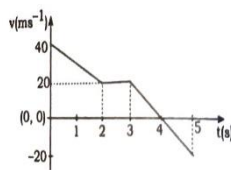
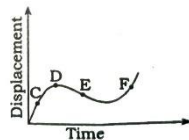


Chapter: 3 Kinematics:

MCQs: [1 marks each]

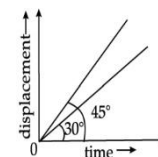
- Which of the following is correct?
 - $distance = displacement$
 - $distance < displacement$
 - $distance > displacement$
 - $distance \geq displacement$
- The displacement of the particle is described by the equation, $s = (2t^3 + 3)m$, its instantaneous acceleration at $t = 2sec$ is,
 - $12m/s^2$
 - $24m/s^2$
 - $19m/s^2$
 - $27m/s^2$
- The displacement of a body is directly proportional to cube of time elapsed. The magnitude of acceleration of the body is.
 - Increasing with time
 - Decreasing with time
 - Constant
 - Zero
- A bus travels the first one-third of distance with speed of $10km/hr$, the next one third at $20 km/hr$ and last at $60km/hr$. Its average velocity is,
 - $16km/hr$
 - $18km/hr$
 - $48km/hr$
 - $30km/hr$
- If a bullet loses half of its velocity on penetrating 3cm in a wooden block, then how much will it penetrate more before coming to rest?
 - $1cm$
 - $2cm$
 - $3cm$
 - $4 cm$
- The distance travelled by a car along a straight line is $x = 12t + 3t^2 - 2t^3$ where, x is in meters and t in seconds. The velocity of the car at the start will be,
 - $7m/s$
 - $9m/s$
 - $12m/s$
 - $16m/s$
- The displacement time graph of a moving particle is shown in the figure. The instantaneous velocity of the particle is negative at the point.
 - C
 - D
 - E
 - F
- In the given $v - t$ graph the distance travelled by the body in 5 seconds will be,
 - 20m
 - 40m
 - 80m
 - 100m
- The trajectory of projectile is given by the equation $y = \sqrt{3}x - 7.5 \times 10^{-4}x^2$, where x and y are in meters,
 - 30°
 - 60°
 - 75°
 - 90°
- A particle covers half of its total distance with speed $30km/hr$ and the rest half distance with speed $20km/hr$. Its average speed during the complete journey is,
 - $25km/hr$
 - $24km/hr$
 - $50km/hr$
 - $10km/hr$
- A ball is thrown vertically downward with a velocity of $20m/s$ from the top of a tower. It hits the ground after some time with a velocity of $80m/s$. The height of the tower is,
 - 300m
 - 320m
 - 340m
 - 360m
- A boy standing at the top of a tower of $20m$ height drops a stone. Assuming $g = 10m/s^2$, the velocity with which it hits the ground is
 - $5m/s$
 - $10m/s$
 - $20m/s$
 - $40m/s$
- The displacement-time graphs of two moving particles make angles of 30° and 45° with the x-axis as shown in figure. The ratio of their respective velocity is:
 - $\sqrt{3}:1$
 - $1:1$
 - $1:2$
 - $1:\sqrt{3}$
- The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is,
 - $\theta = \tan^{-1}(\frac{1}{4})$
 - $\theta = \tan^{-1}(4)$
 - $\theta = \tan^{-1}(2)$
 - $\theta = \tan^{-1}(1)$



- A missile is fired for maximum range with an initial velocity of $20m/s$. The range of missile is,
 - 20m
 - 40m
 - 50m
 - 60m
- The speed of projectile at maximum height is half of its initial speed. The angle of projectile is,
 - 15°
 - 30°
 - 45°
 - 60°
- If a particle is projected at an angle 45° , then relation between range and maximum height is,
 - $R = 4H$
 - $4R = H$
 - $2H = R$
 - None
- A boat goes across a river with velocity $12km/hr$. The magnitude of its resultant speed in flowing water is $13km/hr$. The velocity of water flow in the river is,
 - $1km/hr$
 - $5km/hr$
 - $7km/hr$
 - $9km/hr$

Short Answer type questions

- If the displacement of the particle is proportional to the square of time. State the nature of motion of the body.
 - Define projectile. A projectile is fired at an angle θ with the horizontal. Show that the path followed by projectile is a parabola. Also derive expression for the maximum height, time of flight and horizontal range.
- If the distance travelled by a body in time 't' is given by $x = at + bt^2$, then what will be the acceleration of the body?
 - A batter hits a baseball so that it leaves the bat with an initial speed $37m/s$ at an angle of 53° . Find the position of the ball and the magnitude and direction of velocity after 2 seconds. Treat the baseball as a projectile.
[Ans: $24.23m/s, 23.21^\circ$]
- Can a body have a constant speed but changing velocity? Explain with example.
 - A stone on the edge of a vertical cliff is kicked so that its initial velocity is $9m/s$ horizontally. If the cliff is $200m$ high, calculate, time taken by stone to reach the ground and how far from the cliff the stone will hit the ground?
[Ans: $6.32sec, 56.92m$]
- Find the angle of projection at which the horizontal range and maximum height of a projectile are equal.
[Ans: 75.96°]
 - Prove these equations graphically: a) $s = ut + \frac{1}{2}at^2$ b) $v^2 = u^2 + 2as$
- Draw displacement time graph for two cases: uniform velocity and non-uniform velocity.
 - Show that the path of a projectile projected horizontally from top of the tower is parabolic. Also calculate time of flight and horizontal range travelled by the projectile.
- Show that there are two angles of projection of a projectile for the same horizontal range.
 - A car travelling with a speed of $15m/s$ is braked and is slowed down with uniform retardation. It covers a distance of $88m$ as its velocity reduce to $7m/s$. If the car continues to slow down with same rate, how far will the car travel becoming to rest. [Ans: $24.5m$]
- A body is thrown vertically upward with initial velocity of $40 m/s$. Draw the v-t diagram for the body.



- b. A body falls freely from top of a tower. During the last second of its fall, it falls through 25m. Find the height of the tower. [Ans: 45m]
8. a. What does the area under velocity time graph represents, what about area under acceleration time graph?
- c. An object is dropped from the top of the tower of height 156.8m and at the same time another object is thrown vertically upward with the velocity of 78.1m/s from the foot of the tower, when and where the object meet?

[Ans: 2 sec and 20m below top]

9. a. What would be the effect on maximum range in doubling the initial velocity of a projectile?
- b. A projectile is fired from the ground level with a velocity of 500m/s at 30° to horizon. Find the horizontal range, and greatest height to which it rises. What is the least speed with which it can be projected in order to achieve the same horizontal range?
10. a. What would be the effect on maximum range in doubling the initial velocity of a projectile?
- c. A projectile is launched with an initial velocity of 30m/s at an angle of 60° above the horizontal. Calculate the magnitude and direction of its velocity 5sec after launch.

[Ans: 28.3m /s and 58° from horizontal]

11. a. A bomb is to be dropped from a moving helicopter on a target on the ground. Explain how it can hit the target.
- b. A car is running on a straight road with accelerating motion. It travels 10m distance in 3rd seconds after the start and 12m in 5th second. Now, what distance does it travel in 10th second after its start. [Ans: 17m]
12. a. Under what condition is the average velocity equal to the instantaneous velocity?
- c. Rain is falling vertically with a speed of 30m/s. A woman rides a bicycle with a speed 10m/s from north to south direction. What is the direction i she should hold her umbrella? [18.43]

Some additional questions:

1. A stone is thrown horizontally with a speed of 20m/s from height 100m above the ground: Find, its time of flight, Horizontal range, velocity after 2 seconds, velocity with which it hits the ground, position of stone after 2 seconds. [Use $g = 10m/s^2$]
2. Two tall buildings are 40m apart. With what speed must a ball be thrown horizontally from a window 120m above the ground in one building so that it will enter a window 40m from the ground in the other building? [Ans: 10m/s]
3. A projectile moves in a parabolic path without air resistance. Is there any point at which its acceleration is: a) Perpendicular to velocity? Explain
a) Parallel to the velocity? Explain.
4. A swimmer's speed along the river (downstream) is 20kmph and upstream is 8kmph. Calculate the velocity of the stream and the swimmer's possible speed in still water. [Ans: 14kmph, 6kmph]
5. An airplane is flying with a velocity of 90m/s at an angle of 23° above the horizontal. When the plane is 114m directly above a dog that is standing on level ground, a suitcase drops out of luggage compartment. How far from the dog will the suitcase land? You can ignore the air resistance. [Ans: 787.7m from dog]
6. A man wishes to swim across a river 600m wide. If he can swim at the rate of 4km/hr in still water and the river flows at 2km/hr. Then in what direction must he swim to reach a point

exactly opposite to starting point and when will he reach it? [Ans: 120° with water and 10.4 min]