PHYSICS

CLASS NOTES FOR CBSE

Chapter 01. Motion

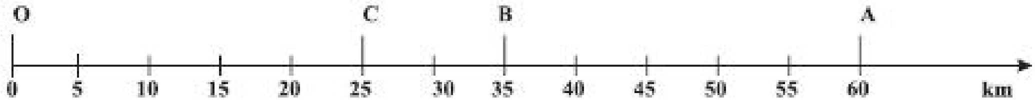
Atoms, molecules, planets, stars and galaxies are all in motion. We often perceive an object to be in motion when its position changes with time.
An object may appear to be moving for one person and stationary for some other. For the passengers in a moving bus, the roadside trees appear to be moving backwards. A person standing on the road–side perceives the bus along with the passengers as moving. However, a passenger inside the bus sees his fellow passengers to be at rest.

01. How to Describe The Motion

Let us assume that a school in a village is 2 km north of the railway station. We have specified the position of the school with respect to the railway station. In this example, the railway station is the reference point. Therefore, to describe the position of an object we need to specify a reference point called the origin.

02. MOTION ALONG A STRAIGHT LINE

Assume the motion of an object moving along a straight path. The object starts its journey from O which is treated as its reference point (Fig.). Let A, B and C represent the position of the object at different instants. At first, the object moves through C and B and reaches A. Then it moves back along the same path and reaches C through B.



Positions of an object on a straight line path

The total path length covered by the object is OA + AC, that is 60 km + 35 km = 95 km. This is the distance covered by the object.
The shortest distance measured from the initial to the final position of an object is known as the displacement.

03. UNIFORM AND NON- UNIFORM MOTION

Assume an object moving along a straight line. Let it travel 9 m in the first second, 9 m more in the next second, 9 m in the third second and 9 m in the fourth second. In this case, the object covers 9 m in each second. As the object covers equal distances in equal intervals of time, it is said to be in uniform motion.

Example 1 An object travels 60 m in 4 s and then another 60 m in 2 s. What is the average speed of the object?

Solution Total distance travelled by the object =
60 m + 60 m = 120 m
Total time taken = 4 s + 2 s = 6 s

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$
$$= \frac{120\text{ m}}{6\text{ s}}$$

Therefore, the average speed of the object is 20 m s^{-1}.

SPEED WITH DIRECTION

Velocity is the speed of an object moving in a definite direction. The velocity of an object can be uniform or variable. It can be changed by changing the object’s speed, direction of motion or both. When an object is moving along a straight line at a variable speed, we can express the magnitude of its rate of motion in terms of average velocity. It is calculated in the same way as we calculate average speed.

In case the velocity of the object is changing at a uniform rate, then average velocity is given by the arithmetic mean of initial velocity and final velocity for a given period of time. That is,

$$\text{Average velocity} = \frac{\text{initial velocity} + \text{final velocity}}{2}$$

$$\text{Mathematically, } v_{av} = \frac{u+v}{2}$$

where vav is the average velocity, u is the initial velocity and v is the final velocity of the object.

Speed and velocity have the same units, that is, m s^{-1} or m/s.

04. Rate of Change of Velocity

During uniform motion of an object along a straight line, the velocity remains constant with time. In this case, the change in velocity of the object for any time interval is zero.

However, in non-uniform motion, velocity varies with time. It has different values at different instants and at different points of the path. Thus, the change in velocity of the object during any time interval is not zero.