PROJECTILE ON A HORIZONTAL PLANE

1. A ball is thrown upwards. It returns to ground describing a parabolic path. Which of the following remains constant?

(A) speed of the ball (B) kinetic energy of the ball

(C) vertical component of velocity (D) horizontal component of velocity.

2. A bullet is fired horizontally from a rifle at a distant target. Ignoring the effect of air resistance, which of the following is correct?

	Horizontal Acceleration	Vertical Acceleration
(A)	$10\ ms^{-2}$	$10\ ms^{-2}$
(B)	$10\ ms^{-2}$	$0\ ms^{-2}$
(C)	$0\ ms^{-2}$	$10\ ms^{-2}$
(D)	$0\ ms^{-2}$	$0\ ms^{-2}$.

3. A point mass is projected, making an acute angle with the horizontal. If angle between velocity $\vec{v}$ and acceleration $\vec{g}$ is θ, then θ is given by

(A) $0^o < \theta < 90^o$ (B) $\theta = 90^o$ (C) $\theta = 90^o$ (D) $0^o < \theta < 180^o$

4. It was calculated that a shell when fired from a gun with a certain velocity and at an angle of elevation $\frac{5\pi}{36}$ rad should strike a given target. In actual practice, it was found that a hill just prevented the trajectory. At what angle of elevation should the gun be fired to hit the target.

(A) $\frac{5\pi}{36}$ rad (B) $\frac{11\pi}{36}$ rad (C) $\frac{7\pi}{36}$ rad (D) $\frac{13\pi}{36}$ rad.

5. A projectile is thrown with a speed v at an angle θ with the vertical. Its average velocity between the instants it crosses half the maximum height is

(A) $v \sin\theta$, horizontal and in the plane of projection

(B) $v \cos\theta$, horizontal and in the plane of projection

(C) $2v \sin\theta$, horizontal and perpendicular to the plane of projection

(D) $2v \cos\theta$, vertical and in the plane of projection.

6. A particle moves along the parabolic path $y = ax^2$ in such a way that the x component of the velocity remains constant, say c. The acceleration of the particle is

(A) $ac\hat{k}$ (B) $2ac^2\hat{j}$ (C) $ac^2\hat{k}$ (D) $a^2c\hat{j}$

7. During projectile motion acceleration of a particle at the highest point of its trajectory is :

(A) g (B) zero

(C) less than g (D) dependent upon projection velocity

8. The velocity at the maximum height of a projectile is half of its initial velocity u. Its range on the horizontal plane is :

(A) $\frac{2u^2}{3g}$ (B) $\frac{\sqrt{3}u^2}{2g}$ (C) $\frac{u^2}{3g}$ (D) $\frac{u^2}{2g}$

9. The velocity of projection of a projectile is $(6\hat{i} + 8\hat{j})$ ms^{-1}. The horizontal range of the projectile is

(A) 4.9 m (B) 9.6 m (C) 19.6 m (D) 14 m

10. A particle is projected with velocity 20 m/s at an angle of 45° with horizontal. Find out the [take g = 10 m/s]

(a) horizontal Range

(b) Maximum Height

(c) Time of flight

(d) For which angle is T maximum, T_{max} = ?

(e) For which angle is R maximum , $R_{max.}$ = ?

11. Two bodies are projected at angles θ and $(90 - \theta)$ to the horizontal with the same speed. Find the ratio of their times of flight?

12. In above question find the ratio of the maximum vertical heights ?

13. A body is so projected in the air that the horizontal range covered by the body is equal to the vertical height attained by the body. Find the angle of projection ?

14. A projectile can have the same range R for two angles of projections. If t_1 & t_2 be the times of flight in two cases, then find out relation between t_1, t_2 and R ?

15. A cricketer can throw a ball to a maximum horizontal distance of 100 m. How much high should above the ground can the cricketer throw the same ball.

PROJECTILE FROM A TOWER

16. One stone is projected horizontally from a 20 m high cliff with an initial speed of 10 ms^{-1}. A second stone is simultaneously dropped from that cliff. Which of the following is true?

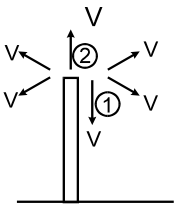
(A) Both strike the ground with the same velocity.

(B) The ball with initial speed 10 ms^{-1} reaches the ground first.

(C) Both the balls hit the ground at the same time.

(D) One cannot say without knowing the height of the building.

17.* Particles are projected from the top of a tower with same speed at different angles as shown. Which of the following are True ?



(A) All the particles would strike the ground with (same) speed.

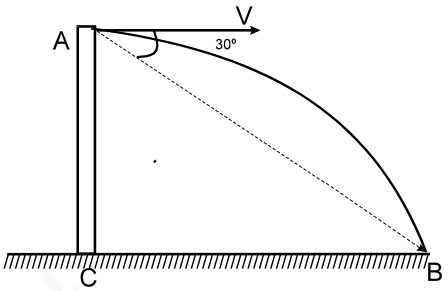
(B) All the particles would strike the ground with (same) speed simultaneously.

(C) Particle 1 will be the first to strike the ground.

(D) Particle 1 strikes the ground with maximum speed.

18. An object is thrown horizontally from a point 'A' from a tower and hits the ground 3s later at B. The

line from 'A' to 'B' makes an angle of 30º with the horizontal. The initial velocity of the object is : (take $g = 10\ m/s^2$)



(A) $15\sqrt{3}$ m/s (B) 15 m/s (C) $10\sqrt{3}$ m/s (D) $25/\sqrt{3}$ m/s

19. A body is projected horizontally from the top of a tower with initial velocity 18 ms^{-1}. It hits the ground at angle 45º. What is the vertical component of velocity when it strikes the ground?

(A) $18\sqrt{2}$ ms^{-1} (B) 18 ms^{-1} (C) $9\sqrt{2}$ ms^{-1} (D) 9 ms^{-1}

20. A projectile is fired horizontally with a velocity of 98 m/s from the top of a hill 490 m high. Find : (take $g = 9.8\ m/s^2$)

(i) the time taken to reach the ground

(ii) the distance of the target from the hill

(iii) the velocity with which the particle hits the ground

21. From the top of a tower of height 50m a ball is projected upwards with a speed of 30 m/s at an angle of 30° to the horizontal then calculate -

(i) maximum height from the ground (ii) at what distance from the foot of the tower does the projectile hit the ground. (iii) Time of flight.

EQUATION OF TRAJECTORY

22. A ball is projected from a certain point on the surface of a planet at a certain angle with the horizontal surface. The horizontal and vertical displacement x and y vary with time t in second as:

$$x = 10\sqrt{3}\,t \text{ and } y = 10t - t^2$$

The maximum height attained by the ball is

(A) 100 m (B) 75 m (C) 50 m (D) 25 m.

23. A ball is thrown upward at an angle of 30° with the horizontal and lands on the top edge of a building that is 20 m away. The top edge is 5m above the throwing point. The initial speed of the ball in metre/second is (take $g = 10\ m/s^2$) :

(A) 10 m/s (B) 20 m/s (C) 25 m/s (D) 30 m/s

24. The equation of a projectile is $y = \sqrt{3}\,x - \frac{gx^2}{2}$ find the angle of projection also find the speed of projection.