PROJECTILE MOTION
RELATIVE MOTION (DPP-5)

PHYSICS

1. The equation of projectile is $y = \sqrt{3}x - \frac{1}{2}gx^2$.

The velocity of projection is :
(a) 1 ms^{-1}
(b) 2 ms^{-1}
(c) 3 ms^{-1}
(d) 1.2 ms^{-1}

2. A rifle shoots a bullet with a muzzle velocity of 400m/s at a small target 400m away. The height above the target at which the bullet must be aimed to hit the target is (g = 10ms^{-2})
(a) 1 m
(b) 5 m
(c) 10 m
(d) 0.5 m

3. A projectile is thrown with a speed u at an angle θ to the horizontal. The radius of curvature of its trajectory when the velocity vector of the projectile makes an angle α with the horizontal is

a) $\dfrac{u^2 \cos^2 \alpha}{g\cos^2 \theta}$
b) $\dfrac{2u^2 \cos^2 \alpha}{g\cos^2 \theta}$
c) $\dfrac{u^2 \cos^2 \theta}{g\cos^3 \alpha}$
d) $\dfrac{u^2 \cos^2 \theta}{g\cos^2 \alpha}$

4. A particle of mass m is projected with a velocity v making an angle of 45° with the horizontal. The magnitude of the angular momentum of the particle about the point of projection when the particle is at its maximum height, is

a) $m\sqrt{2gh^3}$
b) $\dfrac{mv^3}{\sqrt{2g}}$
c) $\dfrac{mv^3}{4\sqrt{2g}}$
d) Zero

5. The maximum height attained by a projectile is increased by 10% by increasing its speed of projection, without changing the angle of projection. The percentage increase in the horizontal range will be
a) 5%
b) 10%
c) 15%
d) 20%

6. A boy is hanging from a horizontal branch of a tree. The tension in the arms will be maximum when the angle between the arms is
a) 0°
b) 60°
c) 90°
d) 120°

7. Two projectiles thrown at 30° and 45° with the horizontal respectively, reach the maximum height in same time. The ratio of their intial velocities is:
a) $1\sqrt{2}$
b) 2:1
c) $\sqrt{2}$:1
d) 1:2

8. A person can throw a ball upto a maximum range of 100 m. How high above the ground he can throw the same ball?
a) 25m
b) 50m
c) 100m
d) 200m

9. A projectile is launched at an angle 'α' with the horizontal with a velocity 20 ms^{-1}. After 10 s, its inclination with horizontal is 'β'. The value of tan β will be: (g = 10 ms^{-2})
a) tan α + 5 sec α
b) tan α - 5 sec α
c) 2 tan α - 5 sec α
d) 2 tan α + 5 sec α

10. A projectile is projected with velocity of 25 m/s at an angle θ with the horizontal. After t seconds its inclination with horizontal becomes zero. If R represents horizontal range of the projectile, the value of θ will be : [use g = 10 m/s^2]

a) $\dfrac{1}{2}\sin^{-1}\left(\dfrac{5t^2}{4R}\right)$

b) $\dfrac{1}{2}\sin^{-1}\left(\dfrac{4R}{5t^2}\right)$

c) $\tan^{-1}\left(\dfrac{4t^2}{5R}\right)$

d) $\cot^{-1}\left(\dfrac{R}{20t^2}\right)$

11. Two particles are projected from the same point with the same speed u such that they have the same range R, but different maximum heights, h_1 and h_2 Which of the following is correct ?

a) $R^2 = 4 h_1 h_2$

b) $R^2 = 16 h_1 h_2$

c) $R^2 = 2 h_1 h_2$

d) $R^2 = h_1 h_2$

12. Two guns A and B can fire bullets at speeds 1 km/s and 2 km/s respectively. From a point on a horizontal ground, they are fired in all possible directions. The ratio of maximum areas covered by the bullets fired by the two guns, on the ground is:

a) 1:16

b) 1:2

c) 1:4

d) 1:8

13. A projectile is given an initial velocity of $(\hat{i} + 2\hat{j})$ m/s, where $\hat{i}$ is along the ground and $\hat{j}$ is along the vertical. If g = 10 m/s^2, the equation of its trajectory is :

a) $y = x - 5x^2$

b) $y = 2x - 5x^2$

c) $4y = 2x - 5x^2$

d) $4y = 2x - 25x^2$

14. A boy can throw a stone up to a maximum height of 10 m. The maximum horizontal distance that the boy can throw the same stone up to will be

a) $20\sqrt{2}$ m

b) 10m

c) $10\sqrt{2}$ m

d) 20m

15. A water fountain on the ground sprinkles water all around it. If the speed of water coming out of the fountain is v, the total area around the fountain that gets wet is:

a) $\pi\dfrac{v^4}{g^2}$

b) $\dfrac{\pi}{2}\dfrac{v^4}{g^2}$

c) $\pi\dfrac{v^2}{g^2}$

d) $\pi\dfrac{v^2}{g}$

16. A particle is moving along a circular path with a constant speed of 10 ms^{-1}. What is the magnitude of the change in velocity of the particle, when it moves through an angle of 60° around the centre of the circle?

a) $10\sqrt{3}$ m/s

b) zero

c) $10\sqrt{2}$ m/s

d) 10 m/s

17. A person swims in a river aiming to reach exactly opposite point on the bank of a river. His speed of swimming is 0.5 m/s at an angle 120° with the direction of flow of water. The speed of water in stream is

a) 1.0 m/s

b) 0.5 m/s

c) 0.25 m/s

d) 0.43 m/s

18. Vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are such that $\vec{A}\cdot\vec{B} = 0$ and $\vec{A}\cdot\vec{C} = 0$. Then the vector parallel to $\vec{A}$ is

a) $\vec{B}$ and $\vec{C}$

b) $\vec{A}\times\vec{B}$

c) $\vec{B}+\vec{C}$

d) $\vec{B}\times\vec{C}$

19. Two stones thrown at different angles have same initial velocity and same range. If H is the maximum height attained by one stone thrown at an angle of 30°, then the maximum height attained by the other stone is

a) $\dfrac{H}{2}$

b) H

c) 2H

d) 3H

20. A ball rolls off the top of a stairway with horizontal velocity v_0 ms^{-1}. If the steps are h metre high and w metre wide, the ball will hit the edge of nth step if

a) $n = \dfrac{2hv_0}{gw^2}$

b) $n = \dfrac{2hv_0^2}{gw}$

c) $n = \dfrac{hv_0^2}{gw^2}$

d) $n = \dfrac{2hv_0^2}{gw^2}$

21. What is the angle between $\hat{i} + \hat{j} + \hat{k}$ and $\hat{i}$

a) 0°

b) $\pi/6$

c) $\pi/3$

d) None of these

22. For a projection, (range)^2 is 48 times of (maximum height)^2 obtained. Find angle projection.

a) 60°

b) 30°

c) 45°

d) 75°

23. A ball is projected from a certain point on the surface of a planet at a certain angel 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

24. Two bullets are fired simultaneously, horizontally and with different speeds from the same place. Which bullet will hit the ground first?
a) The faster bullet
b) The slower bullet
c) Both will hit simultaneously
d) Depends on the masses

25. The horizontal range of a projectile is $4\sqrt{3}$ times its maximum height. Its angle of projection will be
a) 45°
b) 60°
c) 90°
d) 30°

26. A ball rolls of the top of stair-way with a horizontal velocity of magnitude $1.8\,\text{ms}^{-1}$. The steps are 0.20 m high and 0.20 m wide. Which step will the ball hit first?
a) First
b) Second
c) Third
d) Fourth

27. A projectile is thrown at an angle θ such that it is just able to cross a vertical wall at its highest point as shown in the figure. The angle θ at which the projectile is thrown is given by :
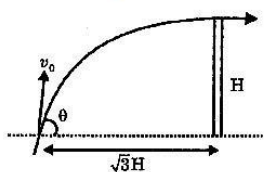

(a) $\tan^{-1}\left(\dfrac{1}{\sqrt{3}}\right)$
(b) $\tan^{-1}\sqrt{3}$
(c) $\tan^{-1}\left(\dfrac{2}{\sqrt{3}}\right)$
(d) $\tan^{-1}\left(\dfrac{\sqrt{3}}{2}\right)$

28. The initial velocity of a particle of mass 2 kg is $(4\hat{i} + 4\hat{j})\,\text{ms}^{-1}$. A constant force of $-20\hat{i}$ N is applied on the particle. Initially the particle was at (0, 0). Find the x-coordinate of the point where its y-coordinate is again zero.
(a) 3.2 m
(b) 6 m
(c) 4.8 m
(d) 1.2 m

29. An aeroplane is flying horizontally with a velocity of 600 km/hr and at a height of 1960m. When it is vertically above a point A on the ground, a bomb is released from it . The bomb strikes the ground at point B. The distance AB is :
(a) 1200m
(b) 0.33 km
(c) 3.33 km
(d) 3.33 km

30. A particle is projected with 10 m/sec at an angle 60° from horizontal as shown. What will be its radius of curvature when it will strike on ground?
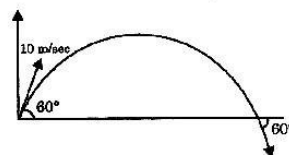
(a) 40 m
(b) 20 m
(c) $20\sqrt{3}$ m
(d) can't say

SPACE FOR ROUGH WORK