CHAPTER-13 –

MOTION AND TIME

SOLUTONS:

Exercises

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 child in a merry-go-round.**
   - **iv) Motion of a child on a see-saw.**
   - **v) Motion of the hammer of an electric bell.**
   - **vi) Motion of a train on a straight bridge.**

Ans:

- i) Oscillatory motion
- ii) Linear motion
- iii) Circular motion
- iv) Oscillatory motion
- v) Oscillatory motion
- vi) Linear motion

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 constant**
   - **v) The speed of a train is expressed in m/h**

Ans:

- i) False
- ii) True
- iii) False
- iv) False
- v) True

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

Ans: Time taken to complete oscillations= 32s

Time taken to complete 1 oscillation=32/20 s

= 1.6 s

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

Ans: Distance = 240 km

Time taken = 4 hours

Speed = distance covered / time taken

= 240 km / 4 hr

= 60 km/hr

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.

Ans: Distance = 57336.0 km – 57321 km

= 15 km

Speed in km/min = 15km/1/3hr

= 3/4 km/min

Speed in km/hr = 15 km / 1/3 hr

= (15 x 3) km/hr

= 45 km/hr

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

Ans: Time taken to reach her school by bicycle= 15 min

= 15 x 60

= 900 s

Speed of Salma's bicycle = 2m/s

Distance = speed x time

= 2 x 900

= 1800 m

1000 m = 1 km

Therefore, distance between Salma's house and the schools is = 1/1000 x 1800= 1.8 km

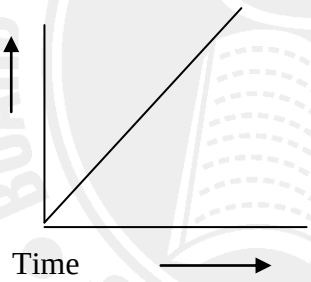
7. Show the shape of the distance-time graph for the motion in the following cases:

i) A car moving with a constant speed

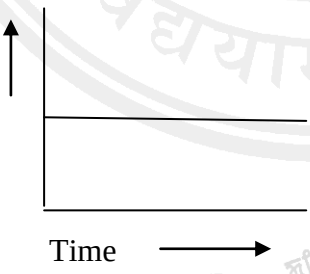
ii) A car parked on a side road.

Ans:

i) Distance



ii) Distance



8. Which of the following relations is correct?

i) Speed=distance x time

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

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

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

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

9. The basic unit of speed is
   i) Km/min
   ii) m/min
   iii) Km/h
   iv) iv) m/s

Ans: iv) m/s

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) 25 km

11. Suppose the two photographs, shown in Fig. 13.1 and Fig.13.2 (of your textbook), 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 fastest car.

Ans: The distance covered by the blue car (as seen in the photograph) from one horizontal white strip to another, which is measured by scale is 1.2 cm

It is given that 1 cm is equivalent to 100 m

Therefore, 1.2 cm is equivalent to 120 m

Time taken to cover this distance = Time interval between the two photographs = 10s

Speed = distance covered/ Time taken

= 120/10

= 12 m/s

12. Fig. 13.15 shows the distance-time graph for the motion of two vehicles A and B. Which one of them is moving faster?

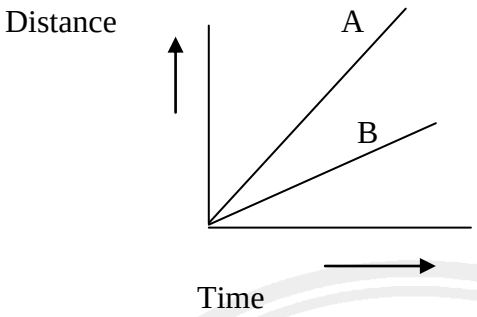
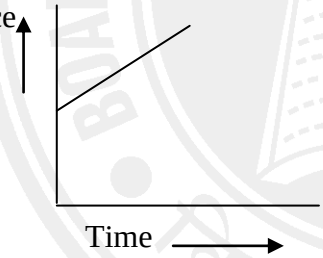
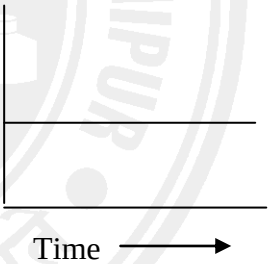


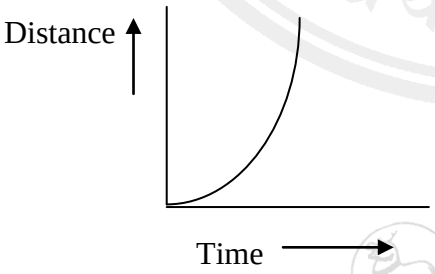
Fig: 13.15 Distance-time graph for the motion of two cars.

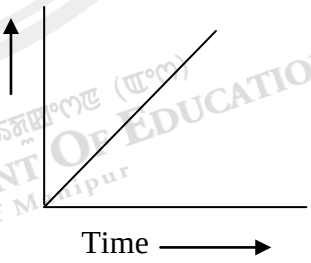
Ans: Vehicle A is moving faster than Vehicle B

13. Which of the following distance-time graphs shows a truck moving with speed which is not constant?

i) 

ii) 

iii) 

iv) 

Ans: iii)

EXTRA QUESTIONS AND ANSWERS

1. What is motion?

Ans: When an object keeps on changing its position with respect to other objects, then it is said to be in motion.

2. Name some types of motion?

Ans: There are different kinds of motion. Some of them are:

i) Linear motion or Rectilinear motion
ii) Circular motion
iii) Periodic or Oscillatory motion
iv) Rotatory motion
v) Translatory motion
vi) Vibratory motion

3. What is time?

Ans: Time is the duration of one happening to another happening.

4. What is a time period?

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

5. Determine the number of seconds in a day.

Ans: In a day, we have 24 hr.

We know that, 1 hr = (60 x 60)
= 3600 s

We know that 24 hrs = (3600 x 24) s
= 86400 s

6. Estimate how many hours are there in a year.

Ans: In a year, we have 365 days

And, 1 day = 24 hrs

Therefore, 365 days = (24 x 365) hrs = 8760 hrs

7. **What is speed?**

Ans: The distance covered by an object in a unit time is called the speed of the object. S

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

8. What do you mean by average speed?

Ans: The total distance covered by an object divided by the total time taken is called average speed.

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

9. Differentiate between uniform and non-uniform motion.

Ans: If an object moving along a straight line with a constant speed, then the motion of the object is said to be in uniform motion. In this case, the average speed is the same as the actual speed. E.g. Moving of a car in 30km/hr

On the other hand, if the speed of an object moving along a straight line keeps changing, its motion is said to be non-uniform. E.g Moving of a bike in 20 km/hr and after some time 30 km/hr.

10. What is the basic unit of speed?

Ans: The basic unit of speed is m/s.

11. How did our ancestors find out the time of the day?

Ans: Our ancestors find out the time of the day by looking at the shadows.

12. Give an example of periodic motion.

Ans: Simple pendulum is an example of periodic motion.

13. What is an oscillation?

Ans: An oscillation is the movement of a pendulum from its one extreme position to the other extreme position and then back to the former position.

14. What are the factors that affect the time period of a simple pendulum?

Ans: The factors that affect the time period of a simple pendulum are

i) Length of pendulum

ii) Acceleration due to gravity.

15. How many types of graphs are there?

Ans: There are 3 types of graphs:

i) Bar graph

ii) Line graph

iii) Pie chart

16. What type of graph is used to represent a distance-time graph?

Ans: Line graph is to represent a distance-time graph.

17. Name the device which is used to measure speed.

Ans: Speedometer.

18. Name the device used to measure the distance.

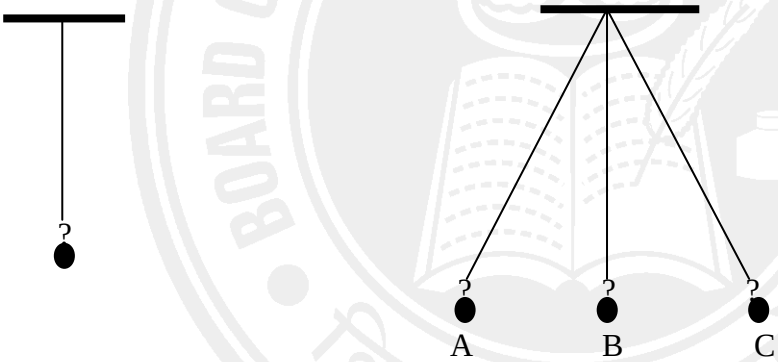
Ans: Odometer

19. Explain how Galileo contributed to the development of clocks.

Ans: Once Galileo was sitting in a church. He noticed that a lamp suspended from the ceiling with chain was moving slowly from one side to other. He was surprised to find that his pulse beat the same number of times during the interval in which the lamp completed one oscillation. He found that a pendulum of a given length takes always the same time to complete one oscillation. This observation led to the development of pendulum clocks and other watches.

20. What is a simple pendulum? Explain how it performs oscillatory motion with an example.

Ans: A simple pendulum consists of a small metallic ball or a piece of stone suspended from a rigid stand by a thread. The metallic ball is called bob of the pendulum.



a) A simple pendulum b) Different positions of the bob of an oscillating simple Pendulum

When the bob of the pendulum is released after taking it slightly one side, it begins to move to and fro. The to and fro motion of a simple pendulum is an example of an oscillatory motion.

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.

21. Write some points to be kept in mind while choosing the most suitable scale for drawing a graph?

Ans: The points for choosing the most suitable scale for drawing a graph are:

i) The difference between the highest and the lowest values of each quantity.

ii) The intermediate values of each quantity, so that with the scale chosen it is convenient to mark the values on the graph, and

iii) To utilise the maximum part of the paper on which the graph is to be drawn.

22. Write the importance of distance-time graph?

Ans: The importances of distance-time graph are given below:

i) Distance-time graph shows whether motion is uniform or non-uniform.

ii) We can find the distance moved by the body at any instant of time.

iii) It provides a variety of information about motion.

iv) It tells us that motion is accelerated or retarded.

23. Complete the following table showing examples of different types of motion.

Examples of motion	**Types of motion** **Linear/ circular/ periodic**
Soldiers in a march past	
Bullock cart moving on a straight road	
Hands of an athlete in a race	
Pedal of a bicycle in motion	
Motion of the Earth around the sun	
Motion of a swing	
Motion of a pendulum	

Ans:

Examples of motion	**Types of motion** **Linear/ circular/ periodic**
Soldiers in a march past	Linear motion
Bullock cart moving on a straight road	Linear motion
Hands of an athlete in a race	Periodic motion
Pedal of a bicycle in motion	Circular motion
Motion of the Earth around the sun	Circular motion
Motion of a swing	Periodic motion
Motion of a pendulum	Periodic motion

24. What are x and y-axis in a graph?

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

25. What is origin in a graph?

Ans: The point where the x-axis and y-axis both intersect each other is called origin of graph.

26. What does a straight line in a distance-time graph indicates?

Ans: A straight line in a distance-time graph indicates that the object is moving with a constant speed.

27. What will be the shape of a distance-time graph if the speed of an object keeps on changing?

Ans: If the speed of an object keeps on changing the distance-time graph can be of any other shape but not a straight line.

28. Convert speed into m/s for the following animals given in the table.

S. No.	Name of the Object	Speed in km/h	Speed in m/s
1	Falcon	320	
2	Cheetah	112	
3	Blue fish	40-46	
4	Rabbit	56	
5	Squirrel	19	
6	Domestic mouse	11	
7	Human	40	
8	Giant tortoise	0.27	
9	Snail	0.05	

Ans:

S. No.	Name of the Object	Speed in km/h	Speed in m/s
1	Falcon	320	$\frac{320 \times 1000}{60 \times 60}$ =88.8 m/s
2	Cheetah	112	$\frac{112 \times 1000}{60 \times 60}$ =31.1 m/s
3	Blue fish	40-46	$\frac{43 \times 1000}{60 \times 60}$ =11.8 m/s
4	Rabbit	56	$\frac{56 \times 1000}{60 \times 60}$ =15.5 m/s
5	Squirrel	19	$\frac{19 \times 1000}{60 \times 60}$ =5.2 m/s
6	Domestic mouse	11	$\frac{11 \times 1000}{60 \times 60}$ =3.0 m/s
7	Human	40	$\frac{40 \times 1000}{60 \times 60}$ =11.1 m/s
8	Giant tortoise	0.27	$\frac{0.27 \times 1000}{60 \times 60}$ =0.075 m/s
9	Snail	0.05	$\frac{0.05 \times 1000}{60 \times 60}$ =0.013 m/s

29. Write the steps to draw distance-time graph with the help of following data.

Table: The motion of a car

S.No.	Time	Distance
1	0	0
2	1 min	1 km
3	2 min	2 km
4	3 min	3 km
5	4 min	4 km
6	5 min	5 km

Ans: The steps for drawing the graph are as follows:

i) Draw two perpendicular lines to represent the two axes and mark them as OX and OY as in Fig 1.

ii) Decide the quantity to show along the x and y-axis. In the case we show time along the x-axis and the distance along the y-axis.

iii) Choose a scale to represent the distance and another to represent the time on the graph. For the motion of the car scales could be

Time: 1 min = 1 cm

Distance: 1 km = 1 cm

iv) Mark the value of time and the distance on the respective axes according to the scale chosen. For the motion of the car mark the time 1 min, 2 min, …. On the x-axis from the origin O. Similarly, mark the distance 1km, 2 km, … on the y-axis (Fig. 2)

v) Now mark the points on the graph paper to represent each set of values for distance and time.

vi) The point corresponding to this set of values on the graph will therefore be the origin itself. After 1 min, the car has moved a distance of 1 km. To mark this set of values look for the point that represents 1 minute on the x-axis. Draw a line parallel to the y-axis at this point.

vii) Then draw a line parallel to the x-axis from the point corresponding to distance 1 km on the y-axis. The point where these two lines intersect represents this set of values on the graph (Fig.2). Similarly, mark on the graph paper the points corresponding to different sets of values.

viii) Fig 2 shows the set of points on the graph corresponding to positions of the car at various times.

ix) Join all the points on the graph as shown in Fig. 3. It is a straight line. This is the distance-time graph for the motion of the car.

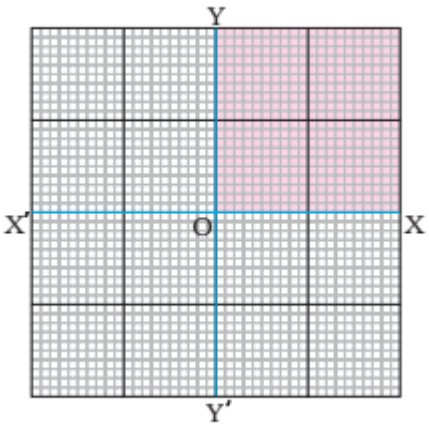


Fig. 1 *x-axis and y-axis on a graph paper*

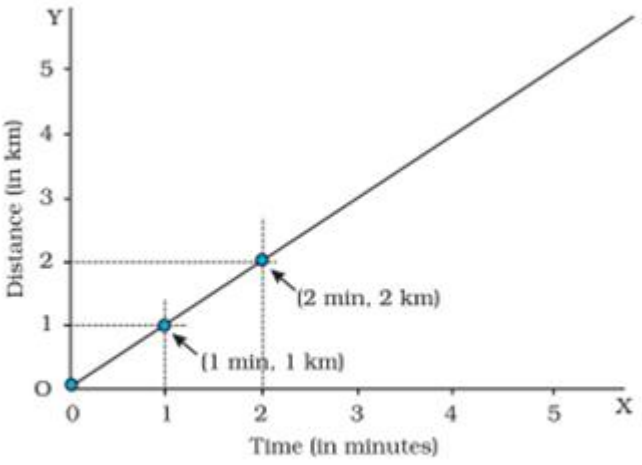


Fig. 2 *Making a graph*

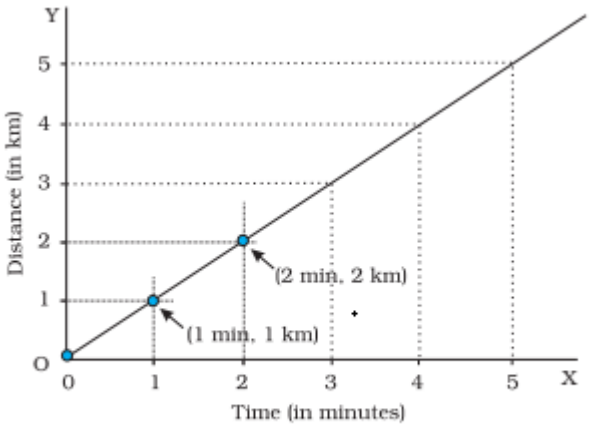


Fig. 3 *Making a graph*