

Sub: Physics (Motion in a Straight line)

01. The displacement (in metre) of a particle moving along X axis is given by $x = 18t + 5t^2$. Calculate (i) the instantaneous velocity at $t = 2s$ (ii) average velocity between $t = 2s$ and $t = 3s$ (iii) instantaneous acceleration.
02. Two parallel rail tracks run north-south. Train A moves due north with a speed of 54 km/h and train B moves due south with a speed of 90 km/h . What is the relative velocity of B with respect to A in m/s ?
03. A body starts from rest, accelerates uniformly along a straight line at the rate of 10 m/s^2 for 5 seconds. It moves for 2 seconds with uniform velocity of 50 m/s , then it retards uniformly and comes to rest in 3 seconds. Draw velocity-time graph of the body and find the total distance travelled by the body.
04. On a foggy day two car drivers spot each other when they are just 80 m apart. They are travelling at 72 km/h and 60 km/h respectively. Both of them simultaneously apply brakes and retard at a rate of 5 m/s^2 . Find whether they avoid a collision or not.
05. A balloon is ascending at a rate of 9.8 m/s at a height of 98 m above the ground, when a packet is dropped from the balloon. After how much time and with what velocity does it reach the ground?
06. From the top of a tower 100 m in height, a ball is dropped, and at the same time another ball is projected vertically upwards from the ground, with a velocity of 25 m/s . Find when and where the two balls meet. ($g = 9.8$)
07. A ball is thrown vertically upwards with a velocity of 20 m/s from the top of a building of height 25 m from the ground.
 - (a) How high the ball will rise?
 - (b) How long will it take the ball to reach the ground? ($g = 10 \text{ m/s}^2$)
08. A lead ball is dropped from a diving board 5 m above the surface of a pool. It reaches the bottom of the pool in 5 seconds. Assuming that the ball moves through water with uniform velocity, calculate the depth of the pool. ($g = 10 \text{ m/s}^2$).
09. A body covers 200 cm in first 2 s , then 220 cm in the next 4 s . What will be the velocity at the end of 7^{th} second from the start?
10. The position and time of a ^{moving} body is related as $t = \sqrt{x} + 3$ where x is metres and t is in seconds. Find the initial velocity & acceleration. Also find the displacement when its velocity is zero.

11. A car accelerates ^{from rest} at a constant rate of α for some time, after which it decelerates at a constant rate β to come to rest. If t is the total time elapsed then calculate (i) maximum velocity attained by the car.
(ii) total distance travelled by the car.
12. A body travels 20m in the 7th second and 24m in the 9th second of its motion. If the body is uniformly accelerated how far will it go in the 15th second?
13. Two trains on the same line are approaching each other with velocities v_1 and v_2 . When there is a distance of x between them each is seen from the other, prove that it is possible to avoid a collision if $v_1^2 a_2 + v_2^2 a_1 = 2a_1 a_2 x$ where a_1 and a_2 are the greatest retardations which the brakes can produce in respective trains.
14. A car starting from rest accelerates uniformly with 5 m/s^2 for some time and then decelerates to come to rest with 8 m/s^2 . Find the maximum velocity attained during the motion and the distance covered in a total time of 6 seconds of the journey.
15. A stone projected vertically upwards from the top of a tower reaches the ground in t_1 second. If it is projected from the same point A, with the same initial velocity vertically downwards it reaches the ground in t_2 second. If it falls freely from A, show that it will reach the ground in $\sqrt{t_1 t_2}$ seconds.
16. If x , y and z are the distances moved by a particle moving with constant acceleration during l th, m th and n th second of its motion show that $x(m-n) + y(n-l) + z(l-m) = 0$.
17. A body dropped from a certain height covers $\frac{7}{16}$ th of its total height in the last second of its motion. Determine the height from which it is dropped.
18. A parachutist bails out from an aeroplane and after dropping through a distance of 19.6m he opens the parachute and decelerate at a rate of 2 m/s^2 . He reaches the ground with a speed of 1.6 m/s . How long was he in air? At what height he bailed out from the plane?