

Motion in a plane

Objective : Learn to use the equations developed for projectile motion

1. A particle is projected with speed 10ms^{-1} at angle 60° with the horizontal. Then the time after which its speed becomes half of the initial speed is
a) $2/\sqrt{3}$ s b) $\sqrt{3}/2$ s c) $1/\sqrt{3}$ s d) $\sqrt{3}$ s
2. Two bodies are projected from the same point in directions inclined at 60° and 30° to horizontal. If they attain same height then the ratio of their velocities of projection is
a) $1:\sqrt{3}$ b) $2:\sqrt{3}$ c) $1:1$ d) $\sqrt{3}:\sqrt{2}$
3. Two bodies are projected from the same point in directions inclined at 60° and 30° to horizontal. If they attain the same horizontal range then the ratio of their velocities of projection is
a) $1:1$ b) $2:\sqrt{3}$ c) $1:1$ d) $\sqrt{3}:\sqrt{2}$
4. If R is the range on a horizontal plane and T the time of flight of a projectile, then the angle of projection α given by $\tan(\alpha)$ is equal to
a) $\frac{gT^2}{R}$ b) $\frac{3gT^2}{R}$ c) $\frac{2gT^2}{3R}$ d) $\frac{gT^2}{2R}$
5. A projectile is projected with an initial velocity of $u_x\mathbf{i} + u_y\mathbf{j}$ ms^{-1} . If the range of the projectile is twice the maximum height, the ratio u_y / u_x is
a) 2 b) 1 c) 4 d. zero
6. From the top of a building of height 20m a ball is thrown horizontally. The line joining the point where the ball hits the ground and the point of projection is 45° w.r.t. the ground. The initial velocity of the ball ($g = 10\text{ms}^{-2}$)
a) 4ms^{-1} b) 6ms^{-1} c) 8ms^{-1} d) 10ms^{-1}
7. A body is projected so as to have maximum possible horizontal range equal to 400m. Considering the point of projection to be the origin, coordinates of the point where its velocity is minimum are
a) (200, 100) b) (100, 200) c) ($50\sqrt{3}$, 100) d) (50, $100\sqrt{2}$)
8. A stone is projected from the ground with velocity 50ms^{-1} at an angle of 30° . It crosses a wall after 3 s. How far, beyond the wall, does the stone strike the ground? ($g = 10\text{ms}^{-2}$)
a) 32.5 m b) 48.6 m c) 64.8 m d) 86.6 m
9. A stone is projected from the ground with velocity 25ms^{-1} . Two seconds later, it just clears a wall 5m high. Angle of projection of the stone is ____ degrees. ($g = 10\text{ms}^{-2}$)
a) 30° b) 45° c) 60° d) 90°
10. For angles of projection ($45^\circ + \theta$) and ($45^\circ - \theta$), where $\theta < 45^\circ$, the horizontal ranges described by the projectile are in the ratio of
a) $1:\sqrt{2}$ b) $\sqrt{2}:1$ c) $1:2$ d) $1:1$
11. A particle is thrown with velocity v such that its range on horizontal plane is twice to the maximum height attained. Its range is

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a) $\frac{4v^2}{3g}$

b) $\frac{2v^2}{5g}$

c) $\frac{4v^2}{5g}$

d) $\frac{v^2}{3g}$

12. A stone projected at angle θ with horizontal from the roof of a tall building falls on the ground after three second. Two second after the projection it was again at the level of projection. Then the height of the building is
a) 15m b) 5 m c) 25 m d) 30 m
13. Two boys stationed at A and B fire bullets simultaneously in the same vertical plane. The bullets are fired from A and B at angles of 53° and 37° with the vertical. If the bullets collide with each other in their flight then what is the value of v_A if v_B is 60 units ? ($\tan 37^\circ = 3/4$)
a) 80 units b) 70 units c) 45 units d) 36 units
14. Two bodies A and B are thrown with speeds u and $u/2$ respectively. Both the balls cover the same horizontal distance before returning to the plane of projection. If the angle of projection of ball B is 15° with the horizontal, then the angle of projection of A is
a) $\sin^{-1}(1/8)$ b) $\frac{1}{2} \sin^{-1}(1/8)$ c) $\frac{1}{3} \sin^{-1}(1/8)$ d) $\frac{1}{4} \sin^{-1}(1/8)$
15. A body is thrown horizontally with a velocity $\sqrt{2gh}$ from the top of a tower of height h . It strikes the level ground through the foot of the tower at a distance x from the tower. The value of x is
a) h b) $h/2$ c) $2h$ d) $2h/3$

Answers

1. b
2. a
3. a
4. d
5. a
6. d
7. a
8. d
9. a
10. d
11. c
12. a
13. a
14. b
15. c