Practice Questions on Equations of Motion

1. A car starts from rest and accelerates uniformly at $3\,\mathrm{m/s^2}$. How long will it take to reach a speed of $30\,\mathrm{m/s}$? How far will it travel in this time?

2. A stone is dropped from a height of $80\,\mathrm{m}$. How long will it take to reach the ground? What will be its speed just before hitting the ground?

3. A ball is thrown vertically upward with an initial velocity of $20\,\mathrm{m/s}$. How high will it go? How long will it take to reach its maximum height?

4. A train is moving with a velocity of $15\,\mathrm{m/s}$ and accelerates at a rate of $2\,\mathrm{m/s^2}$ for $10\,\mathrm{s}$. What will be its final velocity and how far will it have traveled in this time?

5. A car moving with an initial velocity of $10\,\mathrm{m/s}$ accelerates uniformly at $4\,\mathrm{m/s^2}$. How long will it take for the car to cover a distance of $100\,\mathrm{m}$?

6. A cyclist starts from rest and accelerates at $2\,\mathrm{m/s^2}$ for $5\,\mathrm{s}$. What is the final velocity of the cyclist and the total distance traveled?

7. An object is projected horizontally with a velocity of $5\,\mathrm{m/s}$ from a height of $45\,\mathrm{m}$. How long will it take to reach the ground and what will be its horizontal range?

8. A rocket accelerates from rest at a rate of $20\,\mathrm{m/s^2}$ for $8\,\mathrm{s}$. Calculate the final velocity and the distance covered by the rocket.

9. A ball is thrown downward with an initial velocity of $10\,\mathrm{m/s}$ from a height of $50\,\mathrm{m}$. How long will it take to reach the ground and what will be its speed just before hitting the ground?

10. A motorcycle is traveling at $25\,\mathrm{m/s}$ and decelerates uniformly at $5\,\mathrm{m/s^2}$. How long will it take to come to a stop and what distance will it cover during this time?

11. An airplane accelerates uniformly from rest down a runway at $3\,\mathrm{m/s^2}$ for $30\,\mathrm{s}$. Determine the takeoff velocity and the distance covered on the runway.

12. A ball is thrown upward with an initial velocity of $15\,\mathrm{m/s}$. Calculate the time it takes to reach the highest point and the maximum height reached by the ball.

13. A car decelerates uniformly from a velocity of $20\,\mathrm{m/s}$ to rest in $5\,\mathrm{s}$. What is the deceleration and the distance traveled during this time?

14. A cyclist moving at $10\,\mathrm{m/s}$ begins to accelerate at $1.5\,\mathrm{m/s^2}$. How long will it take to reach a velocity of $25\,\mathrm{m/s}$ and what distance will be covered during this acceleration?

15. A train starting from rest accelerates uniformly at $0.5\,\mathrm{m/s^2}$ until it reaches a speed of $20\,\mathrm{m/s}$. Calculate the time taken and the distance covered during this period.

16. Given a velocity-time graph where an object starts at $0\,\mathrm{m/s}$, accelerates uniformly to $10\,\mathrm{m/s}$ in $5\,\mathrm{s}$, maintains this speed for $10\,\mathrm{s}$, and then decelerates uniformly to $0\,\mathrm{m/s}$ in $5\,\mathrm{s}$:

- Calculate the total distance traveled.
- Determine the average velocity.

17. An object moves with a constant velocity of $5\,\mathrm{m/s}$ for $10\,\mathrm{s}$. It then accelerates uniformly at $2\,\mathrm{m/s^2}$ for $5\,\mathrm{s}$, and finally moves at a constant velocity for another $10\,\mathrm{s}$:

- Plot the velocity-time graph.
- Calculate the total displacement.

18. For an object undergoing uniform acceleration from $0\,\mathrm{m/s}$ to $20\,\mathrm{m/s}$ in $4\,\mathrm{s}$, followed by a constant velocity for $6\,\mathrm{s}$, and then decelerating uniformly to $0\,\mathrm{m/s}$ in $2\,\mathrm{s}$:

- Draw the velocity-time graph.
- Find the total distance covered.

19. A particle starts from rest, accelerates uniformly to $15\,\mathrm{m/s}$ in $3\,\mathrm{s}$, moves at this speed for $4\,\mathrm{s}$, and then decelerates uniformly to rest in $2\,\mathrm{s}$:

- Sketch the velocity-time graph.
- Calculate the total distance traveled.

20. Given a velocity-time graph where an object moves at $10\,\mathrm{m/s}$ for $5\,\mathrm{s}$, decelerates uniformly to $-5\,\mathrm{m/s}$ in $4\,\mathrm{s}$, and then accelerates back to $0\,\mathrm{m/s}$ in $3\,\mathrm{s}$:

- Draw the velocity-time graph.
- Determine the displacement of the object.