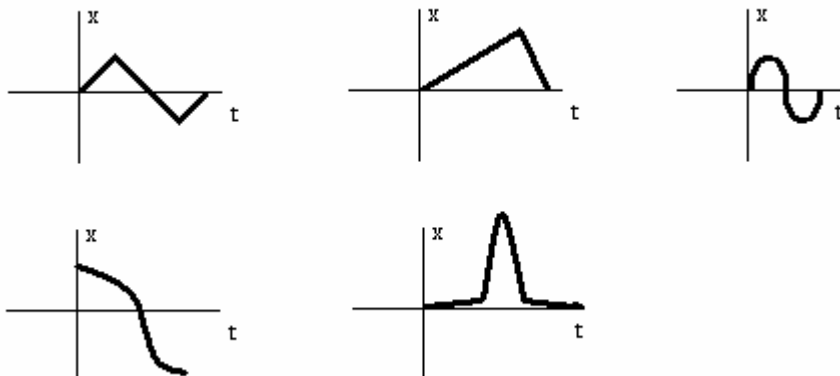


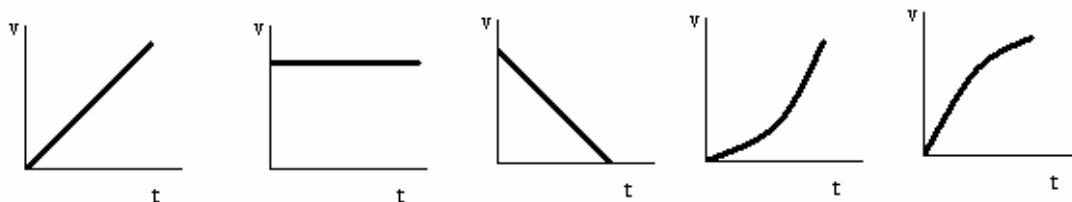
**3.MOTION IN A STRAIGHT LINE**

1. A particle moves along the x-axis from  $x_i$  to  $x_f$ . Of the following values of the initial and final coordinates, which results in a negative displacement?
  - (i)  $x_i = 4 \text{ m}$ ,  $x_f = 6 \text{ m}$
  - (ii)  $x_i = - 4 \text{ m}$ ,  $x_f = - 8 \text{ m}$
  - (iii)  $x_i = - 4 \text{ m}$ ,  $x_f = 2 \text{ m}$
2. A car travels 30 km at an average speed of 60 km/h and then travels 30 km at an average speed of 30 km/h. The average speed of the car for this 60 km trip is?
3. The coordinate of a particle in meters is given by  $x(t) = 12 - 3.0 t^2$ , where t is in seconds. The particle is momentarily at rest at time t =?
4. A ball rolls up a slope. At the end of 3 s, its velocity is 20 cm/s; at the end of 8 s its velocity is 0 cm/s. What is the average acceleration from the third to the eight second?
5. A ball is in free fall. What is its acceleration?
  - (i) during ascent and descent
  - (ii) at the highest point during ascent.
6. A car starts from rest and goes down a slope with a constant acceleration of  $5 \text{ m/s}^2$ . After 5s, the car reaches the bottom of the hill. What is speed at the bottom of the hill?
7. A heavy ball falls freely, starting from rest. Between the third and fourth second of time, what is the distance it travels?
8. What does the area under a velocity-time graph represent?
9. The position –time graph of an object is a straight line with a positive slope. What can you conclude about the velocity and acceleration of the object?
10. An object is thrown vertically upward with a certain initial velocity in a world where the acceleration due to gravity is  $19.6 \text{ m/s}^2$ . The height to which the object would rise if thrown upwards with the same initial velocity on the Earth is \_\_\_\_\_ ( neglect friction).
11. A ball is dropped from a height of 90 m on a floor. At each collision with the floor, the ball loses one-tenth of its speed. Plot the speed time graph of its motion between  $t = 0$  to 4 s.
12. A policeman moving on a highway with a speed of  $30 \text{ kmh}^{-1}$  fires at a thief's car, speeding away in the same direction with a speed of  $192 \text{ kmh}^{-1}$ . If the muzzle speed of the bullet is  $150 \text{ ms}^{-1}$ , with what speed will the bullet hit the thief's car?

13. A car accelerates from rest on a straight road. A short time later, the car decelerates to a stop and then returns to its original position in a similar manner. Which of the five following graphs best describe the motion?



14. An object is thrown vertically into the air. Which of the 5 following graphs represents the velocity ( $v$ ) of the object as a function of time ( $t$ )?



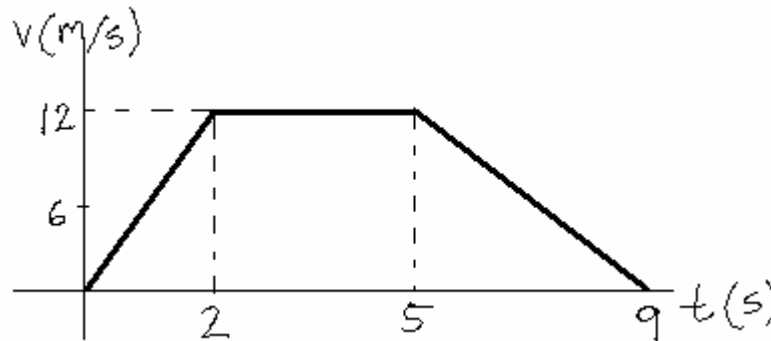
15. One object is thrown vertically upward with an initial velocity of 100 m/s and another object with an initial velocity of 10 m/s. The maximum height reached by the first object will be \_\_\_\_\_ that of the other. (Find the ratio of the heights)
16. A car starts from Ambala. Goes 50 km in a straight line to Chandigarh, (immediately turns around, and returns to Ambala. The time for this round trip is 2 hours. What is the (i) average velocity (ii) average speed of the car for the round trip?
17. Of the following situations, which one is impossible?
- A body having velocity east and acceleration east
  - A body having velocity east and acceleration west
  - A body having zero acceleration zero velocity
  - A body having constant acceleration and zero velocity
  - A body having constant velocity and variable acceleration,
- Give reasons.
18. An object has a constant acceleration of  $3 \text{ m/s}^2$ . The displacement versus time graph for this object has a slope (choose the correct option)
- that increases with time

- ii. that is constant
- iii. that decreases with time
- iv. of 3 m/s
- v. of 3 m/s<sup>2</sup>

19. Two parallel roads run east-west. Car A moves east with a speed of 54 kmh<sup>-1</sup> and car B moves west with a speed of 90 kmh<sup>-1</sup>. What is the relative velocity of B with respect to A in ms<sup>-1</sup>?

20. Define (a) Instantaneous velocity (b) Average velocity

21. Figure gives a speed-time graph of a particle in motion along a constant direction.



- (i) In which time interval is the average acceleration greatest in magnitude
- (ii) In which interval is the average speed greatest.
- (iii) choosing the direction of motion as the positive direction, give signs of  $\mathbf{v}$  and  $\mathbf{a}$  in the three intervals.

22. Two stones are thrown up simultaneously from the edge of a cliff 200 m high with initial speeds of 13 m/s and 30 m/s. Draw a graph that correctly represents the time variation of the relative position of the second stone w.r.t. the first. Take  $g = 10 \text{ m/s}^2$ .

(Hint : find  $x_1$ , find  $x_2$ , then graph  $x_2 - x_1$ .)

Also find time for 1<sup>st</sup> stone to hit ground, and then for 2<sup>nd</sup> stone to hit ground.)

23. Two parallel train tracks run north-south. Train A moves north at 76 km/h and train B moves south at 90 km/h. Velocity of monkey is 18 km/h with respect to train A.

What is the relative velocity of

- (i) B with respect to A?
- (ii) of ground with respect to B?
- (iii) Monkey with respect to a man standing on the ground?