Motion And Time 14

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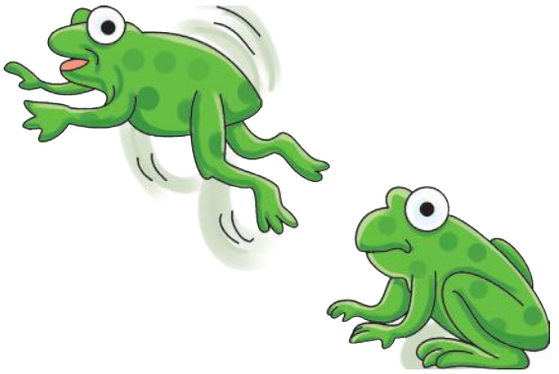
INTRODUCTION

In our daily life we see many object. Some objects at rest and others in motion. We go to school, birds fly, car moves, the wind blows. Atoms, molecules, planets, earth, and stars are all in motion. A body is said to be in motion if its position is changing continuously with respect to its surrounding.

Types of Motion



When an object changes its position according to the time, it is said to be in motion. When there is no change in the position, it is said to be in rest.

There are many types of motion.

Linear, circular, periodic, rotational, oscillatory are the different types of motion.

Measurement of Time

Long-long ago people had no idea about time. They had no watches to see the time. They took help of certain natural events such as rising and setting of sun, the phases of the moon and from motion of low and high tides.

A few hundred years ago, Maharaja Jai Sing II made a huge sundials to measure time. it worked on the principle that as the position of the sun in the sky changed so its length of shadow also

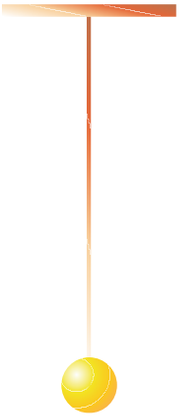
changed. A simple sundial consists of a horizontal circular board with a triangular plate of metal fixed vertically on it. The plate is kept along N-S direction.

Sundial

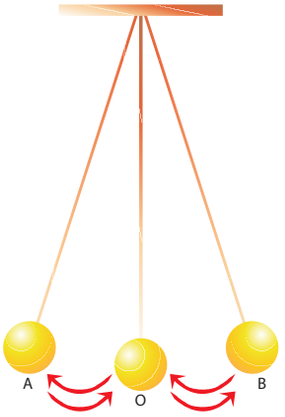
Sand clock

A sand clock which was used by the Roman worked on the principle that all the sand from the upper chamber falls into the lower chamber in a fixed amount of time.

After some time, a Galileo, an Italian scientist made a pendulum clock. He discovered that if we hang a weight from a string and make it swing, it always completes one to and from motion in exactly the same time. A simple pendulum consists of a small metallic ball, suspended from a rigid bar by a thread. When small push is given to the pendulum its makes to and fro movement about the mean position, to and fro motion of a simple pendulum is an example of a periodic or an oscillatory motion.



A simple Pendulum



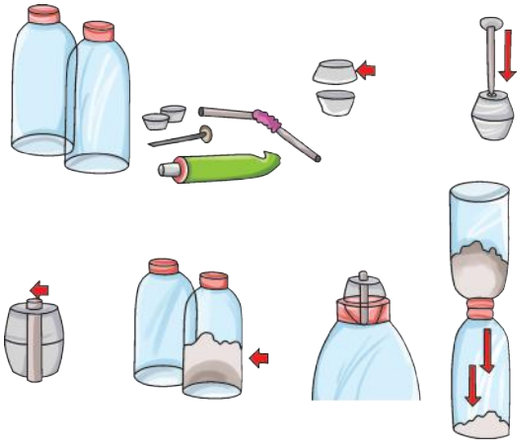
Different Position of a Pendulum

Do You Know ?

The atomic clock has an error ratio of 1 second for every 1.4 million years. Recently in 1999, scientists developed the caesium fountain atomic clock which is off by only 1 second every 20 million years.

A pendulum of about 25 cm length takes exactly one second for one oscillation. The time period can be changed by changing the length of string.

Making a Sand Clock



Making a sand clock

Things you will need are two clean glass bottles of the same size with plastic caps, a drinking straw, a small nail and some adhesive. Apply adhesive to the flat sides of the two caps, Insert the straw in the hole between the two caps. Use a fine sieve to obtain fine sand. Fill the sand in one of the bottles. Put the caps on to the bottles.

On inverting, the sand from the top bottle will trickle down into the lower bottle. Your sand clock is ready. Find out how long it takes for all the sand to trickle down to the empty bottle.

Activity Time

Let us see that what is the effect of length of string on the time period. Take a pendulum and note the time of 10 oscillations. Now, change the length of string and again note the time period of 10 oscillation. Repeat this experiment and note the readings,

S.No.	Length of Things	Time period for 10 oscillations	Time period
1	100 cm	21 Seconds	2.1 seconds
2	120 cm		
3	80 cm		
4	60 cm		
5	50 cm		
6	140 cm		
7	110 cm		
8	200 cm		
9	40 cm		
10	50 cm		

You would see that time period changes when length of string or pendulum is changed.

The relation between time and length of the string is.

$$T = 2\pi \sqrt{\frac{l}{g}}$$

Where,

T = time period

l = length of pendulum

g = acceleration due to gravity and its value is 9.8 m/s^2

π = constant and its value is $\frac{22}{7}$ or 3.14.

There are various units of measuring time but standard unit of time is second.

Conversion of units.

60 seconds = 1 minute (min)

60 minutes (min) = 1 hour (h)

24 hours (h) = 1 day

365 days = 1 year

Do You Know ?

A timer is a special type of clock. It is used to control the sequence of an event or process. Timers can be mechanical, electromechanical or digital. These are used in a variety of devices such as egg timers, traffic signals, automobiles, washing machines and the highly explosive time bombs.

Average Speed

Motion can be fast or slow. A bus may move slowly on a busy road and faster on an empty road. A passenger train may take hours to cover a distance of 350 km while an express train may cover the same distance in 4 hours. The distance covered by an object in a given interval of time helps us decide whether the object is moving slow or fast. The distance covered by moving object in a unit time is the average speed of the object.

The speed of an object in motion depends on two factors.

The total distance travelled.

The total time taken to travel the distance.

$$\text{Average speed of an object} = \frac{\text{distance travelled}}{\text{time taken to cover the distance}}$$

The basic SI unit for length is metre (m) and second (s) is the unit of time. Therefore the unit of speed is metre/second or $\frac{m}{s}$.

If we measure the distance in kilometres (km) and the time in hours (h) the unit of speed will be kilometers per hour or km/h.

Suppose a car covers 180 km distance in 3 hours. So its speed is $\frac{180}{3}$ = 60km/hr.

Another car covers 250 km distance in 5 hours. so its speed is $\frac{250}{5}$ = 50km/hr

Who covers more distance and whose speed is more?

So, it is clear that second car covers more distance but speed of first car is more than the second car.

SPEEDOMETER AND ODOMETER

All motor vehicles have a speedometer and an odometer fitted in them. A speedometer measures the speed of a vehicle in motion. It mostly records the speed in km/h.

A speedometer helps you to keep a check on your speed and drive safely. It helps you to approximately calculate the time you will take to reach your destination. Driving is a simple task, road signs keep you informed all the time.

Dashboard of a car

GRAPHS OF MOTION

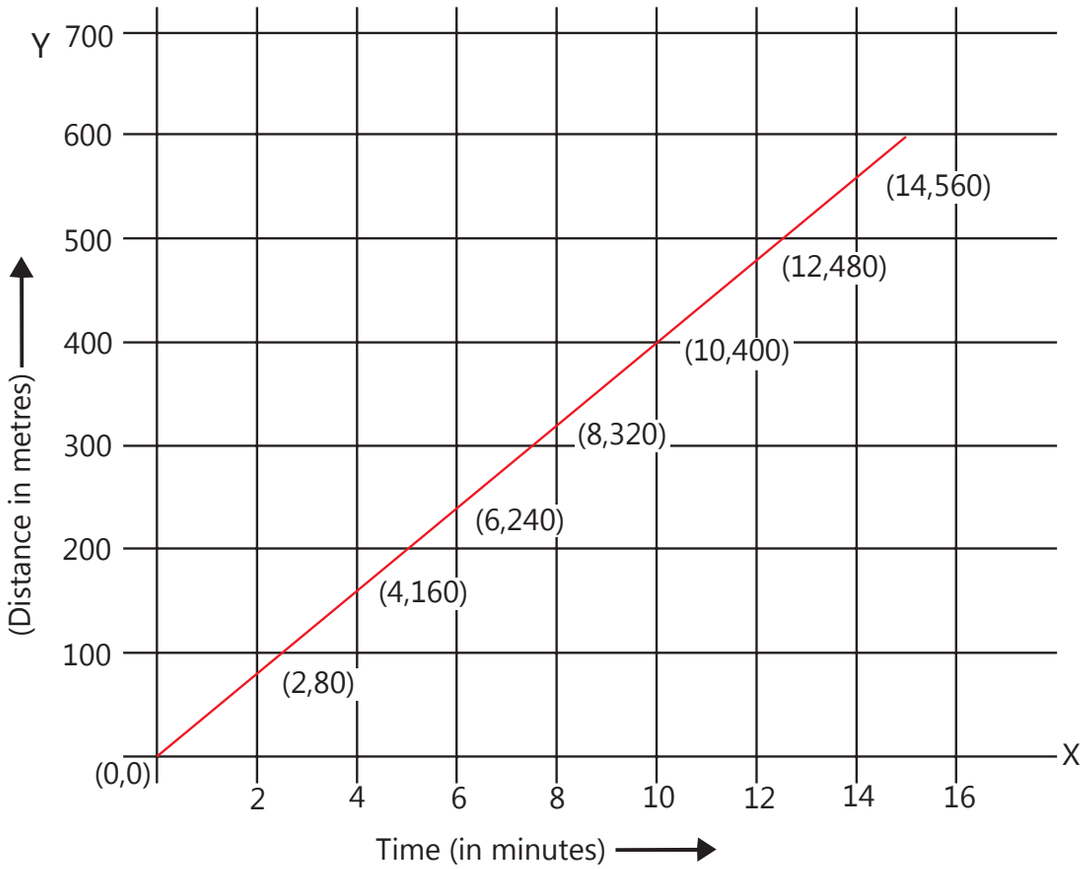
We can represent the motion on a graph paper. A graph shows the relationship between any two variable. A graph paper has two perpendicular axis. These axis are X and Y axis. The x-axis is the horizontal axis and y-axis is the vertically axis, The two axis meet at a point called the origin (0,0)

Example :

Sona once walked from home to her school. She noted the data of her trip as given in the table. She walked every 80 metres in two minutes. Sona walked the distance with uniform motion.

Total time (in minutes)	Total distance covered (in metres)
2	80
4	160
6	240
8	320
10	400
12	480
14	560

2	4	6	8	10	12	14
80	160	240	320	400	480	560



The graph of a uniform motion is a straight line. If the motion is not uniform the graph will not be a straight line thus a graph indicates if the motion is uniform or not.

Know the Keywords :

Speedometer : An instrument on a motor vehicle etc. indicates its speed of movement..

Graph : A diagram showing the relation between two variable quantities, each measured along one of a pair of axis.

Sundial : An instrument showing the time by the shadow of a pointer cast by the sun on to a graduated plate.

Point to Remember

- A body is said to be in motion if its position is changing continuously with respect to its surrounding.
- a speedometer measures the speed of a vehicle in motion.
- A graph shows the relationship between any two variable.
- A Galileo, an Italian scientist made a pendulum clock.
- Linear, Circular, periodic, rotational, oscillatory are the different types of motion.

EXERCISE TIME

A. Answer the following questions.

1. What were sources of measurement of time in ancient time ?
2. What is a simple pendulum and what is its use ?
3. What do you mean by one oscillation?
4. What is an odometer ?
5. Define the speed.

B. Fill in the blanks :

1. _____ is used to measure speed.
2. The standard unit of speed is _____.
3. The graph of distance time is a straight line for _____ motion.
4. Time period is increased on _____ the length of a pendulum.
5. Crystals of the substance in the watches are called _____.

C. Tick (✓) the correct option :

1. When there is no change in the position, the body is said to be in :

   (i) motion ◯ (ii) rest ◯ (iii) none of them ◯

2. Galileo is an _____ scientist.

   (i) Indian ◯ (ii) Italian ◯ (iii) none of them ◯

3. Simple pendulum is an example of a periodic or an _____ motion.

(i) oscillatory ◯ (ii) rectilinear ◯ (iii) none of them ◯

4. The relation between time and length of pendulum is :

(i) $T = \sqrt{\frac{l}{g}}$ ◯ (ii) $T = 4\pi \sqrt{\frac{l}{g}}$ ◯ (iii) $T = 2\pi \sqrt{\frac{l}{g}}$ ◯

5. If we measure the distance in kilometres and the time in hours, the unit of speed is briefly written as :

(i) Km/h ◯ (ii) Km/second ◯ (iii) Km/s ◯

6. If an object is travelling with uniform motion, its speed is the :

(i) distance it covers in a unit of time ◯

(ii) total distance covered ◯

(iii) total time taken to cover the total distance ◯

Creative Work

- **Cut a circular piece of cardboard of about 10 cm radius. Draw and cut out a right-angled triangle with the base angle equal to the latitude of your city on another piece of cardboard. Fix it vertically on the circular cardboard. This triangular piece is known as gnomon. Place it in the sun such that it is in the north-south direction. The gnomon casts a shadow which changes according to the time of day. To calibrate your sundial mark the position of the shadow on the circular piece against time observed on a watch. Once it is calibrated you can use the sundial to measure the time of day.**
- **Draw a picture of sun dial in the space below.**