Ch-7 Motion

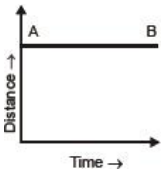
1. Change in position of an object with respect to a fixed position with time is called motion.
    a. **Uniform Motion –** the object covers equal distances in equal intervals of time. E.g., car travelling 2 km in 2 min, 2 km in next 2 min.
    b. **Non-Uniform Motion –** the object covers unequal distances in equal intervals of time. E.g., car moving in a crowded street.
    c. Motion along a straight line –
        i. The actual path traversed by a body is its distance (scalar).
        ii. The shortest straight distance between the initial and final positions of a body is its displacement (vector).
    d. Motion along a circular path –
        i. Then moving in a circular path with uniform speed, it is called as uniform circular motion. Here, direction changes continuously.
        ii. v = $\frac{2\pi r}{t}$.
2. Distance travelled by an object in unit time is speed (scalar).
    a. Usually, objects are in non-uniform motion, hence, we calculate average speed.
    b. Avg. speed = $\frac{total\ distance\ travelled\ (s)}{total\ time\ taken\ (t)}$.
    c. SI unit – m / s OR m s^{-1}.
3. Speed of an object travelling in a definite direction is velocity (vector). It can be uniform or variable.
    a. When the speed is variable, average velocity is calculated.
    b. Avg. vel. = $\frac{total\ distance\ tranvelled\ (s)}{total\ time\ taken\ (t)}$.
    c. SI unit – m / s OR m s^{-1}.
4. Rate of change of velocity with time is acceleration (vector).
    a. a = $\frac{v-u}{t}$.
    b. SI unit – m / s^2 OR m s^{-2}.
    c. **Uniform Acceleration –** velocity of an object increases or decreases by equal amounts in equal intervals of time.
    d. **Non-Uniform Acceleration –** velocity of an object increases or decreases by unequal amounts in equal intervals of time.
5. Pictorial or geometrical representation between 2 quantities on 2 axes is its graphical representation.
    a. Distance-Time graphs –
        i. Time is taken on the x-axis and distance travelled on the y-axis.
        ii. Speed of object = slope of graph.
        iii. For uniform speed, slope is inclined straight line, BUT, for non-uniform speed, slope is a curved line.
        iv. For stationary object, slope is a straight line parallel to time axis.
    b. Velocity-Time graphs –
        i. Time is taken on the x-axis and velocity on the y-axis.
        ii. Acceleration of body = slope of graph.

iii. Distance / displacement = area under the curve.
iv. For uniform acceleration, slope is a straight line, BUT, for non-uniform acceleration, slope is a curved line.

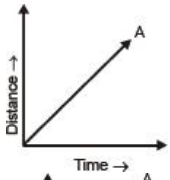
6. **Equation of Motion –**
   a. Velocity-Time relation : $v = u + at$.
   b. Velocity-Time relation : $s = ut + \frac{1}{2}at^2$.
   c. Position-Velocity relation : $v^2 = u^2 + 2as$.

Distance-Time Graphs

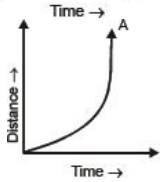
1. For a body at rest. Speed = 0.



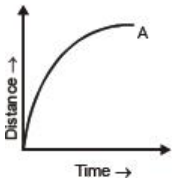
2. For a body moving with uniform speed.



3. For accelerated motion. Slope is increasing.

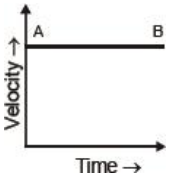


4. For decelerated (speeding down) motion. Slope is decreasing.

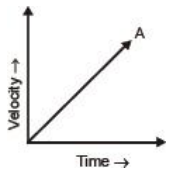


Velocity-Time Graphs

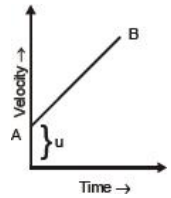
1. When a body moving with a uniform velocity. Acceleration = 0.



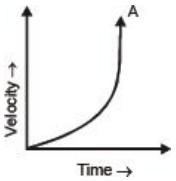
2. When a body starts from rest and moves with uniform acceleration. Slope = acceleration.



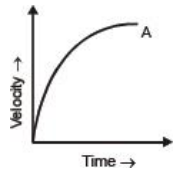
3. When a body is moving with uniform acceleration and its initial velocity is not zero.



4. When a body is moving with increasing acceleration. Slope increases with time.



5. When a body is moving with decreasing acceleration. Slope decreases with time.



6. When a body is moving with a uniform retardation and its initial velocity is not zero. Graph has a negative slope.