RACE # 11

PROEJCTILE MOTION

1. A projectile is given an initial velocity of $\hat{i} + 2\hat{j}$. The equation of its path is

$$\left(g = 10 \text{m/s}^2\right)$$

- (A) $y = 2x 5x^2$ (B) $y = x 5x^2$ (C) $4y = 2x 5x^2$ (D) $y = 2x 25x^2$
- 2. A particle is projected from the surface of a planet. The horizontal and vertical displacements x and y (in metre) respectively vary with time t (in second) as $x = 10\sqrt{3}t$ and $y = 10t t^2$ where t = 0 represents the time when the particle is projected. Then the maximum height attained by the particle is (acceleration on the planet can be assumed uniform)
 - (A) 200 m (B) 100 m (C) 50 m (D) 25 m
- 3. The speed of projectile at its highest point is observed to be half of its speed of projection u. Its range on horizontal plane is
 - (A) $\frac{3u^2}{g}$ (B) $\frac{\sqrt{3}}{2}\frac{u^2}{g}$ (C) $\frac{3}{2}\frac{u^2}{g}$ (D) $\frac{u^2}{3g}$
- 4. A large number of bullets are fired from the same point in all directions with the same speed v. The maximum area on the ground on which these bullets will spread is
 - (A) $\pi \frac{\nu^4}{g^2}$ (B) $\pi^2 \frac{\nu^4}{g^2}$ (C) $\frac{\nu^4}{g^2}$ (D) $\frac{\nu^4}{4g^2}$
- 5. Three projectiles *A*, *B* and *C* are thrown from the same point in the plane. Their trajectories are shown in the figure. Then which of the following statements is true ?



- (A) The time of flight is not the same for all three.
- (B) The launch speed is greatest for A.
- (C) The horizontal velocity component is greatest for particle c.
- (D) None of these
- 6. A cannon ball has the same range R on a horizontal plane for two angles of projection. If h_1 and h_2 are the greatest height in the two paths for which this is possible, then

(A)
$$R = h_1 h_2$$
 (B) $R = 4\sqrt{h_1 h_2}$ (C) $R = 3\sqrt{h_1 h_2}$ (D) $R = (h_1 h_2)^{1/4}$

7. In projectile motion the range R is n times the maximum height. The angle of projection w.r.t. the horizontal is

(A)
$$\tan^{-1}\frac{n}{2}$$
 (B) $\tan^{-1}\frac{2}{n}$ (C) $\tan^{-1}\frac{4}{n}$ (D) $\tan^{-1}\frac{n}{4}$

- 8. A ball of mass *m* is projected from the ground with an initial velocity *u* making an angle θ with the horizontal. Then, choose the correct statement
 - (A) the change in velocity between the point of projection and the highest point is $-u \sin \theta \hat{j}$.
 - (B) the average velocity averaged over the time of flight is $\mu \cos \theta \hat{i}$ (horizontal).
 - (C) the change in velocity in the complete projectile motion is $-2u\sin\theta \hat{j}$.
 - (D) the rate at which momentum of the ball is changing is constant.
- **9.** A boy can throw a stone to maximum height of 50 m. To what maximum range can he throw this stone and to what greatest height so that the maximum range is maintained, select the correct choice/choices
 - (A)maximum range is 100 m (B) maximum height for maximum range is 25 m
 - (C) maximum range is 200 m (D) maximum height for maximum range is 50 m

10. The initial velocity of a particle is $\vec{u} = (2\hat{i} + 3\hat{j})$ m/s. A constant force of $\vec{F} = (4\hat{i} + \hat{j})N$ acts on the particle it follows that

- (A) its velocity is constant (B) its acceleration is constant
- (C) its path is parabolic (D) it moves in a circular path
- 11. Two projectiles A and B are projected with same speed at angles 30° and 60° to the horizontal then

(A) $R_A = R_B$ (B) $H_B = 3H_A$ (C) $H_A = 3H_B$ (D) $T_B = \sqrt{3}T_A$

(R stands for range, H for maximum)

- **12.** A projectile is projected from a point on the horizontal ground, at an angle with the vertical. If the air exerts a constant resistive force,
 - (A) the path of projectile will be a parabola
 - (B) at the highest point, the velocity is horizontal.
 - (C) the time for ascent equals the time for descent.
 - (D) the total mechanical energy of the projectile is not conserved.
- **13.** A projectile shot at an angle of 45° above the horizontal strikes on building 30 m away at a point 15 m above the point of projection. Find :
 - (A) The speed of projection.
 - (B) The magnitude and direction of velocity of projectile when it strikes the building.
- 14. An object is projected so that it must clear two obstacles each 7.5 m height, which are situated 50 m from each other. If the time of passing between the obstacles is 2.5 sec, calculate the complete range of projection and the initial velocity of the projection. (g = 10m/s²).

Answers

 1. (A)
 2. (D)
 3. (B)
 4. (A)
 5. (C)
 6. (B)
 7. (C)
 8. (ABCD)
 9. (AB)

 10. (B)
 11. (ABD)
 12. (CD)
 13. (A) $10\sqrt{6}$ (B) $10\sqrt{3}$, Normal to wall
 14. 20