (15 \times 60) \text{ s} = 1800 \text{ m} \end{aligned}$$

NS. 7

Show the shape of the distance-time graph for the motion in the following cases:

- (i) A car moving with a constant speed.
- (ii) A car parked on a side road.



NS. 8

Which of the following relations is correct?

(i) Speed = Distance × Time

(ii) Speed = $\frac{\text{Distance}}{\text{Time}}$

(iii) Speed = $\frac{\text{Time}}{\text{Distance}}$

(iv) Speed = $\frac{1}{\text{Distance} \times \text{Time}}$

Ans. (ii) Speed = $\frac{\text{Distance}}{\text{Time}}$

NS. 9

The basic unit of speed is:

- (i) km/min (ii) m/min
- (iii) km/h (iv) m/s

Ans. (iv)

NS. 10

A car moves with a speed of 40 km/h for 15 minutes and then with a speed of 60 km/h for the next 15 minutes. The total distance covered by the car is:

- (i) 100 km (ii) 25 km
- (iii) 15 km (iv) 10 km

Ans. (ii): $v_1 = \frac{d_1}{15}$

$\Rightarrow d_1 = 40 \text{ km/h} \times 15 \text{ min}$

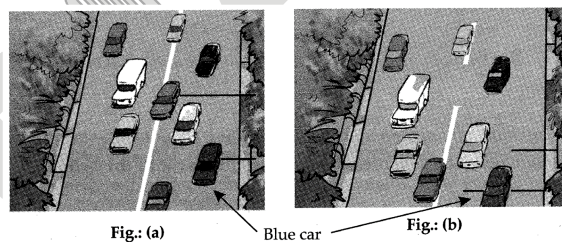
Similarly, $d_2 = 60 \text{ km/h} \times 15 \text{ min}$

Thus, total distance covered by car

$d_1 + d_2 = 40 \text{ km/h} \times 15 \text{ min} + 60 \text{ km/h} \times 15 \text{ min}$

NS. 11

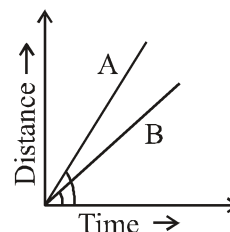
Suppose the two photographs, shown in fig. (a) and fig. (b) had been taken at an interval of 10 seconds. If a distance of 100 metres is shown by 1 cm in these photographs, calculate the speed of the blue car.



Ans. 14 m/s

NS. 12

Figure shows the distance-time graph for the motion of two vehicles A and B. Which one of them is moving faster?



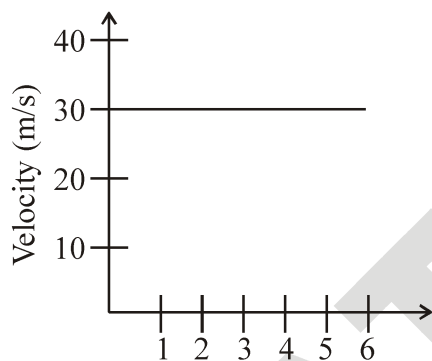
Ans. As shown in distance-time graph, at any particular time, A has covered more distance than B, therefore A is moving faster.

EXERCISE – I

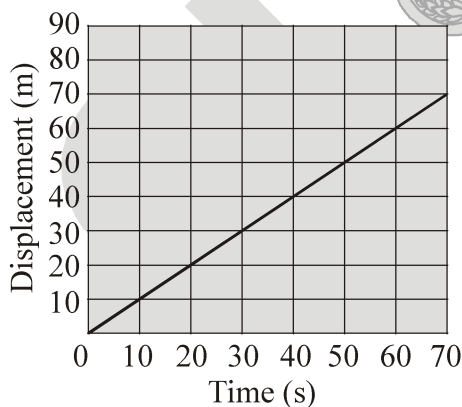
ONLY ONE CORRECT TYPE

- A body whose position with respect to surrounding does not change, is said to be in a state of :
(A) Rest
(B) Motion
(C) Vibration
(D) Oscillation
- In case of a moving body :
(A) Displacement $>$ Distance
(B) Displacement $<$ Distance
(C) Displacement \geq Distance
(D) Displacement \leq Distance
- A distance :
(A) Is always positive
(B) Is always negative
(C) May be positive as well as negative
(D) Is neither positive nor negative
- A particle is travelling with a constant speed. This means :
(A) Its position remains constant as time passes
(B) It covers equal distances in equal interval of time
(C) Its acceleration is zero
(D) It does not change its direction of motion
- In 10 minutes, a car with speed of 60 kmh^{-1} travels a distance of :
(A) 6 km (B) 600 km
(C) 10 km (D) 7 km
- A car acceleration uniformly from 18 km/h to 36 km/h in 5s. The acceleration in ms^{-2} is :
(A) 1 (B) 2
(C) 3 (D) 4
- The brakes applied to a car produce a negative acceleration of 6 ms^{-2} . If the car stops after 2 seconds, the initial velocity of the car is :
(A) 6 ms^{-1} (B) 12 ms^{-1}
(C) 24 ms^{-1} (D) zero
- A body is moving with uniform velocity of 10 ms^{-1} . The velocity of the body after 10 s is :
(A) 100 ms^{-1} (B) 50 ms^{-1}
(C) 10 ms^{-1} (D) 5 ms^{-1}
- In 12 minutes a car whose speed is 35 kmh^{-1} travels a distance of :
(A) 7 km (B) 3.5 km
(C) 14 km (D) 28 km
- A body is moving along a straight line at 20 ms^{-1} under-goes an acceleration of 4 ms^{-2} . After 2s, its speed will be :
(A) 8 ms^{-1} (B) 12 ms^{-1}
(C) 16 ms^{-1} (D) 28 ms^{-1}
- A car increases its speed from 36 km/h to 54 km/h in 10s. Its acceleration is :
(A) 30 ms^{-2} (B) 3 ms^{-2}
(C) 18 ms^{-2} (D) 0.5 ms^{-2}
- The device used to measure speed of a vehicle is :
(A) Odometer (B) Speedometer
(C) Thermometer (D) Voltmeter
- Light takes $8\frac{1}{2}$ minutes to travel from the sun of the earth. The velocity of light $3 \times 10^8 \text{ km s}^{-1}$. Then the distance of the sun from earth is :
(A) $1.53 \times 10^8 \text{ km}$ (B) $3 \times 10^8 \text{ km}$
(C) $4 \times 10^8 \text{ km}$ (D) $2.55 \times 10^6 \text{ km}$
- A clock works on the principle of :
(A) Periodic motion (B) Oscillation
(C) Translation (D) Rotation

15. When a body spin, the body is in :
 (A) Rectilinear motion (B) Circular motion
 (C) Rotatory motion (D) Periodic motion
16. Motion of a car on a straight path is an example of :
 (A) Rectilinear motion (B) Circular motion
 (C) Rotatory motion (D) Periodic motion
17. Look at the graph given below carefully and find whether the body is in uniform acceleration :



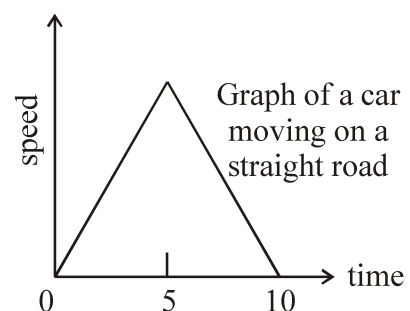
- (A) Yes
 (B) No
 (C) the graph does not give the information that the body is in uniform acceleration
 (D) None of these
18. Look at the following graph carefully and find the velocity of the moving body.



- (A) 0 m/s (B) 1 m/s
 (C) 2 m/s (D) 3 m/s

19. If a body covers unequal distances in equal interval of time, the body is said to be in
 (A) Uniform acceleration
 (B) Non-uniform acceleration
 (C) Uniform motion
 (D) Non-uniform motion
20. Which of the following is NOT matched correctly
 (A) Speedometer : Speed
 (B) Odometer : Odour
 (C) Anemometer : Wind speed
 (D) Stopwatch : Time
21. A jet is moving with a speed of 180 km/h. What is its speed in m/s ?
 (A) 10 m/s (B) 50 m/s
 (C) 200 m/s (D) 500 m/s

22. According to the following graph, what happens to the distance covered by the body from 0-10 minutes



- (A) It goes on increasing
 (B) It goes on decreasing
 (C) It first increases and then decreases.
 (D) It first decreases and then increases.
23. What part of second is called nanosecond ?
 (A) One hundredth (B) One thousandth
 (C) One millionth (D) One billionth

24. The relation between speed and distance is :

- (A) Distance = Speed / Time
- (B) Distance = Speed × Time
- (C) Distance = Time/Speed
- (D) None of these

25. Time period of a simple pendulum depends upon :

- (A) Weight of bob
- (B) Length of pendulum
- (C) Both A and B
- (D) Neither (A) nor (B)

PARAGRAPH TYPE

PARAGRAPH # 1

The simple pendulum is a mechanical system that sways or moves in an oscillatory motion. This motion occurs in a vertical plane and is mainly driven by the gravitational force. Interestingly, the bob that is suspended at the end of a thread very light somewhat we can say it is even massless. The period of a simple pendulum can be made extended by increasing the length string while taking the measurements from the point of suspension to the middle of the bob. However. It should be noted that if the mass of the bob is changed it will the period remains unchanged. Period is influenced mainly by the position of the pendulum in relation to Earth as the strength of gravitational field is not uniform everywhere.

26. The time taken by the pendulum to complete one oscillation is called its

- (A) Time period (B) Time speed
- (C) Distance covered (D) Total time

27. The time taken by a simple pendulum to complete each oscillation remains

- (A) Different (B) Same
- (C) Both (A) and (B) (D) None of the above

28. A simple pendulum takes 30s to complete 18 oscillations. What is the time period of the pendulum ?

- (A) 166.0 s (B) 0.166 s
- (C) 16.6 s (D) 1.66 s

PARAGRAPH # 2

We deal with the distance-time graph while studying the motion of bodies. If we record distance and time for the motion of a body and plot the same data on a rectangular graph, we will obtain a distance-time graph corresponding to the motion of that body. A distance-time graph shows how far an object has travelled in a given time. It is a simple line graph that denotes distance versus time findings on the graph.

29. The distance moved per unit time is known as

- (A) Speed (B) Displacement
- (C) Velocity (D) Acceleration

30. When a body covers equal distance in equal interval of time, it is said to be in :

- (A) Average speed
- (B) Uniform motion
- (C) Non-uniform motion
- (D) Speed

31. On which axis is dependent variable represented ?

- (A) X-axis
- (B) Y-axis
- (C) Any axis
- (D) Depends on the data

EXERCISE – II

VERY SHORT ANSWER TYPE

1. Give the name of device which measures time.
2. Give the term used for the time taken by a pendulum to complete one oscillation.
3. What is the shape of distance-time graph for a body moving with uniform motion.
4. Define speed.
5. Name the device which records the speed of a moving vehicle.
6. What type of motion is possessed by a body, when it moves unequal distances in equal intervals of time or vice-versa ?
7. Give one example of periodic motion.
8. Convert 54 km/h into m/s.
9. What do you mean by zero speed ?
10. Give example of any situation showing translatory motion.

SHORT ANSWER TYPE

1. Explain the following terms with respect to a pendulum : time period, oscillation and mean position.
2. A car is moving on a hill station and cover the distance as per the data given. Read the following data and construct a distance-time graph on a graph paper.

Time (in minutes)	Distance (in km) From the starting point
10	5
20	10
30	15
40	20
50	25

3. Define the following terms ;

- (a) Non-uniform motion
- (b) Speed

4. What do you mean by average speed ?

5. A car travels a distance of 270 kilometer in $4\frac{1}{2}$ hours. Find its speed.

LONG ANSWER TYPE

1. Explain the sundial, water clock and sand clock with diagram.
2. Write down difference between distance and displacement.
3. There are bodies in motion which execute two or more types of motion at the same time. Give two examples and explain.
4. Explain the statement “Rest and motion are relative” with example.
5. What is the advantage of distance-time graph?

TRUE / FALSE TYPE

1. The time required to complete one oscillation depends on the mass of the string of simple pendulum.
2. The direction of motion and the speed of a body in uniform motion do not change.
3. Acceleration in uniform circular motion is constant.
4. The graph of distance Vs time is a straight line for non-uniform motion.
5. Measuring time is more difficult than measuring length.

Answer Key

EXERCISE-I														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	D	A	B	C	A	B	C	A	D	D	B	A	A	C
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	B	B	D	B	B	A	D	B	B	A	B	D	A	B
31	32	33												
B	C	A												

EXERCISE – II														
TRUE / FALSE														
1. F	2. T	3. F	4. F	5. F										
FILL IN THE BLANKS														
1. Periodic motion	2. Time period	3. Non uniform motion												
4. Odometer	5. Speed													
NUMERICALS														
1. 10 years	2. 60 km/hr	3. 25 km	4. 31 Weeks	5. 25 m/s										

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : MOTION AND TIME)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In- Text Examples			
Solved Examples			
NCERT Exercises			
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.



Space for Notes :

A large rectangular area containing 25 horizontal dotted lines, intended for writing notes.



HEAT

(HEAT TRANSFER IN NATURE)

2

Concepts

Introduction

1. *Heat and temperature*
2. *Sources of heat energy*
3. *Effects of heat energy*
4. *Hot and cold*
5. *Difference between heat and temperature*
6. *Measuring Temperature*
 - 6.1 *Types of thermometer*
 - ☛ *Clinical thermometer*
 - ☛ *Laboratory thermometer*
 - ☛ *Precaution to be observed while reading a Clinical thermometer*
7. *Transfer of heat*
 - 7.1 *How does heat flow ?*
 - ☛ *Conduction*
 - ☛ *Conductors and insulators*
 - ☛ *Convection*
 - ☛ *Applications of convection*
 - ☛ *Radiation*

Solved Examples

NCERT Solutions

Exercise – I (SCQ Type)

Exercise – II (Board Pattern Type)

Answer Key

INTRODUCTION

We observe that when a pressure cooker is heated on a gas stove, the water in the pressure cooker gets heated and after some time the steam comes out through the nozzle by lifting the weight over the nozzle. This shows that work is done on the weight. We know that capacity to do work is called energy. In this case the work is done due to the heat supplied to the pressure cooker. Thus, we can conclude that heat is a form of energy.

In the ancient times, people used to produce fire by rubbing stones against one another. In an electric iron box, we get heat from electricity. When a candle is lit, the chemical energy stored in the candle generates heat. Thus, heat energy is produced at the expense of some other forms of energy. A steam engine works by converting heat energy into mechanical energy. When a tungsten filament gets intensely hot, it produces light. Thus, heat energy can be transformed to some other forms of energy. So, it is needless to say that heat is a form of energy.

Heat energy can be transformed into other forms of energy like electrical, mechanical, light etc., by suitable methods. Heat energy can bring about changes in the physical dimensions, state and the chemical properties of a substance.

1. HEAT AND TEMPERATURE

Heat is an invisible form of energy that can produce the sensation of hot or cold. The property that tells us how hot or cold a particular body is called its **Temperature**, i.e., the degree of hotness or coldness of a body is denoted by its **Temperature**. When heat is supplied to a body, its temperature increases and when heat is taken away from a body, its temperature decreases.

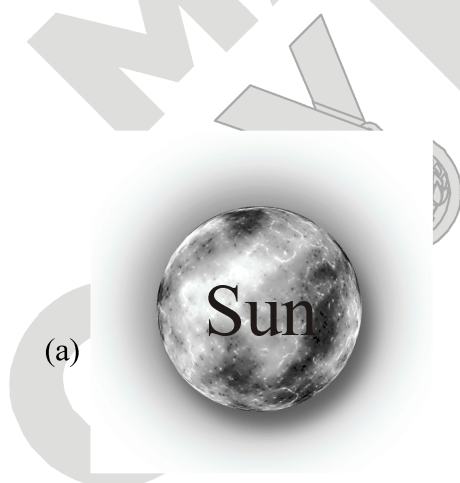


Figure : Natural source of heat

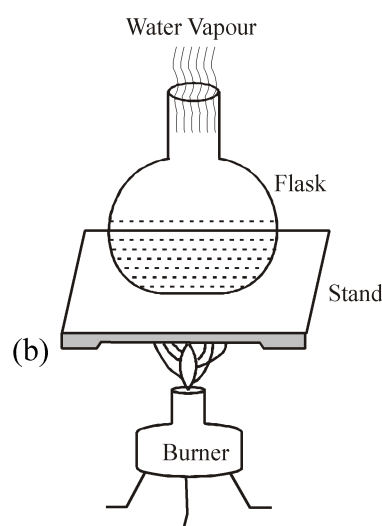
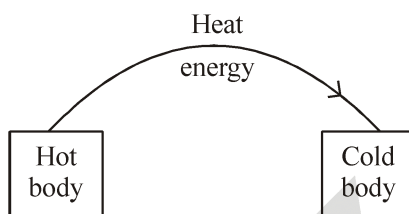


Figure : Artificial source of heat

2. SOURCES OF HEAT ENERGY

Sun is the Earth's main source of heat energy. Other sources of heat include burning of fuels eg. wood, coal, kerosene and liquefied petroleum gas (LPG), rubbing of two surfaces against each other or from electricity. Heat always flows from a body of higher temperature to the body at lower temperature



A body which is losing heat is feeling the other body to be cold, and a body which is gaining heat is feeling the other body to be hot.

Unit of Heat Energy

S.I. unit of heat in joule (J). Another commonly used unit of heat is calorie (cal).

$$1 \text{ calorie} = 4.18 \text{ J} = 4.2 \text{ J}$$

$$1 \text{ kilocalorie (kcal)} = 1000 \text{ calories} = 4180 \text{ J}$$

$$1 \text{ kilojoule (kJ)} = 1000 \text{ J}$$

$$1 \text{ megajoule (MJ)} = 10^6 \text{ J}$$



Focus Point

Important things related to Heat :

- Heat is a scalar quantity
- As heat is a form of energy. So, its unit is same as energy.
- **One calorie is the quantity of heat energy required to raise the temperature of 1 g of water through 1°C.**
- If heat can flow between two objects or systems, the objects or systems are said to be in **thermal contact**.

3. EFFECTS OF HEAT ENERGY

(a) Heat energy brings about change in temperature conversely, if a hot body gives out heat energy, its temperature falls.

(b) Heat energy brings about change in dimensions when a material body is heated. Its length, area and volume increases.

(c) Heat energy brings about change in state. When heat supplied to the solid, at a particular constant temperature it changes into the liquid state. Similarly liquid changes into gaseous state. During the change of state, the temperature of the body remains constant.

(d) Heat energy affects the living things.

(e) Heat energy brings about chemical change when calcium carbonate is heated strongly, it changes into calcium oxide and carbon dioxide.

4. HOT AND COLD

How do we compare the heat energy contained in different bodies. We see that some objects around us are cold while some others are hot. How do we say whether a body is hotter or colder? We often try to know the same by touching them. But is it possible to use the same method always?

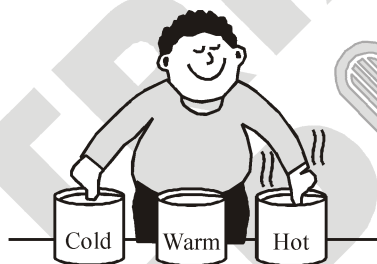


Figure : Heat energy contained in different bodies

Then how do we find out how hot an object really is? A reliable method to determine the hotness of an object is measuring its temperature.

Example 1

When two bodies of different temperatures are in contact, what is the direction of flow of heat?

Solution :

Heat always flows from a body of higher temperature to one of lower temperature.

5. DIFFERENCE BETWEEN HEAT AND TEMPERATURE

Heat		Temperature	
1	Heat is a form of energy	1.	Temperature indicate the thermal condition of a body i.e., how much hot (or) how much cold the body is.
2	Heat is the cause	2	Temperature is the effect
3	Heat is a scalar quantity. It only have magnitude.	3	Temperature of a body decides the direction of heat flow from the body
4	S.I. unit of heat is joule (J)	4	S.I. unit of temperature is kelvin (K).

6. MEASURING TEMPERATURE

Temperature is measured by a device called thermometer. The property of the expansion and contraction of substances due to heating and cooling is made use in **Thermometres**. Generally mercury is used in the thermometer.

6.1 TYPES OF THERMOMETER

Clinical thermometer

It is a thermometer used to measure body temperature. The liquid used in it is mercury. It is used for the temperature range 35°C to 42°C. (or 94°F to 108°F). This is because the body temperature usually does not fall below 35°C or rise above 42°C. The bigger marks normally read 1°C. If there are 5 divisions between bigger marks, each small division reads (1/5) of a degree or 0.2 °C.

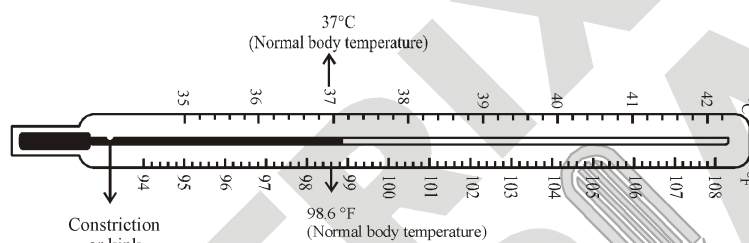


Figure : A clinical thermometer

Precaution to be observed while reading a Clinical thermometer

- (i) Thermometer should be washed before and after use, preferably with an antiseptic solution.
- (ii) Ensure that before use, the mercury level is below 35°C
- (iii) Read the thermometer keeping the level of mercury along the line of sight.
- (iv) Handle the thermometer with care. If it hits against some hard object, it can break.
- (v) Don't hold the thermometer by the bulb while reading it.



Focus Point

Temperature is measured in Kelvin (K) in SI system and °C in CGS system.

Conversion of temperature from Kelvin scale to Celsius scale is

$$T(K) = T(^{\circ}C) + 273$$

Normal body temperature is 37°C or 98.6°F.

Laboratory thermometer

The thermometers available in the laboratory consist of a long sealed glass tube (also called stem) marked with a scale on the outside (see fig). Inside the glass tube there is another thin tube called the capillary tube (or bore) at the end of which there is a bulb made of thick glass. The bulb is filled with a liquid at the other end. The most commonly used liquid is **Mercury**. A shining thread of mercury can be seen from outside the thermometer. As the temperature rises, the mercury in the bulb expands and rises into the capillary tube. The scale on the glass tube is marked in $^{\circ}\text{C}$ or $^{\circ}\text{F}$. The height of the liquid in the stem gives the reading of temperature. Laboratory thermometers have a range from -10°C to 110°C .

Precaution to be observed while reading a Laboratory thermometer

- (i) The thermometer is delicate and should be handled with care to avoid breakage.
- (ii) It should be kept upright and not tilted.
- (iii) The bulb should be completely surrounded by the substance whose temperature is being measured, and the bulb should not touch the sides of the container.
- (iv) While reading the thermometer, the level of mercury should be the same level as the eye.
- (v) The thermometer should not be held by the bulb while reading the temperature.

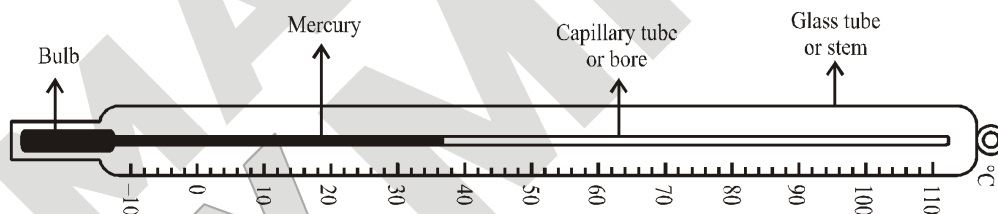


Figure : Laboratory thermometer



Focus Point

THERMOMETRY

Thermometry is the branch of heat dealing with the measurement of temperature. The degree of hotness or coldness of the body is called temperature. S.I. unit of temperature is Kelvin (K). Other unit of temperature is degree Celsius (°C) and degree Fahrenheit (°F).

Fahrenheit scale

On the Fahrenheit scale, water freezes at 32 degrees and boils at 212 degrees. There are 180 Fahrenheit degrees between the freezing point and the boiling point of water.

Celsius scale

The Celsius scale divides the interval between the freezing and boiling points of water into 100 degrees (instead of 180). Water freezes at 0°C and boils at 100°C. Most scientists and engineers use Celsius because 0 and 100 are easier to work with, than 32 and 212.

Kelvin scale

This scale is based on the existence of absolute zero, the minimum possible temperature.

Absolute zero

Absolute zero is the lowest temperature in the universe. At absolute zero, there is no heat and the motion of particles (atoms or molecules) ceases (stops), you can think of absolute zero as the temperature where molecules are completely frozen, with no motion. Absolute zero occurs at -273°C or -459°F .

The Kelvin scale divides the interval between the freezing and boiling points of water into 100 divisions. Water freezes at 273 K and boils at 373 K.

A temperature in Celsius measures only relative thermal energy, relative to zero Celsius. The Kelvin temperature scale is useful in science because it starts at absolute zero. A temperature in Kelvin measures the actual energy of atoms relative to zero energy.

Relation between different temperature scales

The relation between the Celsius (C), Fahrenheit (F), and Kelvin (K) scales are :

$$\frac{C - 0}{100 - 0} = \frac{F - 32}{212 - 32} = \frac{K - 273}{373 - 273} = \frac{T - \text{L.F.P.}}{\text{U.F.P.} - \text{L.F.P.}}$$

Where, T is temperature of any scale, L.F.P. is lower fixed point, U.F.P. is upper fixed point.

$$\text{or } \frac{C - 0}{100} = \frac{F - 32}{180} = \frac{K - 273}{100} = \frac{T - \text{L.F.P.}}{\text{U.F.P.} - \text{L.F.P.}}$$



Focus Point

Relation between Celsius and Fahrenheit scales

$$\frac{C - 0}{100} = \frac{F - 32}{180} \text{ or } \frac{C}{100} = \frac{F - 32}{180} \text{ or } \frac{C}{10} = \frac{F - 32}{18} \text{ or } \frac{C}{5} = \frac{F - 32}{9} \text{ or } C = \frac{5}{9}(F - 32)$$

$$\text{or } F = \frac{9}{5}C + 32 = 1.8C + 32$$

$$F = 18(K - 273) + 32$$

Relation between Celsius and Kelvin scales

$$\frac{C - 0}{100} = \frac{K - 273}{100}$$

$$\text{or } \frac{C - 0}{100} = \frac{K - 273}{100}$$

$$\text{or } C = K - 273$$

$$\text{or } K = C + 273$$

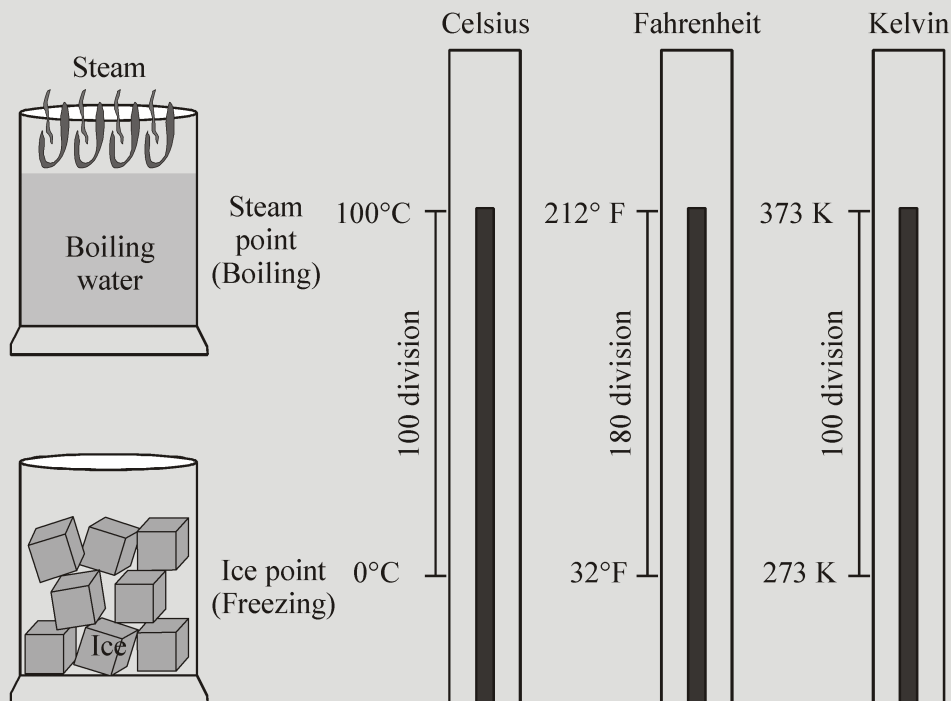


Figure : Number of divisions for Celsius, Fahrenheit and Kelvin scale

Example 2

At what temperature, if any, do the following pairs of scales give the same reading :

(a) Celsius and Fahrenheit, (b) Fahrenheit and Kelvin and (c) Kelvin and Celsius ?

Solution:

If the temperature is θ at which the reading of two scales coincides, then from :

$$\frac{T_c - 0}{100} = \frac{T_f - 32}{180} = \frac{T_k - 273.15}{100}$$

(a) $\frac{\theta}{100} = \frac{\theta - 32}{180}$, i.e., $\theta = -40$

i.e., reading of Celsius and Fahrenheit scale coincides at -40° .

(b) $\frac{\theta - 32}{180} = \frac{\theta - 273.15}{100}$, i.e., $\theta = 574.6$

i.e., reading of Fahrenheit and Kelvin scale coincides at 574.6° .

(c) $\frac{\theta - 273}{100} = \frac{\theta}{100}$ which is not possible

So reading of Celsius and Kelvin scale can never respectively.

Example 3

Find the value of 5°C in $^\circ\text{F}$ and K scale respectively.

Solution:

Relation between Celsius and Fahrenheit scale

$$\frac{C}{5} = \frac{F - 32}{9}$$

So corresponding value of 5°C in Fahrenheit scale is

$$\frac{5}{5} = \frac{F - 32}{9} \Rightarrow F = 41^\circ\text{F}$$

Relation between Celsius and Kelvin scale

$$T(\text{K}) = T(^{\circ}\text{C}) + 273 = 5 + 273 = 278 \text{ K}$$

LAB TIME

Let's Do & Learn



Let us perform an activity to understand how heat flows from a body at a higher temperature to one at a lower temperature.

Take some hot water in a tumbler. Dip a metal spoon in this water for some time. How long does it take for the spoon to become hot for you to feel uncomfortable to hold it any more ? This shows that heat is transferred from the hot water in the tumbler to the spoon and then to your hand. Leave the tumbler with water in it for 10-15 minutes. Feel the water now. Has it cooled down ? Why ? Because water has lost its heat to the surroundings. This shows that heat has been transferred from the water to the surroundings.

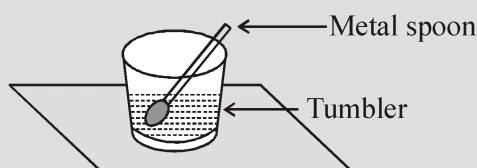


Figure : Flow of heat

7. TRANSFER OF HEAT

Put a hot object in contact with a cold object. After some time, you would notice that the cold object becomes hot while the hot object becomes less hot. This happens because the hot object transfers some of its heat to the colder object. In fact in all cases heat flows from a hotter object to a colder object.

LAB TIME

Let's Do & Learn



1. Put drops of wax at regular intervals on an iron rod. Heat one end of the rod over a candle flame (see figure). You will observe that the drop nearest to the flame melts first. One by one all the drops melt and the end of the rod opposite to the flame begins to feel warm to the touch.
2. Repeat the same procedure using a plastic rod (see figure). You will observe that the end closer to the flame begins to melt while the wax drops remain unaffected. Also, the rod does not feel warm to the touch.
3. From this activity we can conclude that there are certain materials like metals which allow heat to pass through them while certain materials like plastic do not. Also, the entire rod does not get heated at once. The wax drops melt one by one as the heat reaches each one gradually. This mode of heat transfer is called conduction.

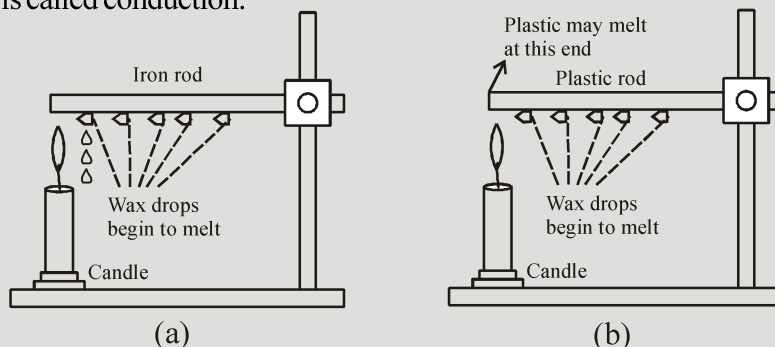


Figure : Transfer of heat through iron rod and plastic rod

7.1 HOW DOES HEAT FLOW ?

The mechanism by which heat is transferred from one region to another are called modes of heat transfer.

There are three modes of heat transfer :

- (i) Conduction (ii) Convection (iii) Radiation.

Conduction

The process of the transfer of heat from the hotter end to the colder end of an object without any movement in the object is called **conduction**. In solids, the heat is transferred by the process of conduction.

Matter is made up of molecules. In solids, molecules are tightly packed. They are not free to move, but they can vibrate about their fixed positions. When one part of a solid is heated, the molecules in that part have more energy and move faster. When molecules vibrating more vigorously, they push and pull the molecules of the colder part and make their vibrations more energetic. Thus, energy flows from the hotter to the colder part of the body.

Conductors and insulators

The materials which allow heat to pass through them easily are good conductors of heat. For example, aluminium, iron and copper. The materials which do not allow heat to pass through them easily are poor conductors of heat such as plastic and wood. Poor conductors are known as insulators. Both good and bad conductors are used in cooking utensils. The bottom is made of copper or some other metal. Metals are good conductors, so they conduct heat readily from the fire to the material inside the utensil. The handle, on the other hand, is made of bakelite, which is a bad conductor. Therefore, it does not become too hot even when the utensil is on the fire.

Materials such as wool and cotton are used to make winter clothing, blankets and quilts. This is because they are made of very thin fibres which have a lot of air spaces. Air is a good insulator, so materials with air spaces are good insulators. That is why traditional quilt makers beat cotton to make it fluffy.

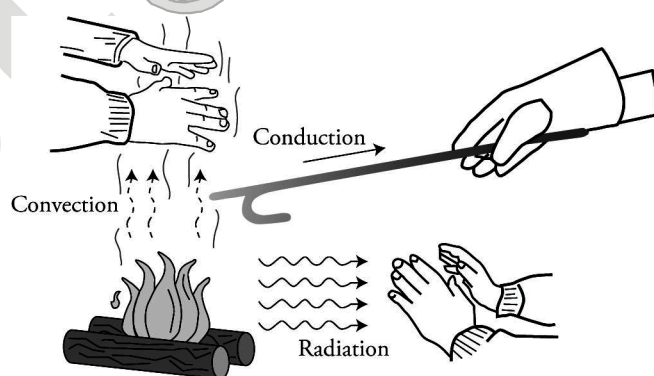


Figure : Different modes of heat transfers

Example 4

At what common temperature, would a block of wood and a block of metal feel equally cold or equally hot when touched ?

Solution:

When the temperature of the object equal to that of the human body, no transfer of heat takes place between the body and the object. Thus, when the temperature of the block of wood or block of metal is equal to 37° C, i.e., the temperature of the human body, these appear equally hot or cold on touching on account of non-transference of heat.



Let us perform following activity to understand the conductors and insulators.

Take a steel spoon, a geometry box compass, a plastic scale, a pencil and divider. Dip one end of these articles in hot water and wait for a few minutes. Touch the other end and find out which of the above mentioned articles are conductors and which are insulators. Note down your observation in the following table.

Materials taken	Conductor or Insulator
Steel spoon	
Geometry box compass	
Plastic scale	
Pencil	
Divider	

Convection

The materials which allow heat to pass through them easily are good conductors of heat. In fluids (liquids and gases together), the molecules themselves carry energy from a hotter region to a colder region. This process of heat transfer is called **convection**. Convection plays a major role in weather phenomena, for example, the almost daily rainfall in equatorial regions. In these regions, the almost direct rays of the sun heat the ground rapidly. The air near the ground gets heated and rises. The rising air cools, and the water vapour present in it forms clouds.

Cooler air from above sinks, gets heated and rises again to form more clouds. The clouds bring rain, usually in the afternoon.

Heat transfer in fluids occurs almost exclusively through convection. This is because almost all liquids and gases are poor conductors of heat.



Focus Point

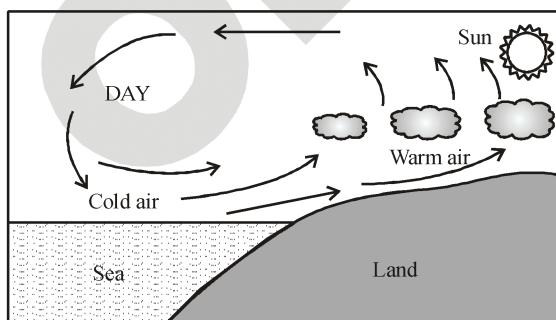
Let us understand that liquids and gases are poor conductor fo heat.

Dip a small nail in molten wax so that it gets a coating of wax. Drop it into a test tube of water. Heat the top of the test tube by holding it above a flame. Heat can now reach the nail from the flame through the water only by conduction and not convection. (Conduction can transfer heat in all directions, while convection can transfer it only upwards.) After some time, the water at the top will begin to boil, but the wax will not melt, showing that water is poor condcutor of heat.

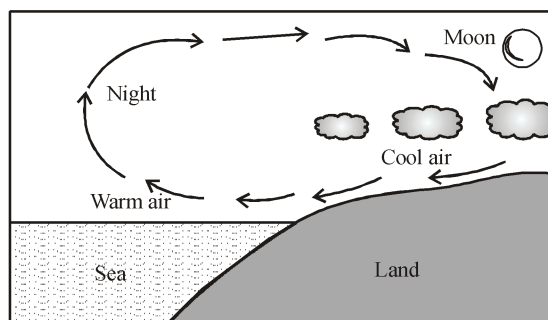
Application of Convection

The following are some applications of convection:

- Ventilators are located near the ceilings of rooms. This allows hot air of the room which has risen up to move out of the ventilator. The fresh cool air from the window rushes in to take the place of rising warm air.
- Air conditions are installed near the roof. The cool air moves down and the warm air near the surface of the room rises up thereby setting up convectional currents which cool the whole room effectively.
- **Land and Sea Breezes :** Convection plays a central role in setting up winds. When some region gets heated, the air over it becomes lighter and moves up. Cold air from neighbouring regions move in to take its place, causing winds. In coastal areas, when the land and the sea absorb heat from the sun during the day, the land heats up faster than the sea. The air above the land becomes hot and moves up, and cooler air from over the sea moves in to take its place. This is called a sea breeze. At night, the air above the land cools faster than the sea. Air above the sea becomes hot and moves up, and cooler air from over the land n\moves in to take its place. This is called a land breeze.



Sea Breeze



Land Breeze

Figure : Sea Breeze and Land Breeze

Radiation

When you sit in front of a fire, you feel warmth of the fire. However, the air between you and the fire is a bad conductor of heat and does not get heated up much. Therefore, heat is not reaching you by conduction. It also cannot reach you by convection since convection currents rise upwards. There is therefore another method by which heat reaches you. This method is called **Radiation**. Radiation is the only process of heat transfer that can occur in the absence of any form of medium. It refers to the transmission of energy as electromagnetic radiation. Radiation is the fastest mode of transfer of heat.

All hot objects—solid, liquid or gas—emit radiant energy. When radiant energy falls on another object, it is partially absorbed and partially reflected. The amount of heat absorbed or radiated depends upon the nature and the colour of the object. Dark colours are good absorbers of radiant heat while light colours are poor absorbers and good radiators of heat.

Heat from the Sun reaches the Earth by the process of radiation. In this case, conduction or convection is not possible because of the vacuum between the Sun and the Earth.

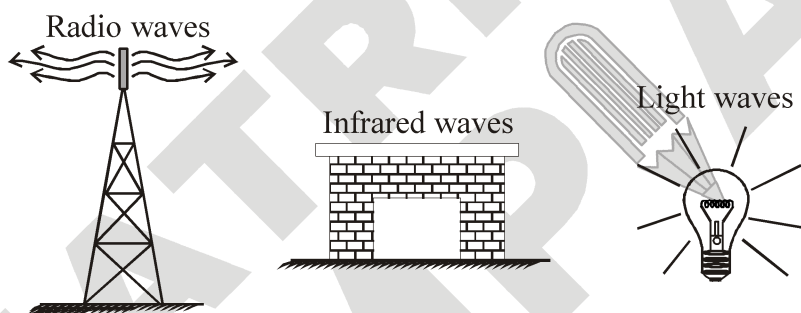


Figure : Different type of waves in Radiations

Example 5

Why is it more comfortable to wear white or light-coloured clothes in the summer and dark-coloured clothes in the winter?

Solution:

Light coloured clothes reflect most of the heat that falls on them and, therefore, we feel more comfortable wearing them in the summer. Dark surfaces absorb more heat and, therefore, we feel comfortable with dark coloured clothes in the winter.

Example 6

How does the heat travel in air? In which direction does the smoke go? Try an activity to show it.

Solution:

The air near the heat source gets hot and rises. The air from the sides comes in to take its place. In this way the air gets heated. The following activity confirms this idea :

Light a candle, Keep one hand above, the flame and one hand on the side. Be careful. Keep your hands at a safe distance from the flame so that they do not get burnt. The hand above the flame feels hot. This means that hot air moves in upward direction and towards the top, the air gets heated by convection. On the sides, however, there is no convection and air does not feel as hot as at the top.

SOLVED EXAMPLES

SE. 1

What differences can you find between a clinical thermometer and a laboratory thermometer?

Ans. The clinical thermometer is smaller. It measures only from 35°C to 42°C . There is a small bend or kink in the capillary tube. This prevents the mercury from coming down, when the thermometer is taken out of patient's mouth. Thus the doctor can read the temperature after removing the thermometer.

The laboratory thermometer is larger and measures from -10°C up to 110°C or more. It has no kink in its capillary tube.

SE. 2

(i) Raghav has a temperature of 40°C . What would you suggest him to do?

(ii) Can you say which of these is the temperature inside the Sun?

(a) 30°C (b) 300°C

(c) 3000°C (d) $3,000,000^{\circ}\text{C}$

Ans. (i) Raghav has fever and should see a doctor.

(ii) $3,000,000^{\circ}\text{C}$

SE. 3

Dhruv got a slab of chocolate from his friend on his birthday. He kept it in his bag. On reaching home, he opened his bag and found a brown sticky liquid leaked out of the wrapper. It had spread over some of his books. What do you think happened?

Ans. The chocolate melted in the heat. It changed from a solid to a thick liquid and leaked out, spreading over Dhruv's books.

SE. 4

Complete these sentences.

The air inside the bottle gets _____ and _____ . This _____ the

balloon fully. When the bottle is taken out of the _____, the air _____ and

Due to this the balloon is no longer fully inflated.

This activity show that solids, liquids and gases expand on heating, and contract on cooling.

Ans. The air inside the bottle gets heated and expands.

This inflates the balloon fully. When the bottle is taken out of the hot water, the air cools and contracts. Due to this the balloon is no longer fully inflated.

SE. 5

Arrange these in order of decreasing expansion on heating: steel, milk, air.

Ans. Air, milk, steel

SE. 6

Can convection take place in solids? Why?

Ans. No. The molecules in a solid are only free to vibrate about their fixed positions. For convection to take place, the molecules need to move carrying the heat with them. Hence convection can not take place in solids.

SE. 7

In winters, when the sun suddenly goes behind the clouds we feel cold. Can you say why?

Ans. The clouds cut off the radiant heat from the sun.

NS. 1

State similarities and differences between the laboratory thermometer and the clinical thermometer.

Ans. Similarity : Both contain mercury in bulb.

Difference : The laboratory thermometer is generally used to measure temperatures ranging from -10°C to 110°C .

The clinical thermometer has its range of measureable temperature from 35°C to 42°C .

NS. 2

Give two examples each of conductors and insulators of heat.

Ans. Conductors - Aluminium, iron

Insulators - Air, Distilled water

NS. 3

Fill in the blanks :

(a) The hotness of an object is determined by its _____.

(b) Temperature of boiling water cannot be measured by a _____ thermometer.

(c) Temperature is measured in degree _____.

(d) No medium is required for transfer of heat by process of _____.

(e) A cold spoon is dipped in a cup of hot milk. It transfers heat to its other end by the process of _____.

(f) Clothes of _____ colours absorb heat better than clothes of light colours.

Ans. (a) Temperature (b) Clinical
(c) of hotness (d) Radiation
(e) Conduction (f) Dark

NS. 4

Match the following :

- | | |
|--|------------|
| (i) Land breeze blows during | (p) summer |
| (ii) Sea breeze blows during | (q) winter |
| (iii) Dark coloured clothes are preferred during | (r) day |
| (iv) Light coloured clothes are preferred during | (s) night |

Ans. (i)-s (ii)-r (iii)-q (iv)-p

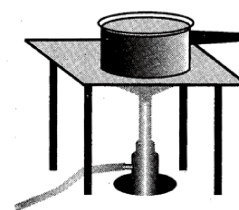
NS. 5

Discuss why wearing more layers of clothing during winter keeps us warmer than wearing just one thick piece of clothing.

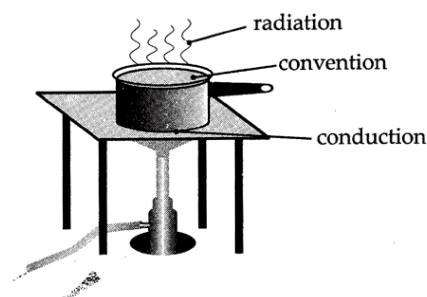
Ans. In winter, it is preferred to wear more layers of clothing because the air trapped in between the various layers prevents the flow of heat from our body to the cold surrounding and hence it keeps us warmer than wearing just one thick piece of clothing.

NS. 6

Look at figure. Mark where the heat is being transferred by conduction, by convection and by radiation.



Ans.



NS. 7

In places of hot climate it is advised that the outer wall of houses be painted white. Explain.

Ans. In places of hot climate, it is advised that outer wall of houses be painted white because white colour reflects heat and the houses do not heat up too much.

NS. 8

One litre of water at 30°C is mixed with one litre of water at 50°C . The temperature of the mixture will be

- (a) 80°C (b) more than 50°C but less than 80°C
- (c) 20°C (d) between 30°C and 50°C

Ans. (d) : As we know, heat flows from water at a higher temperature to water at a lower temperature, so temperature of the mixture will be between 30°C and 50°C .

NS. 9

An iron ball at 40°C is dropped in a mug containing water at 40°C . The heat will

- (a) flow from iron ball to water
- (b) not flow from iron ball to water or from water to iron ball.
- (c) flow from water to iron ball.
- (d) None of these.

Ans. (b) : As temperature of iron ball and water is same.

NS. 10

A wooden spoon is dipped in a cup of ice cream.

Its other end

- (a) becomes cold by the process of conduction.
- (b) becomes cold by the process of convection.
- (c) becomes cold by the process of radiation.
- (d) does not become cold.

Ans. (d) : A wooden spoon is an insulator.

NS. 11

Stainless steel pans are usually provided with copper bottoms. The reason for this could be that

- (a) copper bottom makes the pan more durable
- (b) such pans appear colourful
- (c) copper is a better conductor of heat than the stainless steel.
- (d) copper is easier to clean than the stainless steel.

Ans. (c) Conductivity of copper is more than the stainless steel, while other reasons are not justified.

EXERCISE – I

ONLY ONE CORRECT TYPE

- A clinical thermometer is calibrated from
(A) 35°C to 42°C (B) 10°C to 100°C
(C) 32°C to 110°C (D) 0°C to 100°C
- Name the thermometer which ranges from -10°C to 110°C
(A) Clinical thermometer
(B) Digital thermometer
(C) Laboratory thermometer
(D) All of these
- Which one of the following scale has lower fixed point at 0°C ?
(A) Kelvin scale
(B) Fahrenheit scale
(C) Celsius scale
(D) All of these
- The normal body temperature in the clinical thermometer on the Celsius scale represents which one of the following temperature?
(A) 24°C (B) 45°C
(C) 57°C (D) 37°C
- In which of the following, chemical energy is converted into heat energy?
(A) Heater (B) Refrigerator
(C) Candle (D) Motor
- A liquid changes into a gas at a constant temperature known as its
(A) absolute zero (B) boiling point
(C) evaporation point (D) dew point
- In solid substances, heat is transferred by
(A) Conduction (B) Convection
(C) Radiation (D) (A) and (C)
- The handles of cooking vessels are covered with plastic or wood because
(A) they are beautiful
(B) it is customary
(C) they are good conductors of heat
(D) they are bad conductors of heat
- In conduction, heat flows from
(A) hotter to hotter region
(B) colder to hotter region
(C) hotter to colder region
(D) colder to colder region
- During the formation of rain, when water vapours change back to liquid in the form of rain drops, _____.
(A) Heat is absorbed
(B) Heat is released
(C) Heat is first absorbed and then released
(D) There is no exchange of heat
- The measure of degree of hotness or coldness of a body is called
(A) Heat energy (B) Celsius
(C) Kelvin (D) Temperature
- Process of change of state from gaseous state to liquid state is called
(A) freezing (B) sublimation
(C) boiling (D) condensation
- When two objects are in thermal contact, the heat is transferred by
(A) conduction (B) convection
(C) radiation (D) none of these
- Which of the following is a good conductor of heat?
(A) Copper (B) Glass
(C) Water (D) Wood

15. The phenomenon involved in sea breeze and land breeze is

- (A) convection (B) conduction
(C) radiation (D) none of these

16. Which of the following statements about radiation is/are true?

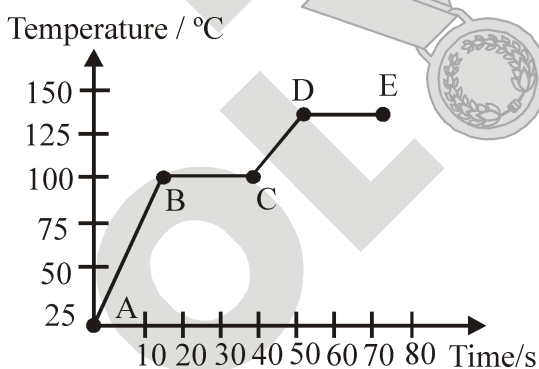
1. Radiation can pass through solids.
2. Radiation can pass through liquids.
3. Radiation can pass through gases,

- (A) 3 only
(B) 2 and 3 only
(C) 1 and 3 only
(D) 1, 2 and 3

17. A liquid changes into a gas at a constant temperature known as its

- (A) absolute zero
(B) boiling point
(C) evaporation point
(D) dew point

18. Which point on the graph below shows that the substance is beginning to boil?



- (A) B (B) D
(C) C (D) E

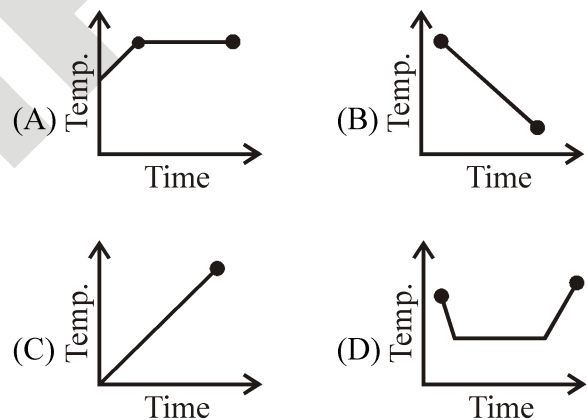
19. When some liquid evaporates, the average speed of the remaining molecules will

- (A) increase because the more energetic molecules have left
(B) decrease because the more energetic molecules have left
(C) remain unchanged because all molecules have about the same speed
(D) increase because there are fewer molecules.

20. Cooling always accompanies evaporation because

- (A) the air molecules cool the liquid surface.
(B) the more energetic molecules leave the liquid.
(C) there are fewer liquid molecules left in the liquid.
(D) the escaped molecules return to the liquid.

21. A pot full of water is put to boil on the stove. Which one of the graphs below shows the correct change in temperature over time?



22. At what temperature, both celsius and Fahrenheit scale shows the same value.

- (A) + 40°C (B) +4°C
(C) -100°C (D) -40°C

23. There is a hole in the middle of a copper plate. When heating the plate, diameter of hole would

- (A) always increase (B) always decrease
(C) remains the same (D) none of these

24. In which of the following process convection does not take place primarily?
 (A) Sea and land breeze
 (B) Trade wind
 (C) Boiling of water
 (D) Warming of glass of bulb due to filament
25. The equatorial and polar regions of the earth receive unequal solar heat. The convection current arising due to this is called.
 (A) land breeze (B) sea breeze
 (C) trade wind (D) tornado

PARAGRAPH TYPE

PARAGRAPH # 1

Radiation is the transfer of heat by means of electromagnetic waves. To radiate means to send out or spread from a central location. Whether it is light, sound, waves, rays, flower petals, wheel spokes or pain, if something radiates then it protrudes or spreads outward from an origin. The transfer of heat by radiation involves the carrying of energy from an origin to the space surrounding it. The energy is carried by electromagnetic waves and does not involve the movement or the interaction of matter. Thermal radiation can occur through matter or through a region of space that is void of matter (i.e., a vacuum). In fact, the heat received on Earth from the sun is the result of electromagnetic waves traveling through the void of space between the Earth and the sun.

26. Heat energy of the sun is received by the earth, by using the.....
 (A) Conduction (B) Convection
 (C) Radiation (D) None of these

27. Heat transfer by radiation mainly depends on.....
 (A) Nature of body (B) Its temperature
 (C) Surface of body (D) All of these
28. Radiation is take place
 (A) Through vaccum
 (B) Through molecular momentum
 (C) Through any medium
 (D) None of these

PARAGRAPH # 2

Absolute zero is the lowest temperature possible. At a temperature of absolute zero there is no motion and no heat. Absolute zero occurs at a temperature of 0 Kelvin, or -273.15 degrees Celsius, or at -460 degrees Fahrenheit.

29. Which is true about the molecules at 0 K ?
 (A) They are moving really fast
 (B) They are moving really slowly
 (C) There is no motion at 0 K
 (D) All of the above are true
30. Why can't there be a temperature lower than absolute zero.
 (A) Because at absolute zero, motion of molecules of a substance almost stops.
 (B) Because heat is related to temperature and is the energy of moving particles of matter.
 (C) Because of kinetic energy of molecular motion.
 (D) Because when you add heat, ice begins to melt and turns into water.
31. What is the value of absolute zero temperature in celsius.
 (A) 0 (B) - 273
 (C) - 40 (D) 100

EXERCISE – II

VERY SHORT ANSWER TYPE

1. Give the name of instrument, which is used for measurement of heat.
2. Write down the example of good and Bad conductors.
3. Name the method of heating of the earth by the sun.
4. What is the freezing point of water?
5. How many methods are there for transfer of heat.
6. Give one condition for heat to flow between two bodies.
7. Write two advantages of use of mercury in thermometer.
8. What are insulators?
9. Write the relation between Celsius and Kelvin scales.
10. Name the thermometer which is used to measure the temperature of human body.

SHORT ANSWER TYPE

1. Write the differences between conduction, convection and radiation.
2. What precautions should we take while using a clinical thermometer?
3. Define the following terms :
(i) Temperature (ii) Thermometer
(iii) Conductor of heat (iv) Insulator of heat
4. What do you mean by conduction mode of transfer of heat energy?
5. If difference of temperature between A and B is 5°C , what is the difference in Kelvin's scale?

LONG ANSWER TYPE

1. What is the use of 'kink' in clinical thermometer?
2. Draw labelled diagram of a clinical thermometer and explain its construction.
3. Explain the conduction and write its necessary condition.

4. What are the differences between heat and temperature?
5. Define the lower fixed point and upper fixed point on temperature scales. Give these points on different temperature scales.

TRUE OR FALSE

1. Mercury is a toxic substance.
2. Air is good conductor and water is poor conductor of heat.
3. The transfer heat by radiation does not require any medium.
4. On heating the density of the substance always decreases.
5. The constant movement of water while heating is called convection current.

FILL IN THE BLANKS

1. In solids, generally, heat is transferred by _____.
2. In vacuum, heat energy can travel by the process of _____.
3. Black colour is a _____ absorber of heat.
4. The handles of cooking utensils are made of _____.
5. Digital thermometers do not use _____.

NUMERICAL TYPE QUESTIONS

1. If the temperature is given in $^{\circ}\text{C}$ and that is 35°C then find out the temperature in kelvin.
2. If the temperature in Fahrenheit is 104°F then find out in $^{\circ}\text{C}$?
3. Convert 77°F to $^{\circ}\text{C}$.
4. The temperature rises by 180°F . What is the rise on celsius scale ?
5. Convert 293K into celsius scale.

Answer Key

EXERCISE-I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	C	C	D	C	B	A	D	C	B	D	D	A	A	A
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
D	B	A	B	B	A	D	A	D	C	C	D	A	C	A
31	32	33												
B	A	A												

EXERCISE – II

TRUE / FALSE

1. T 2. F 3. T 4. F 5. T

FILL IN THE BLANKS

1. Conduction 2. Radiation 3. Good 4. Insulators
5. Mercury

NUMERICALS

1. 308 K 2. 40°C 3. 25°C 4. 100°C
5. 20°C

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : HEAT)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In- Text Examples			
Solved Examples			
NCERT Exercises			
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.



Space for Notes :

A large rectangular area containing numerous horizontal dotted lines, intended for writing notes.



ELECTRIC CURRENT AND ITS EFFECTS (ELECTRICITY CIRCUIT AND THEIR COMPONENTS)

3

Concepts

Introduction

- 1. *Static electricity***
- 2. *Electric charge***
- 3. *Conductors and insulators***
- 4. *Electric current***
- 5. *Electrical circuits***
- 6. *Circuit diagrams and circuit symbols***
- 7. *Difference between cell and battery***
- 8. *Short circuit***
- 9. *Heating effect of electric current***
- 10. *Fuse***
 - 10.1 *Chemical effect of current***
 - 10.2 *Magnetic effect of current***
- 11. *Electric bell***
- 12. *Calculate the cost of electricity***
- 13. *Conserve electricity***

Solved Examples

NCERT Solutions

Exercise - I (SCQ Type)

Exercise - II (Board Pattern Type)

Answer Key

INTRODUCTION

Electricity is the branch of physics which deals with the study of behaviour and characteristics of charge. It is one of the most versatile forms of energy. It is kind of energy that powers electric trains, vacuum cleaners, ovens, radios, television sets, computers and many more devices.

We study electricity in two parts-

- (i) **Static electricity**, deals with charges at rest and phenomenon associated with them.
- (ii) **Current electricity**, deals with charges in motion and phenomenon associated with them

1. STATIC ELECTRICITY

Static electricity is a stationary electric charge that is built up on a material. The static electricity is formed when extra electrons get accumulated on the surface.

Source of static electricity:-

When two substances are rubbed together, some electrons are removed from the atoms on the surface of one and transferred to the other. The substance which gains electrons becomes negatively charged and the one which loses electrons becomes positively charged (see fig.). Thus, the excess or deficiency of electrons makes a substance negative or positive.

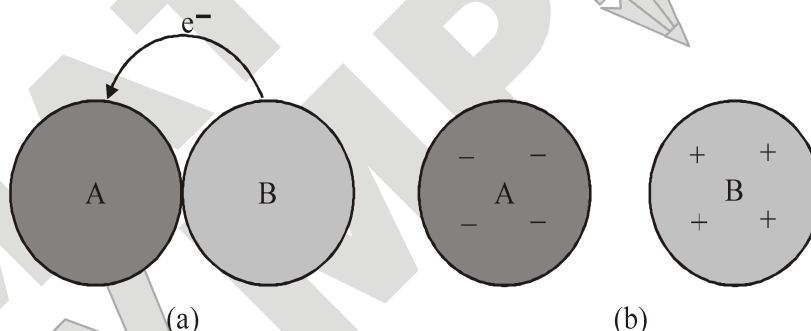


Figure : Rubbing of two bodies makes one positive and another negative.

2. ELECTRIC CHARGE

In order to understand the nature of electricity, one has to first understand the nature of matter.

- (i) All matter are made up of very tiny particles called atoms. An atom consists of three main particles, protons, electrons and neutrons.
- (ii) A proton carries a positive charge, an electron carries a negative charge and the neutron has no charge, i.e., it is neutral.
- (iii) The protons and neutrons reside in the nucleus (central core) of the atom while the electrons revolve round the nucleus in paths called orbits.
- (iv) In an atom, the number of protons are equal to the number of electrons. Since the total positive charge and negative charge are equal, an atom is electrically neutral.

- (a) If an atom gains electrons (i.e., it now has more electrons than protons), it becomes negatively charged.
- (b) If an atom loses electrons (i.e., it now has more protons than electrons), it becomes positively charged.
- (c) Charged particles (atoms carrying electric charge) are called ions.

3. CONDUCTORS AND INSULATORS

The substances which allow the electric current to flow through them are called ‘**Conductors**’. Conductors have free electrons due to which they conduct electricity.

Examples of conductors :

- (1) **Metals :** Copper(Cu), Aluminium(Al), Silver(Ag), Iron(Fe) etc.
- (2) **Non metals :** Graphite
- (3) **Electrolytic solution:** Aqueous solutions of NaCl, HCl, H₂SO₄ etc.

The substances which do not allow the electric current to flow through them are called ‘**Insulators**’. They do not have free electrons.

Examples of insulators : Rubber, glass, wood, plastics, porcelain, pure water, sugar etc.



Focus Point

- ⇒ Electric charge is a scalar quantity. It can be of two types : positive and negative.
- ⇒ S.I. unit of charge is coulomb (C). It is denoted by Q or q.
- ⇒ Like charges repel each other while unlike charges attract each other.
- ⇒ Two charged objects near one another may experience attraction or repulsion from each other because each object exerts a force on the other object. This force is called the **Electric force**.

4. ELECTRIC CURRENT

The charges that flow through electric wire are electrons. Under certain conditions, charges can flow. When charges flow, they give rise to what is called an ‘electric current’. An electric current is defined as the charge flowing per unit time. Thus, when Q coulombs of charge flows in t seconds, the current I will be

$$I = \frac{Q}{t} \text{ coulomb/second}$$

The unit coulomb/second is called the Ampere, with the symbol A. **Ampere is the SI unit of current.**

Ammeter is an instrument for measuring strength of an electric current.

It is always connected in series in circuit.

Most of the electrical gadgets we use in our homes work only when an electric current flows through them. In other words, they work because of the effects produced when an electric current flows through them.

LAB TIME
Let's Do & Learn

How does electric current flow in wire ?

Explanation

When the metal wire has not been connected to a source of electricity like a cell or a battery, then the electrons present in it move randomly in all the directions between the atoms of the metal wire as shown in figure.

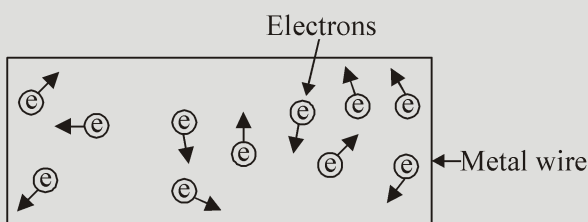


Figure : When no cell or battery is connected across a metal wire, the electron in it flow at random in all direction

When a source of electricity like a cell or a battery is connected between the ends of the metal wire, Since the electrons are negatively charged, they start moving form negative end to the positive end of the wire. This flow of electrons constitutes the electric current in the wire.

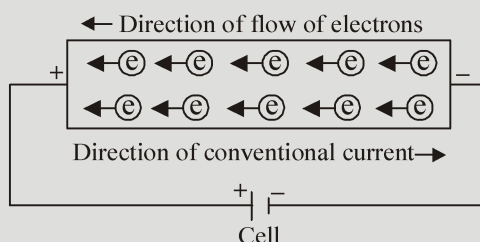


Figure : When a cell or battery is connected across a metal wire, the electrons in it flow towards positive terminal.

5. ELECTRICAL CIRCUITS

The path of flow of electricity from one terminal of the cell and returning to the other terminal is called an electrical circuit.

(i) Open electric circuit : An electric circuit in which normal path of current has been interrupted (broken).

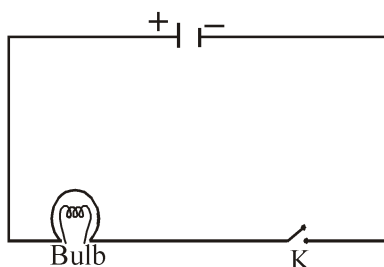


Figure : Open electric circuit

(ii) **Closed circuit** : An electric circuit that provides uninterrupted (unbroken), endless path for the flow of current.

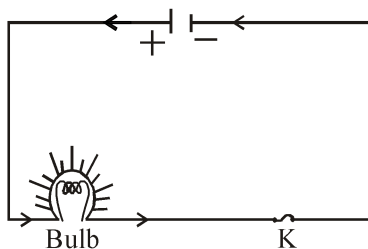


Figure : Closed circuit

- The switch in this circuit is open. Electric current cannot flow through the circuit
- The switch in this circuit is closed. Electric current can flow through the circuit.



Focus Point

- ⇒ For a fixed voltage (i.e, in a domestic light bulb) the thicker the filament the lower is its resistance and so less energy is converted into heat and the filament is dimmer. Brighter filaments are thinner, have higher resistance and so heat up more brighter.
- ⇒ Nichrome is an alloy containing 80% of nickel and 20% chromium. It resists oxidation even when red hot and its temperature can rise up to 900°C.
- ⇒ The current capacity of a fuse is independent of its length, it is proportional to its radius. More the radius, more will be the current capacity and vice – versa.
- ⇒ A magnetic compass has a magnetic needle supported on a pivot. The needle moves freely around on the pivot, when the magnetic needle is left undisturbed, it always points towards north–south direction.

6. CIRCUIT DIAGRAMS AND CIRCUIT SYMBOLS

Scientists use certain symbols to draw electrical circuits. An electrical circuit drawn using these symbols is called a circuit diagram. The symbols used to indicate different components are called circuit symbols. Figure shows some components and their circuit symbols.

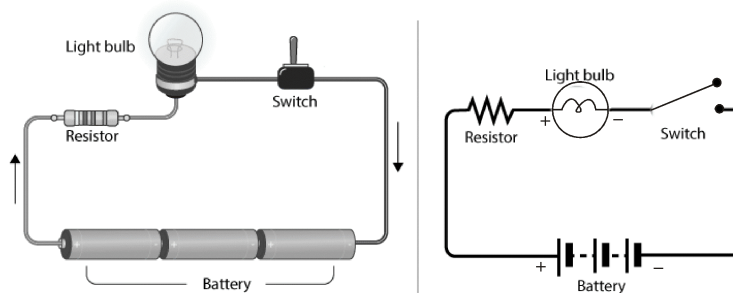


Figure : Circuit Diagram

Circuit elements	Name of Circuit elements
	Electric cell
	Battery
	Plug or switch (off)
	Plug key or switch (on)
	Variable resistance or rheostat
	Wire joint
	Wires crossing without joining
	Resistor
	Electric bulb
	Ammeter
	Voltmeter
	Galvanometer

Figure : Electric Symbols

7. DIFFERENCE BETWEEN CELL AND BATTERY

The positive terminal of one cell is connected to the negative terminal of the next cell. Such a combination of two or more cells is called a battery.

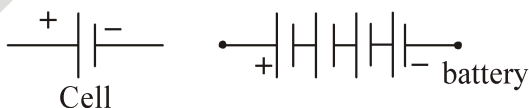


Figure : (a) Cells

Figure (b) Cells connected in series

If two cells are connected in series as in the above case, their combined strength is the sum of their respective strengths. In this case, the combined strength is $1.5\text{ V} + 1.5\text{ V} = 3\text{ V}$. Similarly, if three identical cells, each of strength 1.5 V , are connected in series, their combined strength will be

$$1.5\text{ V} + 1.5\text{ V} + 1.5\text{ V} = 4.5\text{ V}$$

8. SHORT CIRCUIT

Each wire is capable of withstanding a current of specific value. When the two wires, being used on one line, lose their insulation; the metallic ends may come in contact with one another and if the current exceeds this value, the wire may burn.

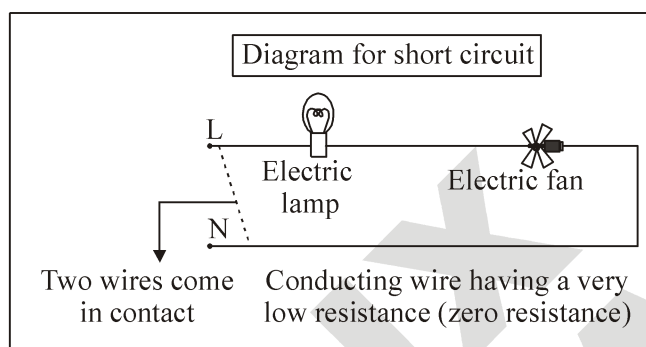


Figure : Short circuit

9. HEATING EFFECT OF ELECTRIC CURRENT

We know that to maintain the current, the source (cell or battery) has to keep expending its energy. A part of the source energy is consumed into useful work like in rotating the blades of an electric fan, producing light and sound in television, etc. Rest of the source energy is converted into heat to raise the temperature of the device.

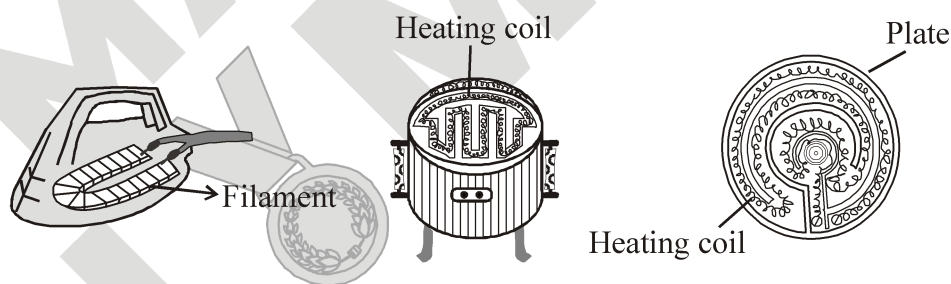


Figure : Heating appliances

Normally, all heating appliances consist primarily of two parts :

- (i) A resistance called filament which is a coiled length of nichrome wire. This wire has high resistivity and a high melting point.
- (ii) The insulating base made of fireclay, mica, silica or asbestos in which the filament is embedded. These materials are also able to withstand high temperature of the filament and are non-conductors of electricity.

⇒ Electric bulb

In a bulb, the electric current pass through a very thin wire made of a special material (such as tungsten) called the filament. When the bulb is switched on, the filament gets heated up. This is due to the heating effect of the electric current (see fig.)

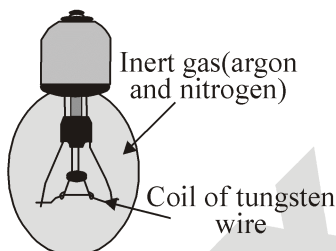


Figure : Electric bulb

Can you think of some appliances that get heated up just like a bulb when electric current passes through them ? Electric toasters, electric irons, hot plates, electric hair dryers and electric ovens are some appliances that get hot when electric current passes through them. These appliances contain tightly wound coils called elements. An element heats up when an electric current passes through it. In many electrical appliances, since the element is not covered, it can be identified by its dull red glow when the appliances is ON.

⇒ Compact fluorescent lamps

Compact fluorescent lamps (CFLs) have an average life span of six years and each bulb provides a saving of 80% in consumption of energy. That would mean a saving of 34 kilos of CO₂ per lamp per year ! These days LED bulbs are also made, they save electricity, even more than CFL's and they are free of mercury.



Figure : CFLs

10. FUSE

A fuse is a small piece of wire made of lead and tin and mounted in porcelain holder. It is placed in the path of main electric cables that enters the house as well as in each sub unit of house. As soon as an excess of electricity flows through the wire, the wire gets heated up and melts, thus preventing further flow of electricity

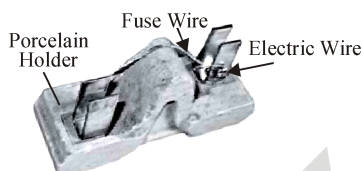


Figure : Electric Fuse

Fuse

Use of fuse : To protect our electrical appliances from excess electric current, which may otherwise burn the appliance.

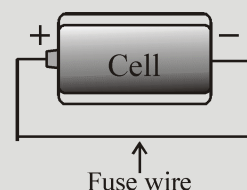
LAB TIME
Let's Do & Learn

Aim : To show the working of a fuse

Material required : A battery of four cells, a thin strand of steel wool (steel wool commonly used for cleaning utensils), two connecting wires.

Method :

1. Peel the end of the two connecting, 3 wires and connect the strand of steel wool between them. The steel wool will serve as a fuse wire.
2. Connect the loose end of one connecting wire to the negative terminal of the battery.
3. Now, touch the loose end of another connecting wire to the positive terminal of the battery. Observe the strand of steel wool.



Observation : The steel strand melts down and breaks the circuit. The current stops flowing in the circuit. This is how a fuse works.

10.1 CHEMICAL EFFECT OF CURRENT

When an electric current is passed through water containing sulphuric acid, the water breaks up into its components hydrogen and oxygen. Therefore an electric current can cause a chemical change. This effect of electric current is used in electroplating.

- **Electroplating:** The method of plating one metal object with another metal by using of electricity is called electroplating. The metal which is to be electroplated is made cathode and the metal to be deposited is made anode while the soluble salt of the same metal serves as the electrolyte. When a current is passed, a thin film of metal is deposited on the metal, which becomes electroplated.

Eg. : Let we are having a steel razor blade is to be electroplated with copper.

LAB TIME

Let's Do & Learn

- **Aim :** To plate a stainless steel razor blade with copper.
- **Materials required :** Glass beaker, copper sulphate solution, two pieces of connecting wire (50cm long), a cell, stainless steel razor blade.
- **Method :** Remove the insulation from the ends of both wires. Tie one end of a wire to the stainless steel razor blade and tape the other bare end to the negative terminal of the cell. Tape one end of the other wire to the positive terminal of the cell and dip its other end into the copper scrub the razor blade clean and dip it in the solution.

After electricity passes through the circuit for some time, you will find a reddish-brown deposit on the blade. This is the coating of copper. If you continue this for some more time, you will find that your blade is slowly getting plated with copper

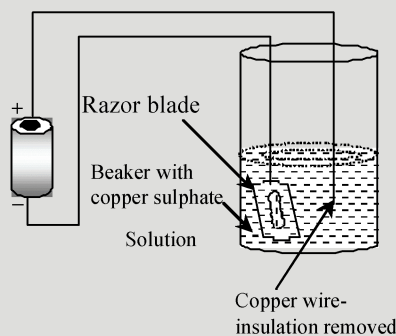


Figure : A simple circuit showing electroplating

10.2 MAGNETIC EFFECT OF CURRENT

We know that a moving magnet can generate an electric current. Also we can say that electric current can produce a magnetic effect. A coil, through which when an electric current flows behave like a magnet with its two poles.

Eg.: Electric bell shows magnetic effect of current.

LAB TIME

Let's Do & Learn

- **Aim:** To make our own magnet with electricity.
Materials required : Iron nail, Cell, Connecting wires.
- **Method :** Remove the insulation from each end of the wire. coil the wire tightly around the nail as shown in figure and tape the two ends of the wire to the two terminals of the cell. Now hold the iron nail over some common pins.

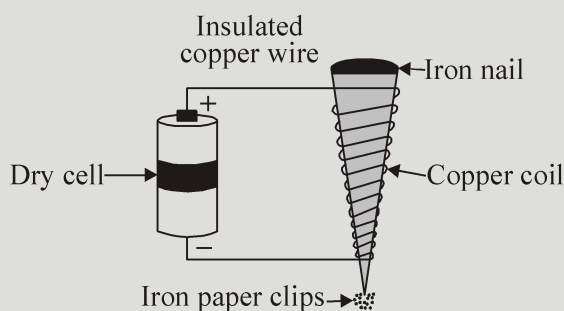


Figure : Electromagnet

The coil in the above activity behaves like a magnet when electric current flows through it. When the electric current is switched off, the coil loses its magnetism. Such coils are called electromagnets.

(ii) Factors which effect the strength of electromagnet :

- Magnetic effect of current depends on number of turns.
- Magnetic effect of current depends the value of current.
- Magnetic effect of current depends on the nature of core inside the coil.

Advantages of electromagnet over permanent magnet:-

- An electromagnet can produce a stronger magnetic field as compared to a permanent magnet.
- The strength of magnetic field of an electromagnet can be changed easily by changing the current or the number of turns in the coil.
- The polarity (north pole or south pole) of the electromagnet can be changed by reversing the direction of the current.
- An electromagnet can be easily magnetised or demagnetised as per the requirement.



Focus Point

- ⇒ Strong electromagnets are made using metallic core made from an alloy named ALNICO which is made from aluminium, nickel and cobalt metals.
- ⇒ A solenoid is a device which can be used as an electromagnet.
- ⇒ Iron is called ‘soft’ magnetic material because it loses its magnetism easily. Iron is used in making electromagnets. Steel is called a ‘permanent’ magnetic material because it does not lose its magnetism so easily. It is used to make permanent magnets.
- ⇒ A temporary strong magnet acquires magnetic properties when an electric current flows through it and loses its magnetic properties as soon as the current is stopped.
- ⇒ Electric bell is based on the principle of an electromagnet

11. ELECTRIC BELL

When the switch of an electric bell is pressed, the circuit is completed and current flows through the coils of the electromagnet it gets magnetized and attracts the iron strip towards itself. This brings the hammer in contact with the gong and the sound of the bell is heard. Due to the displacement of the iron strip from its original position, it loses contact with the contact screw due to which the circuit of the electromagnet breaks. Current stops flowing and the electromagnet loses its magnetism. Hence, the iron strip comes back to its original position, which once again completes the circuit. The entire process is repeated as long as the switch is kept pressed. The hammer would strike the gong again and again and the ringing of the bell would be heard.

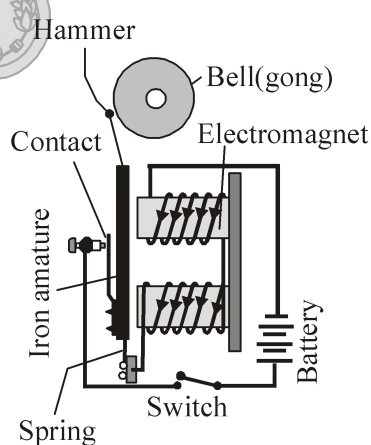


Figure : Electric Bell

12. CALCULATE THE COST OF ELECTRICITY

Commercial unit of electric energy : Kilowatt -hour (kWh) :

Electric energy is required to run the electric lamps, heaters, refrigerators, televisions and other electric appliances. The department of electricity sells the electric energy to the consumers in units called kilowatt-hours(kWh). If our electricity bill shows that we have paid for 10 units, then it means the electric appliances of our house have consumed 10 kilowatt-hour. So 1 unit will be equal to 1kWh.

A kilowatt-hour is the amount of electric energy used by 1000 Watt electric appliance (say a heater) when it operates for one hour.

kWh is also known as “**Board of Trade Unit**”(B.O.T)

⇒ **Relation between kWh and Joule :**

$$1 \text{ kWh} = 1000 \text{ Wh} \quad (\because 1 \text{ kW} = 1000 \text{ w})$$

$$1 \text{ J} = 1 \text{ watt} \times 1 \text{ sec.}$$

$$\text{Now } 1 \text{ W} = 1 \text{ Js}^{-1} \text{ and } 1 \text{ h} = 60 \times 60 \text{ s} = 3600 \text{ s.}$$

$$\therefore 1 \text{ kWh} = 1000 \text{ Js}^{-1} \times 3600 \text{ s} = 3600000 \text{ J} = 3.6 \times 10^6 \text{ J}$$

$$\therefore 1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$$

13. CONSERVE ELECTRICITY

Each one of us has a responsibility to prevent misuse of electricity by developing proper habits.

- (i) Switch off all electrical appliances when not in use.
- (ii) Encourage (maximum) use of CFL and LED lightings.

Example 1

The heating elements of a heater becomes red hot but not the connecting wire. Why ?

Solution:

This is because the resistance of a heater wire is high, whereas that of the connecting wire is extremely low.

Example 2

What is the difference between a fuse wire and a heating wire ?

Solution:

The fuse wire has low melting point, whereas the heating wire has a high melting point. Fuse wire is made up of tin-lead alloy, whereas heating wire is made of constantan.

SE. 1

What is a battery ?

Ans. The combination of two or more cells is known as a battery.

SE. 2

Define electric cell. What is the direction of electric current in a cell ?

Ans. The Simplest source of an electric current is an electric cell and it has a positive terminal and a negative terminal. In electric cell the current starts from positive terminal of the cell, passes through the equipment connected to it, and terminates at the negative terminal of the cell.

SE. 3

The electric current is complete if there are no breaks in the circuit. Such a circuit is called a _____. If there is a break in the circuit, it becomes incomplete. Such an incomplete circuit is called an _____.

Ans. closed circuit, open circuit

SE. 4

What are the essential components of an electric circuit ?

Ans. Electric cell, Electric bulb, Switch in ON position or in OFF position, battery and wires.

SE. 5

What is a fuse ?

Ans. Fuse is a safety device that is used in household circuits to protect the appliances. It prevents them from getting burnt out in case excess current flows through the circuit.

SE. 6

What is heating effect of the electric current ?

Ans. The wire or component or device gets hot when an electric current passes through them. This is known as heating effect of the electric current.

SE. 7

Name any two effects of electric current ?

Ans. Electric current has the following effect :

- (i) Electric current can give rise to heating and lighting.
- (ii) Electric current can convert a straight conductor into a temporary magnet.

SE. 8

Make a list of such appliances which work on the basis of heating effect of current ?

Ans. Bulb, iron, heater, toaster, geysers etc.

SE. 9

On what factors does the heat produced in a wire depends ?

Ans. Amount of heat produced in a wire depends on its material, length and thickness.

SE. 10

What do you mean by magnetic effect ?

Ans. When electric current passes through a wire, it behaves like a magnet. This is called magnetic effect of electricity.

SE. 11

How does the electric heater or an electric iron work?

Ans. Electric heater and iron work on the basis of heating effect of electricity. When an electric current passes through the wires they become hot. Electric heater or iron contains a coil of wire. This coil of wire is called an element. When these appliances are switched on after connecting to the electric supply, their elements become red hot and give out heat.

SE. 12

What are MCBs ? How do they work ?

Ans. MCBs (Miniature circuit breakers) are switches which automatically turn off when current in a circuit exceeds the safe limit. We turn them on circuit is once again complete.

SE. 13

Write the differences between a bar magnet and an electromagnet.

Ans. Bar Magnet

1. It is permanent magnet.
2. Its strength cannot be changed.
3. Its uses are limited

Electromagnet

1. It is a temporary magnet
2. Its strength can be changed.
3. Its uses are more wide

SE. 14

What are the uses of electromagnets ?

Ans. Electromagnets are used in cars, speakers, electric motors, electric bells, telephone receivers, television, picture tubes etc.

SE. 15

What is an electric fuse made up of? How does it function to prevent a circuit from burning ?

Ans. A fuse is a small piece of wire of an alloy of adequately low melting point (usually 63% tin and 37% lead). There is a maximum limit of the current which can safely flow through a circuit. If the current exceeds the safe limit, then the fuse wire gets hot and melts. This creates a gap in the circuit and the appliance is saved from getting burnt.

NS. 1

Draw in your notebook the symbols to represent the following components of electrical circuits : connecting wires, switch in the 'OFF' position, bulb, cell, switch in the 'ON' position and battery.

Ans. Connecting wires



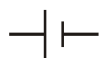
Switch in 'ON' position



Bulb



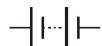
Cell



Switch in 'off' position

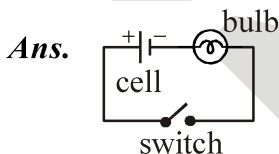


Battery



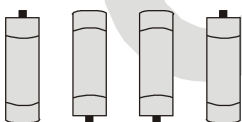
NS. 2

Draw the circuit diagram to represent the circuit shown in figure.

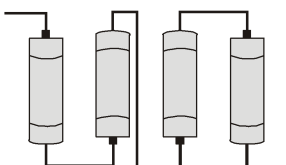


NS. 3

In figure shows four cells fixed on a board. Draw lines to indicate how you will connect their terminals with wires to make a battery of four cells.

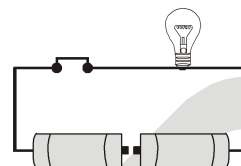


Ans.

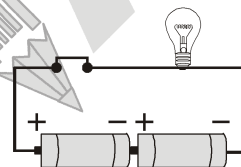


NS. 4

The bulb in the circuit shown in figure does not glow. Can you identify the problem ? Make necessary changes in the circuit to make the bulb glow.



Ans. The bulb in the circuit is not glowing because the two batteries are not connected properly. To make the bulb glow, the negative end of one cell should be connected to the positive end of the other cell.



NS. 5

Name any two effects of electric current.

Ans. Electric current has the following effect :

- (i) Electric current can give rise to heating and lighting
- (ii) Electric current can convert a straight conductor into a temporary magnet.

NS. 6

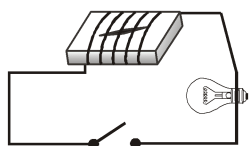
When the current is switched on through a wire, a compass needle kept nearby gets deflected from its north-south position. Explain.

Ans. When current is passed through the wire, it deflects the compass near it from its north-south position like a magnet. This is called magnetic effect of the current. As we know that needle of the compass is made up of a thin magnet. When this needle comes

in contact with another magnet then the like poles of the magnet repel each other and opposite poles attract each other. So the deflection is seen in the needle. In this case the wire behaves like a magnet and cause deflection in needle of the compass.

NS. 7

Will the compass needle show deflection when the switch in the circuit shown by figure closed ?



Ans. No, because there is no source of electric current in this circuit, i.e., there is no battery.

NS. 8

Fill in the blanks :

- (a) Longer line in the symbol for a cell represents its _____ terminal.
- (b) The combination of two or more cells is called a _____.
- (c) When current is switched 'on' in a room heater, it _____.
- (d) The safety device based on the heating effect of electric current is called a _____.

Ans. (a) positive (b) battery
(c) becomes red hot and emits heat
(d) fuse.

NS. 9

Mark 'T' if the statement is true and 'F' if it is false:

- (a) To make a battery of two cells, the negative terminal of one cell is connected to the negative terminal of the other cell. (T/F)
- (b) When the electric current through the fuse exceeds a certain limit, the fuse wire melts and breaks. (T/F)

(c) An electromagnet does not attract a piece of iron. (T/F)

(d) An electric bell has an electromagnet. (T/F)

Ans. (a) F (b) T (c) F (d) T

NS. 10

Do you think an electromagnet can be used for separating plastic bags from a garbage heap? Explain.

Ans. No, the plastic bags do not get attracted by the magnet, so they cannot be separated by an electromagnet. Plastic bags are not magnetic materials, only magnetic materials like iron can be attracted by the magnet.

NS. 11

An electrician is carrying out some repairs in your house. He wants to replace a fuse by a piece of wire. Would you agree? Give reasons for your response.

Ans. No, we would not agree to allow to replace the fuse by a wire. Wires in the fuses are of specific melting points. So we should always use ISI marked fuses in our houses to prevent short circuits.

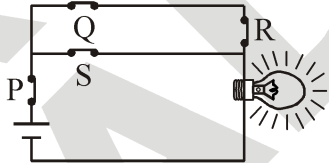
NS. 12

Zubeda made an electric circuit using a cell holder shown in figure, a switch and a bulb. When she put the switch in the 'ON' position, the bulb did not glow. Help Zubeda in identifying the possible defects in the circuit.

EXERCISE – I

ONLY ONE CORRECT TYPE

- An electric component used as a safety device in electric circuits is :
(A) Switch (B) Fuse
(C) Cell (D) Electric wires
- The electric bell makes use of :
(A) a U-shaped electromagnet
(B) a bar-shaped electromagnet
(C) a ring-shaped electromagnet
(D) no electromagnet
- In an electric circuit, the current starts from :
(A) the negative terminal of the battery
(B) the positive terminal of the battery
(C) either of the terminals of the battery
(D) none of the terminals of the battery
- The strength of an electromagnet does not depend upon :
(A) the current flowing through the coil
(B) the number of turns of the coil
(C) the insulating material of the coil
(D) the length of the electromagnet
- In the symbol of an electric cell, the longer line represents the _____ terminal, and the thicker and shorter line represents the _____ terminal.
(A) negative, positive (B) neutral, positive
(C) neutral, negative (D) positive, negative
- The device used to prevent the flow of excess current in the circuit is :
(A) Switch (B) Fuse
(C) Bulb (D) Coil
- A current carrying coil of an insulated wire wrapped around a piece of soft iron becomes :
(A) A filament (B) An electromagnet
(C) A fuse (D) A conductor
- The thin wire inside a bulb is :
(A) Coil (B) Magnet
(C) Filament (D) None of these
- The bulb in an electric circuit glows because of :
(A) Magnetic effect of current
(B) Heating effect of current
(C) Chemical effect of current
(D) None of these
- Which of the following is not a source of electric current ?
(A) Car battery (B) Dry cell
(C) Cell (D) Electromagnet
- A battery is a group of :
(A) only two cells (B) two or more cells
(C) only single cell (D) all of these
- Key or switch in circuit is placed :
(A) left side of the battery
(B) right side of the battery
(C) anywhere in the circuit
(D) near the positive terminal of the bulb
- The coil of wire contained in heater is known as
(A) component (B) circuit
(C) element (D) spring
- Which of the following is not a circuit element ?
(A) Potential difference
(B) Voltmeter
(C) Resistor
(D) Battery
- The necessary requirement for a fuse wire is :
(A) Conductor with low melting point
(B) Conductor with high melting point
(C) Insulator with low melting point
(D) Insulator with high melting point

16. Mark out the correct statement :
- Fuses and MCBs are safety device
 - Fuses are safety device but MCBs are not
 - MCBs are safety device but fuses are not
 - Neither fuses nor MCBs are safety device.
17. Which of these appliances does not use an electromagnet ?
- Washing machine
 - Refrigerator
 - Room heater
 - Electric bell
18. The shorter, thicker vertical line in the symbol of a cell represents
- The positive terminal
 - The negative terminal
 - The direction of current
 - None of these
19. In which circuit will the bulb or bulbs glow the brightest ?
- A simple circuit with one bulb and one cell.
 - A simple circuit with one bulb and two cells
 - A simple circuit with two bulbs and one cell
 - A simple circuit with two bulbs and two cells
20. Why is electrical wiring usually covered with a layer of plastic ?
- To make it strong
 - To help electricity flow in it
 - To make it safe
 - To make it beautiful
21. Why is electrical wiring usually made from copper and not silver ?
- Copper is a better conductor
 - Copper is a better insulator
 - Copper is less expensive
 - Copper is non magnetic
22. Study the circuit shown here. Which switch if opened will cause the light bulb to stop glowing ?
- 
- P
 - Q
 - R
 - S
23. An electric heater is used by us to convert electrical energy to :
- heat energy
 - light energy
 - chemical energy
 - both (A) and (B)
24. Iron is used for making electromagnet ; not steel, nickel, cobalt because :
- Iron is cheap and easily available
 - Iron is a good conductor of electricity
 - When current is switched off in the coil of an electromagnet made of iron, iron loses all its magnetism
 - none of these
25. The electric fuse work on which one of the following phenomenon ?
- Chemical effect of current
 - Magnetic effect of current
 - Heating effect of current
 - None of these

PARAGRAPH TYPE

PARAGRAPH # 1

Look at the given figure carefully and answer the following questions.



26. It is a symbol of :
 (A) Switch (B) Fuse
 (C) Bulb (D) Cell
27. The figure is made up of two parallel lines. One is thin and long, while the other is thick and short. The thick and short line represents
 (A) Negative terminal of the cell
 (B) Positive terminal of the cell
 (C) Negative terminal of the bulb
 (D) Positive terminal of the bulb
28. The combination of electric cells are called
 (A) Battery (B) Fuse
 (C) Filament (D) Bulb

PARAGRAPH # 2

The purpose of using MCB or fuse is the same but the working principals of both the devices are different. MCB stands for Miniature circuit breaker and both fuse and MCB are used to protect electric equipment and you from a short circuit or any kind of electrical fault. MCB and fuse disrupt the flow of the current whenever there is unexpected high voltage of electricity passing through electric device and also interrupt the flow when the temperature of the electric device high which can cause a short circuit or any miss happening. The MCB detects the excess current flow and immediately breaks the circuit.

29. Fusing element of a fuse is usually made of :
 (A) Steel (B) Iron
 (C) Mica (D) Copper

30. The primary function of a fuse is to
 (A) Open the circuit
 (B) Protect the appliance
 (C) Protect the line
 (D) Prevent excessive currents from flow through the circuit
31. What is the full form of MCB ?
 (A) Miniature circuit Broker
 (B) Maximum Circuit Breaker
 (C) Miniature Circuit Breaker
 (D) Minimum Circuit Breaker

MATCH THE COLUMN TYPE

32. Column I

- (a) CFL
 (b) ISI
 (c) Fuse
 (d) Element

Column II

- (p) A safety device to prevent short circuit
 (q) The wire used in heater to get heat
 (r) Consume less energy than bulb
 (s) Appliances is safe to use

- (A) a-s, b-p, c-r, d-q
 (B) a-r, b-s, c-q, d-p
 (C) a-r, b-s, c-p, d-q
 (D) a-s, b-r, c-q, d-p

33. Column I

- (a) Charges
 (b) Electric current
 (c) Silver
 (d) Wood
 (A) a-p, b-q, c-r, d-s
 (B) a-s, b-r, c-q, d-p
 (C) a-r, b-p, c-s, d-q
 (D) a-s, b-r, c-p, d-q

Column II

- (p) Conductors
 (q) Insulators
 (r) Ampere
 (s) Coulomb

EXERCISE – II

VERY SHORT ANSWER TYPE

1. What is the source of electric current in a torch ?
2. Name any four appliances which work on the principle of heating effect of current ?
3. Name any four devices where magnetic effect of electric current is used.
4. Name the element from which the filament of electric bulb is made.
5. What type of magnet is used in an electric bell ?
6. What do you mean by an electric circuit ?
7. In which position is key placed in a circuit ?
8. How can we connect the cells to prepare battery ?
9. What are the effect of electricity ?
10. What is element in respect of heating effect ?

SHORT ANSWER TYPE

1. Why does an electric bulb get hot if it is switched on for a while ?
2. What are the factors on which heating effect of electric current depends ?
3. Write two applications of electromagnets.
4. What happens when a compass needle is brought near to a current carrying wire ?
5. Draw diagram of electromagnet. On which effect of electricity does it work ?

LONG ANSWER TYPE

1. What do you mean by an electric circuit ? What are the main components of an electric circuit ? Draw diagram of an closed circuit ?
2. How does an electric torch work ?
3. How can you show that an electric current has magnetic field ?
4. What is an electromagnet ? Name some devices in which it is used.
5. Explain the working of electric bell.

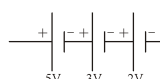
TRUE / FALSE TYPE

1. An MCB can be used instead of a fuse in an electrical circuit.
2. The potential difference in a circuit is shown by an arrow.
3. An electric motor makes use of the magnetic effect of a current.
4. To make a battery of two cells, the negative terminal of one cell is connected to the negative terminal of the other cell.
5. When the electric current through the fuse exceeds a certain limit, the fuse wire melts and breaks.

FILL IN THE BLANKS

1. A circuit may get _____ due to reasons like short-circuiting.
2. When an electric current flows through a wire, it behaves like a _____.
3. A battery, made up of more than one cell is used to provide _____ current in the circuit.
4. The heating coil of an electric geyser is made up of _____.
5. The melting point of a fuse is _____ than the melting point of remaining circuit.

NUMERICAL TYPE QUESTION

1. In a wire there is 5A current and time is 5 sec then find out the value of charges.
2.  find total strength of the battery ?
3. Find the value of 5 kwh in joule (ignore the power of ten)
4. Find the electric current in a wire there is 5C charges flow per second.
5. How many units in 10 kwh.

Answer Key

EXERCISE-I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B	A	B	C	D	B	B	C	B	D	B	C	C	A	A
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	C	B	B	C	C	A	A	C	C	D	A	A	D	D
31	32	33												
C	C	D												

EXERCISE – II

TRUE / FALSE

1. T 2. F 3. T 4. F 5. T

FILL IN THE BLANKS

1. overheated 2. magnet 3. more
 4. element 5. lower

NUMERICALS

1. 25 C 2. 10 V 3. 18×10^6 J 4. 5 A
 5. 10 units

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : ELECTRIC CURRENT AND ITS EFFECTS)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
Solved Examples			
NCERT Exercises			
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.



Space for Notes :

A large rectangular area filled with horizontal dotted lines, intended for writing notes.

