ETERNAL CAREER CLASSES

SUBJECT : PHYSICS

[SECTION - A]

1. What determines the nature of the path followed by the particle ?
(a) Speed (b) Velocity
(c) Acceleration (d) Both (b) & (c)

2. A particle has an initial velocity of $3\hat{\boldsymbol{\imath}} + 4\hat{\boldsymbol{\jmath}}$ and an acceleration of $0.4\hat{\boldsymbol{\imath}} + 0.3\hat{\boldsymbol{\jmath}}$. Its speed after 10s is :
(a) 10 units (b) $7\sqrt{2}$ units
(c) 7 units (d) 8.5 units

3. A ball is thrown with a velocity $6\hat{\jmath}$ with an acceleration $6\hat{\imath} + 2\hat{\jmath}$. The velocity of the ball after 5 seconds is :
(a) $30\hat{\imath} + 10\hat{\jmath}$ (b) $30\hat{\imath} + 16\hat{\jmath}$
(c) $10\hat{\imath} + 24\hat{\jmath}$ (d) None of these

4. A body lying initially at point (3, 7) starts moving with a constant acceleration of $4\hat{\boldsymbol{\imath}}$. Its position after 3s is given by the coordinates :
(a) (7, 3) (b) (7, 18)
(c) (21, 7) (d) (3, 7)

5. A man is walking due to east at the rate of 2kmh^{-1}. The rain appears to him to come down vertically at the rate of 2kmh^{-1}. The actual velocity and direction of rainfall with the vertical, respectively are :
(a) $2\sqrt{2}\ \text{kmh}^{-1}$, 45° (b) $\frac{1}{\sqrt{2}}\ \text{kmh}^{-1}$, 30°
(c) $2\ \text{kmh}^{-1}$, 0° (d) $1\ \text{kmh}^{-1}$, 90°

6. A ship A is moving westwards with a speed of 10 kmh^{-1} and a ship B 100km south of A is moving northwards with a speed of 10km h^{-1}. The time after which the distance between them becomes shortest is :
(a) 0 h (b) 5 h
(c) $5\sqrt{2}$ h (d) $10\sqrt{2}$ h

7. Ship A is travelling with a velocity of 5kmh^{-1} due east. The second ship is heading 30° east of north. What should be the speed of second ship if it is to remain always due north with respect to the first ship ?
(a) 10kmh^{-1} (b) $9\ \text{kmh}^{-1}$
(c) $8\ \text{kmh}^{-1}$ (d) $7\ \text{kmh}^{-1}$

8. A boat is moving with a velocity $3\hat{\imath} + 4\hat{\jmath}$ with respect to ground. The water in the river is moving with a velocity $-3\hat{\imath} - 4\hat{\jmath}$ with respect to ground. The relative velocity of the boar with respect to water is :
(a) $8\hat{\jmath}$ (b) $-6\hat{\imath} - 8\hat{\jmath}$
(c) $6\hat{\imath} + 8\hat{\jmath}$ (d) $5\sqrt{2}\hat{\imath}$

9. A steamer is moving due east with 36km/h. To a man in the steamer the wind appears to blow at 18km/h due north. Fing the velocity of the wind.
(a) $5\sqrt{5}\text{ms}^{-1}$ 30° north of east
(b) $6\ \text{ms}^{-1}$ 60° north of east
(c) $5\sqrt{5}\text{ms}^{-1}$ 60° north of east
(d) $5\ \text{ms}^{-1}$ 30° north of east

10. Wind is blowing N-E with $18\sqrt{2}$ km h^{-1} and steamer is heading due east with 18 kmh^{-1}. In which direction is the flag on the mast fluttering ?

(a) North-West (b) North

(c) South-West (d) South

11. A car is moving towards east with a speed of 25km/h. To the driver of the car, a bus appears to move towards north with a speed of $25\sqrt{3}$ km/h. What is the actual velocity of the bus ?

(a) 50km/h, 30° east of north

(b) 50km/h, 30° north of east

(c) 25km/h, 30° east of north

(d) 25km/h, 30° north of east

12. A car is going in south with a speed of 5m/s. To a man sitting in car a bus appears to move towards west with a speed of $2\sqrt{6}$m/s. What is the actual speed of the bus ?

(a) $4ms^{-1}$ (b) $3ms^{-1}$

(c) $7ms^{-1}$ (d) none of these

13. A man 'A' is going due east with speed of 5m/s. Another man 'B' is going due north with 7m/s. The relative velocity B w.r.t. A.

(a) $\sqrt{74}$ *m/s,* $\theta = tan^{-1}\left(\frac{5}{7}\right)$ *E of S*

(b) $\sqrt{74}$ *m/s,* $\theta = tan^{-1}\left(\frac{5}{7}\right)$ *W of N*

(c) $\sqrt{24}$ *m/s,* $\theta = tan^{-1}\left(\frac{5}{7}\right)$ *E of S*

(d) $\sqrt{24}$ *m/s,* $\theta = tan^{-1}\left(\frac{5}{7}\right)$ *W of N*

14. The distance between two moving particles at any time is a. If v be their relative velocity and v_1 and v_2 be the components of v along the perpendicular to a. The time when they are closest to each other is :

(a) $\frac{av_1}{v^2}$ (b) $\frac{av_2}{v^2}$

(c) $\frac{av}{a_1^2}$ (d) $\frac{av}{v_2^2}$

15. A body is projected horizontally from the top of a tower with a velocity of 10m/s. If it hits the ground at an angle of 45° then the vertical component of velocity when it hits ground (in m/s) is :

(a) $10\sqrt{2}$ (b) $5\sqrt{2}$

(c) 5 (d) 10

16. A body is projected horizontally with velocity 196 ms^{-1} from height 400m. What is the time to reach the ground ?

(a) 5s (b) 9s

(c) 15s (d) 20s

17. A bullet is fired from the gun with a speed of $100ms^{-1}$ in order to hit a targer s = 100m away. At what height above the target should be gun be aimed ? (the resistance of air is negligible and g = $10ms^{-2}$)

(a) 23 cm (b) 15 cm

(c) 9 cm (d) 5 cm

18. A particle (A) is dropped from a height and another particle (B) is thrown into horizontal direction with speed of 5m/sec from the same height. The correct statement is :

(a) Both particles with reach at ground simultaneously.

(b) Both Particles will reach at ground with the same speed.

(c) Particle (A) will reach at ground first with respect to particle (B)

(d) particle (B) will reach at ground first with respect to particle (A)

19. A stone is just released from the window of a train moving along a horizontal straight track. The stone will hit the ground following a :

(a) straight line path

(b) circular path

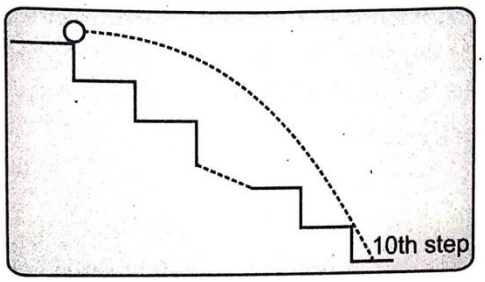
(c) parabolic path

(d) hyperbolic path

20. 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 buttle must be aimed to hit the target is ($g = 10ms^{-2}$)

(a) 1m (b) 5m
(c) 10m (d) 0.5m

21. A ball rolls horizontally off a stair case with initial velocity '*u*' and just manages to hit the 10^{th} step as shown. If length of each step is 20cm and height is 10cm, the initial velocity of the ball is : ($g = 10m/s^2$)



(a) $2\sqrt{5}$m/s (b) $3\sqrt{2}$m/s
(c) $2\sqrt{3}$m/s (d) $5\sqrt{2}$m/s

22. A ball is projected horizontally with a speed of 20m/s from a large height. What time after the projection its vertical and horizontal components of speed become equal ?

(a) 2 sec (b) 1 sec
(c) 3 sec (d) 4 sec

23. An aeroplane flying at 540 km/hr horizontally drops a packet when it was exactly above the target, at a height of 2km from the target. By what horizontal distance packet will miss the target ?

(a) 3km (b) 5km
(c) 6km (d) 9km

24. If the angle of projection of projectile with same initial velocity exceed or fall short of 45° by equal amount α, then the ratio of horizontal range is :

(a) 1 : 2 (b) 1 : 3
(c) 1 : 4 (d) 1 : 1

25. For an object thrown at 45° to the horizontal, the maximum height H an horizontal range R related as :

(a) R = 16 H (b) R = 8H
(c) R = 4H (d) R = 2H

26. A body is projected with an angle θ. The maximum height reached is h. If the time of flight is 5s and $g = 10\ m/s^2$, then value of h is :

(a) 40 m (b) 20 m
(c) 5 m (d) 10 m

27. An arrow is shot into air. Its range is 200m and its time of flight is 5s. If $g = 10\ m/s^2$, Then horizontal component of velocity of the arrow is :

(a) 12.5 m/s (b) 25 m/s
(c) 31.25 m/s (d) 40 m/s

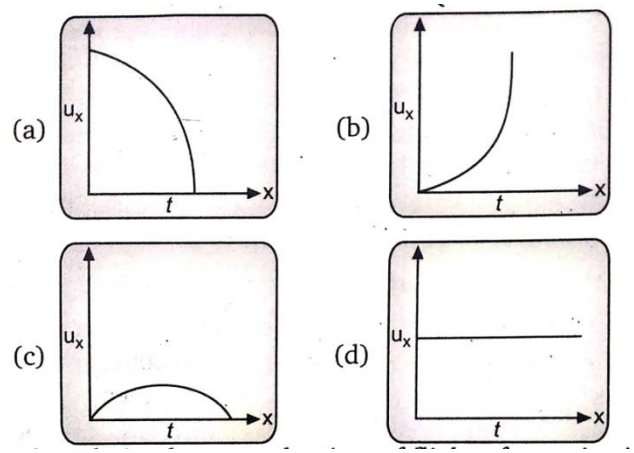
28. The equation of trajectory of a projectile is $y = 10x - \left(\frac{5}{9}\right)x^2$. If we assume g = 10 ms^{-2} then the range of projectile (in metre) is :

(a) 36 (b) 24
(c) 18 (d) 9

29. The height y and the distance x along the horizontal plane of a projectile on a certain planet (with no surrounding atmosphere) are given by $y = 8t - 5t^2 m$ and $x = 6t$ m, where, *t* is in seconds. The velocity with which the projectile is projected, is :

(a) 6 ms^{-1} (b) 8 ms^{-1}
(c) 10 ms^{-1} (d) 14 ms^{-1}

30. Which of the following is the graph between the horizontal velocity (u_x) of a projectile and time (*t*), when it is projected from the ground ?



31. The relation between the time of flight of a projectile, T_f and the time to reach the maximum height, t_m is :

(a) $T_f = 2t_m$ (b) $T_f = t_m$

(c) $T_f = \frac{t_m}{2}$ (d) $T_f = \sqrt{2}\,(t_m)$

(e)) $T_f = \frac{t_m}{\sqrt{2}}$

32. A particle is projected with a velocity v such that its range on the horizontal plane is twice the greatest height attained by it. The range of the projectile is (where, g is acceleration due to gravity) :

(a) $\frac{4v^2}{5g}$ (b) $\frac{4g}{5v^2}$

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

33. A projectile is projected at an angle 60° with horizontal with speed $10ms^{-1}$. The minimum radius of curvature of trajectory described by the projectile is :

(a) 2.55m (b) 2m

(c) 10m (d) None of these

34. During projectile motion, the horizontal velocity :

(a) First increases, then decreases

(b) First decreases, then increases

(c) Always increases

(d) Always constant

35. A projectile is fired making an angle 2θ with horizontal with velocity $4ms^{-1}$. At any instant it makes and angle θ, then its velocity is :

(a) 4 cosθ

(b) 4(2 cosθ – secθ)

(c) 2(secθ + 4 cosθ)

(d) 4(secθ + cosθ)

36. A stone thrown at an angle θ to the horizontal reaches a maximum height H. Then, the time of flight of stone will be :

(a) $\sqrt{\frac{2H}{g}}$ (b) $2\sqrt{\frac{2H}{g}}$

(c) $\frac{2\sqrt{2H\,sin\theta}}{g}$ (d) $\sqrt{\frac{2H\,Sin\,\theta}{g}}$

37. If R and H represent the horizontal range and the maximum height achived by a projectile then which of the relation exists ?

(a) $\frac{H}{R} = 4\cot\theta$ (b) $\frac{R}{H} = 4\cot\theta$

(c) $\frac{H}{R} = 4\tan\theta$ (d) $\frac{R}{H} = 4\,\mathrm{Tan}\,\theta$

38. A large number of bullets are fired in all directions with same speed v. What is the maximum area on the ground on which these bullets will spread ?

(a) $\pi\frac{v^2}{g}$ (b) $\pi\frac{v^4}{g^2}$

(c) $\pi^2\frac{v^4}{g^2}$ (d) $\pi^2\frac{v^2}{g^2}$

39. The angle of projection at which the horizontal range and maximum height of projectile are equal is :

(a) 45°

(b) $\theta = \tan^{-1}(0.25)$

(c) $\theta = \tan^{-1} 4$ or ($\theta = 76°$)

(d) 60°

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

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

(c) $4y = 2x - 5x^2$ (d) $4y = 2x - 25x^2$

[SECTION - B]

41. An object is projected with a velocity of 20m/s making an angle of 45° with horizontal. The equation for the trajectory is $h = Ax - Bx^2$, where h is height, x is horizontal distance, A and B are constants. The ratio A : B (g = $10ms^{-2}$) :

(a) 1 : 5 (b) 5 : 1

(c) 1 : 40 (d) 40 : 1

42. Two bodies are thrown up at angles of 45°and 60° respectively, with the horizontal. If both bodies attain same vertical height, then the ratio of velocities with which these are thrown is :

(a) $\sqrt{\frac{2}{3}}$ (b) $\frac{2}{\sqrt{3}}$

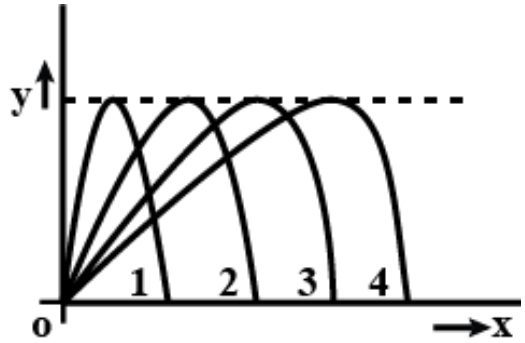
(c) $\sqrt{\frac{3}{2}}$ (d) $\frac{\sqrt{3}}{2}$

43. The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is :

(a) 60° (b) 15°

(c) 30° (d) 45°

44. Figure shown four paths for a kicked football. Ignoring the effects of air on the flight, rank the paths according to initial horizontal velocity component, highest first :



(a) 1, 2, 3, 4 (b) 2, 3, 4, 1

(c) 3, 4, 1, 2 (d) 4, 3, 2, 1

45. A person sitting at the rear end of the compartment throws a ball towards front end. The ball follows a parabolic path. The train is moving with uniform velocity of $20ms^{-1}$. A person standing outside on the ground also observed the ball. How will the maximum heights (h_m) attained and the ranges (R) seen by the thrower and the outside observer compare each other ?

(a) same h_m different R

(b) same h_m and R

(c) different h_m same R

(d) different h_m and R

46. Three particles A, B and C are projected from the same point with the same initial speeds making angles 30°, 45° and 60°, respectively, with the horizontal. Which of the following statement is correct ?

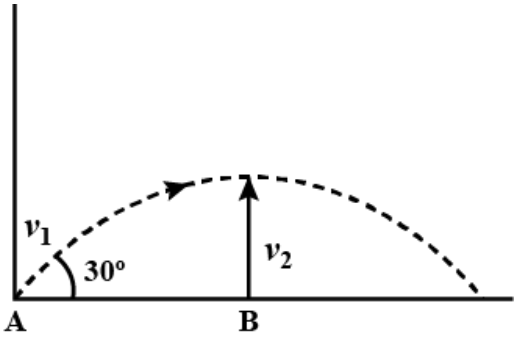
(a) A, B and C have unequal ranges

(b) Ranges of A and C are equal and less than that of B.

(c) Ranges of A and C are equal and greater than that of B.

(d) A, B and C have equal ranges

47. A body is projected with velocity v_1 from the point A as shown in the figure. At the same time another body is projected vertically upwards from B with velocity v_2. The point B lies vertically below the highest point. For both the bodies to collide, $\frac{v_2}{v_1}$ should be :



(a) 2 (b) $\sqrt{\frac{3}{2}}$

(c) 0.5 (d) 1

48. The ceiling of a hall is 40m high. For maximum horizontal distance, the angle at which the ball may be thrown with speed of 56m s^{-1} without hitting the ceiling the hall is :

(a) 25° (b) 30°

(c) 45° (d) 60°

49. A shell fired from the ground is just able to cross in a horizontal direction to the top of a wall 90m away and 45m high. The direction of projection of the shell will be :

(a) 25° (b) 30°

(c) 60° (d) 45°

50. A ball thrown by one player reaches the other in 2 seconds. The maximum height attained by the ball above the point of projection will be about :

(a) 2.5m (b) 5m

(c) 7.5m (d) 10m

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