$$v = u + gt$$

$$h = ut + \frac{1}{2}gt^2$$

$$v^2 = u^2 + 2gh.$$

Important: (*i*) When we throw a body vertically upward its velocity decreases and g is taken $-ve$.

(*ii*) For motion in vertical direction, **time of ascent equals to time of descent.**

Graphs:

In this unit there are mainly three types of graph.

(*i*) Distance – time graph

(*ii*) Velocity – time graph

(*iii*) Acceleration-time graph.

(*a*) Slope of position (distance, displacement) time graph gives us velocity.

(*b*) Slope of velocity-time graph gives us acceleration.

(*c*) Area bounded by velocity-time graph and time axis equals to displacement of the body.

(d) Area under acceleration-time graph gives change in velocity.

SOLVED EXAMPLES

BASED ON DISTANCE-DISPLACEMENT AVERAGE SPEED AND VELOCITY

Example 1. An object moves on a semicircular path, calculate the ratio of distance to displacement.

Solution: Let radius of circular path is r

$$\therefore \quad \frac{\text{distance}}{\text{displacement}} = \frac{\pi r}{2r} = \frac{\pi}{2}$$

$$= \frac{3.14}{2} = \mathbf{1.57.}$$

Example 2. Two towns A and B are 100 km apart. A bus travels from A to to B at 40 kmh^{-1} and returns from B to A at 50 kmh^{-1}. Calculate the average speed and average velocity of the bus.

Solution.

Time taken to go from A to B = $\frac{100}{40} = \frac{5}{2}$hr.

Time taken to come from B to A = $\frac{100}{50}$ = 2hr.

$$\therefore \quad \text{Average speed} = \frac{100+100}{5/2+2} = \frac{200}{9/2} = \frac{400}{9} = \mathbf{44.4\ kmh^{-1}.}$$

$$\text{Average velocity} = \frac{\text{Total displacement}}{\text{Total time taken}}$$

$$= \mathbf{0}$$