MAHESH PUBLIC SCHOOL, JODHPUR

REVISION NOTES - 3

CLASS IX **Subject : SCIENCE**

Chapter : Motion

Motion:
Movement of any object from one position to another position with respect to the observer is called as Motion.

Motion Along a Straight Line:
When an object moves along a straight line, the motion of the object is called rectilinear motion. For example; motion of a car on highway.

Vectors and Scalar Quantities:

- Vector is a quantity which have both magnitude and direction. For examples: Force, position etc.
- Scalar is quantity with which direction is not associated. For examples: Mass, temperature, time etc.

Distance:

- Length of path covered by a moving an object in the given time irrespective of direction
  is called distance.
- It is a scalar quantity.
- Its SI unit is metre(m).

Displacement:

- The shortest distance measured from initial to the final posftion of an object is known as the displacement.
- It is a vector quantity.

Uniform Motion:

- When an object covers equal distances in equal intervals of time, it is said to be in uniform motion.
- In case of uniform acceleration, there are three equations of motion which are also known as the laws of constant acceleration. Hence, these equations are used to derive the components like

displacement(s), velocity (initial and final), time(t) and acceleration(a). Therefore they can only be applied when acceleration is constant and motion is a straight line. The three equations are,

- $v = u + at$
- $v^2 = u^2 + 2as$
- $s = ut + \frac{1}{2}at^2$
- where, s = displacement; u = initial velocity; v = final velocity; a = acceleration; t = time of motion. These equations are referred as SUVAT equations where SUVAT stands for displacement (s), initial velocity (u), final velocity (v), acceleration (a) and time (T)
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Non-Uniform Motion:

- When an object covers unequal distances in equal intervals of time, it is said to be in non-uniform motion.

Speed (s):

- The distance travelled by an object in unit time is referred to as speed.
- It is represented as:

- Its SI unit is metre/ second (m/s).
- It is a scalar quantity.
- **Average speed:** For non-uniform motion, the average speed of an object is obtained by dividing the total distance travelled by an object by the total time taken.

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

Velocity (v):

- Speed of an object in a particular direction is named as velocity, i.e., it is the displacement of body in unit time.
- It is represented as:

- It is a vector quantity.

- Average velocity: It is given by the arithmetic mean of initial velocity and final velocity for a given period of time.

Acceleration (a):

- The rate of change of velocity is termed as acceleration.
- It is represented as:

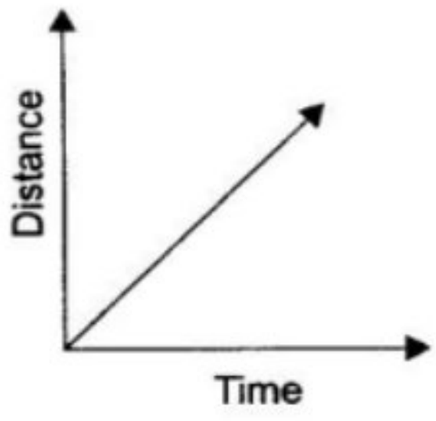
$$\text{Acceleration} = \frac{\text{Final velocity} - \text{Initial velocity}}{\text{Time}}$$

- Its SI unit is metre/seccond^2 (m/s^2).
- It is a vector quantity.
- The acceleration is taken to be positive if it is in the direction of velocity and negative when it is opposite to the direction of velocity.
- Negative acceleration is also named as retardation or deacceleration.
- An object moving on a circular path though with uniform speed, is always said to be accelerated as it changes its direction every moment.
- **Uniform acceleration:** When velocity of body changes by equal amounts in equal time intervals, acceleration is said to be uniform. For example: Motion of a freely falling ball.
- **Non - uniform acceleration:** When velocity of body changes by unequal amounts in equal intervals if time, acceleration is said to be non - uniform. For example: Motion of car.

Graphical Representation of Motion

1. Distance -Time Graph for Uniform Speed:

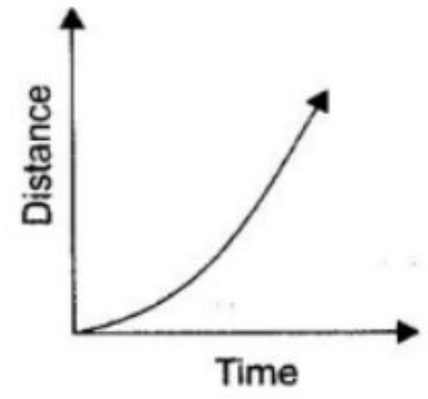
Distance -Time graph for uniform speed, is a straight line as shown below:



Uniform speed

2. Distance -Time Graph for Non-Uniform Speed:

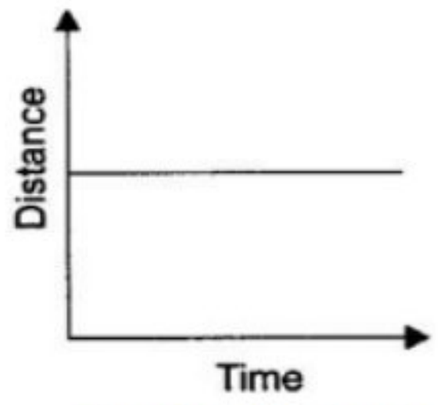
Distance -Time graph for uniform speed, is obtained in the form of a curve as shown below:



Non-uniform speed

3. Distance -Time Graph for a Body at Rest:

Distance -Time graph for a body at rest is a straight line parallel to the time axis (x-axis):

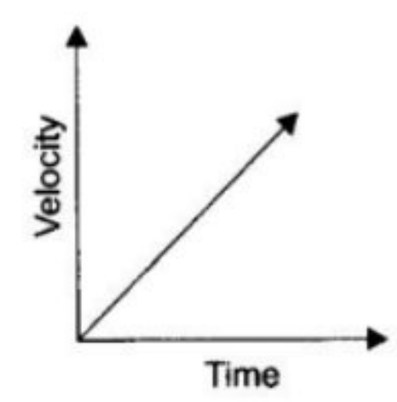


Stationary Body

Velocity-Time Graph

1. Velocity-Time Graph for Uniform Acceleration:

Velocity-Time graph for uniform acceleration, is a straight line as shown below:



Uniform acceleration

2. Velocity-Time Graph for Non-Uniform Acceleration:

Velocity-Time graph for non-uniform acceleration, is obtained as a zig-zag line as shown below:

Non-uniform acceleration