

E. Problem

1. A particle travels half a distance at 12 km/h and the remaining half at 18 km/h. Calculate the average speed.

[Ans: 14.4 km/h]

2. A particle moving with an initial velocity of 60 ms^{-1} is brought to rest in a distance of 120 m. Assuming the deceleration uniform, calculate the retardation and the time interval.

[Ans: 15 ms^{-2} ; 4 s]

3. Starting from rest from one end of a runway, a jet airliner acquires a speed of 90 ms^{-1} in one minute. Find (A) the acceleration (B) distance travelled and (C) speed at the end of the first 40 s.

[Ans: 1.5 ms^{-2} ; 2700 m; 60 ms^{-1}]

4. A uniformly accelerated body travelling along a straight line with initial velocity 2 ms^{-1} passes over 24 m from start in 3 seconds. Calculate the uniform acceleration and the velocity it will acquire when it has passed over 4 m from the start. [Ans: 4 ms^{-2} ; 6 ms^{-1}]
5. A train starting from rest is accelerated uniformly and reaches a speed of 72 km/h in 40 s. It travels at this speed for 5 minutes and is brought to rest in 20 s subjecting it to uniform retardation. Draw a velocity-time graph and find the total distance travelled. [Ans: 6600 m]
6. A bullet strikes a uniform plank with a velocity of 400 ms^{-1} and comes out with half the velocity. What would be the velocity if the plank were only half thick. [Ans: 316.2 ms^{-1}]
7. A train passes three points A, B, C at 24, 36, 54 km/h respectively with uniform acceleration. If the distance $AB = 2 \text{ km}$ find the distance BC. [Ans: 4.5 km]
8. A particle moving with a certain velocity is subjected to a retardation 4 ms^{-2} . If the particle returns to the starting point in 12 s, calculate the initial velocity. [Ans: 24 ms^{-1}]
Hint: $u = ?$; $a = -4 \text{ ms}^{-2}$; $t = 12 \text{ s}$, $S = 0$
9. A person is running at his maximum speed of 4 ms^{-1} to catch a train. When he is 6 m from the door of the train, it starts moving at a constant acceleration of 1 ms^{-2} . How long does he take to catch the train? [Ans: 2 s or 6 s]
10. In a 100 m race which a sprinter clears in 11 s calculate his initial uniform acceleration and its duration, if his speed remains constant at 10 ms^{-1} thereafter. [Ans: 5 ms^{-2} ; 2 s]
11. A body moving with uniform acceleration has velocities 20 ms^{-1} and 30 ms^{-1} when passing points P and Q in its path. Find the velocity midway between P and Q. [Ans: 25.5 ms^{-1}]
12. A stone dropped into a well hits the water surface in 4 seconds. How deep is the well and with what velocity does the stone hit the water surface? [Ans: 78.4 m; 39.2 ms^{-1}]
13. A ball dropped on an anvil from a height 3.6 m is found to rise up 2.5 m after rebounding. Calculate the velocity with which the ball (A) strikes the anvil (B) leaves the anvil. [Ans: 8.4 ms^{-1} ; 7 ms^{-1}]
14. A stone is thrown vertically upwards with a velocity 14.7 ms^{-1} . Calculate (A) the greatest height (B) time taken to reach the highest point (C) time of flight (D) velocity with which it strikes the ground. [Ans: 11.025 m; 1.5 s; 3 s; 14.7 ms^{-1}]
15. Two balls A and B are thrown simultaneously, A vertically upwards with a speed of 20 ms^{-1} from the ground, and B vertically downwards from a height of 40 m with the same speed and along the same line of motion. When and where will they meet? [Ans: 1 s, 15.1 m]
16. A body let fall from the top of a tower falls through $7/16$ of its height during the last second of its fall. What is the height of the tower? [Ans: 78.4 m]

17. A stone thrown vertically up went up 98 m and came down . How long was it in air?
[Ans: 8.945 s]

18. A body is dropped from a point 4.9 m above a window 1.5 m high. Find the time taken by the body to pass against the window.
[Ans: 1/7 s]

19. A stone is dropped from a rising balloon when it is at a height 61.25 m above the ground and it reaches the ground in 5 s. What was the velocity of the balloon just at the moment the stone was dropped?
[Ans: 12.25 ms⁻¹]

20. A parachutist bails out from an aeroplane flying horizontally and after dropping through a distance of 40 m, opens the parachute and decelerates at 2 ms⁻². If he reaches the ground with a speed of 2 ms⁻¹, how long was he in air? At what height did he bail out from the plane?
[Ans: 15.86 s; 235 m]

21. A juggler throws balls into air. He throws one whenever the previous one is at its highest point. How high do the balls rise if he throws 'n' balls each second? Acceleration due to gravity = g.

Hint: Time taken by each ball to reach the highest point $t = (1/n)$ s. Then $u = g/n$; $S = h = ?$ or consider the downward motion, $u = 0$, $t = 1/n$, $S = h = ?$

[Ans: $h = g/2n^2$]