Exercise-1

PART-I : ONLY ONE OPTION CORRECT TYPE

SECTION : (A) DEFINITION, PROJECTILE ON A HORIZONTAL PLANE

1. A particle moves in a plane with constant acceleration in a direction different from the initial velocity. The path of the particle will be
(1) A straight line (2) An arc of a circle (3) A parabola (4) An ellipse

2. A ball is thrown upwards and it returns to ground describing a parabolic path: Which of the following remains constant
(1) Kinetic energy of the ball (2) Speed of the ball
(3) Horizontal component of velocity (4) Vertical component of velocity

3. At the top of the trajectory of a projectile, the directions of its velocity and acceleration are'
(1) Perpendicular to each other (2) Parallel to each other
(3) Inclined to each other at an angle of 45_o (4) Antiparallel to each other

4. At the top of the trajectory of a projectile, the acceleration is
(1) Maximum (2) Minimum (3) Zero (4) g

5. A ball is thrown at an angle of 30° to the horizontal. It falls on the ground at a distance of 90m. If the ball is thrown with the same initial speed at an angle 30° to the vertical, it will fall on the ground at a distance of-
(1) 120 m (2) 27 m (3) 90 m (4) 30 m

6. A particle is projected under gravity at an angle of projection 45°. If for ground to ground projectile motion its range is 36 m. Then maximum Height attained by particle.
(1) 6 m (2) 9 m (3) 5 m (4) 8 m

7. At what other angle of elevation, the range of a shell fired from a gun will be the same as that for an angle of elevation 5π/36 ?
(1) 10π/36 (2) 5π/72 (3) 13π/36 (4) no other angle

8. When a body is thrown with a velocity u making an angle θ with the horizontal plane, the maximum distance covered by it in horizontal direction is-
(1) $\frac{u^2 \sin\theta}{g}$ (2) $\frac{u^2 \sin 2\theta}{2g}$ (3) $\frac{u^2 \sin 2\theta}{g}$ (4) $\frac{u^2 \cos 2\theta}{g}$

9. The direction of motion of a projectile at the highest point of its trajectory becomes
(1) Horizontal (2) Vertical (3) Tangential (4) None of these

10. Two particles are projected with same initial velocity, one makes angle θ with vertical and another with horizontal. If their common range is R, then product of their time of flight is directly proportional to
(1) R (2) R_2 (3) 1/R (4) R_O

11. Two projectiles of same mass and with same velocity are thrown at an angle 60° and 30° with the horizontal, then which will remain same-
(1) Time of flight (2) Range of projectile
(3) Max height acquired (4) All of them

12. A particle of mass m is projected making angle 45º with horizontal having kinetic energy K. The kinetic energy at highest point will be - (Kinetic energy = $\frac{1}{2}mv^2$)
(1) $\frac{K}{\sqrt{2}}$ (2) $\frac{K}{2}$ (3) 2 K (4) K

13. If the horizontal range of a projectile is equal to the maximum height reached, then the corresponding angle of projection is -

(1) $\tan^{-1}(1)$ (2) $\tan^{-1}(7)$ (3) $\tan^{-1}(4)$ (4) $\tan^{-1}(12)$

14. A body is projected at such an angle that the horizontal range is three times the greatest height. The angle of projection is
(1) 25° 8' (2) 33° 7' (3) 42° 8' (4) 53° 8'

15. Two bodies are projected with the same velocity. If one is projected at an angle of 30° and the other at an angle of 60° to the horizontal, the ratio of the maximum heights reached is
(1) 3 : 1 (2) 1 : 3 (3) 1 : 2 (4) 2 : 1

16. The maximum range of a gun horizontal terrain is 16 km. If g = 10 m/s_2 what must be the muzzle velocity of the shell
(1) 400 m/s (2) 200 m/s (3) 100 m/s (4) 50 m/s

17. If two projectiles are fired at the angles 30º and 60º respectively then the ratio of their horizontal ranges is
(1) 2 : 1 (2) 4 : 1 (3) 1 (4) 1 : 2

18. The coordinates of a moving particle at any time t are given by $x = \alpha t^3$ and $y = \beta t^3$. The speed of the particle at time t is given by :
(1) $\sqrt{\alpha^2+\beta^2}$ (2) $3t_2\sqrt{\alpha^2+\beta^2}$ (3) $t_2\sqrt{\alpha^2+\beta^2}$ (4) $\sqrt{\alpha^2+\beta^2}$

19. A ball is thrown from a point with a speed v_0 at angle of projection θ. From the same point and at the same instant, a person starts running with a constant speed $v_0/2$ to catch the ball? If yes, what should be the angle of projection?
(1) Yes, 60º (2) Yes, 30º (3) No (4) Yes, 45º

20. A particle is projected at 60º to the horizontal with a kinetic energy K. The kinetic energy at the highest point is
(1) K (2) Zero (3) K/4 (4) K/2

21. 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
(1)	10 ms^{-2}	10 ms^{-2}
(2)	10 ms^{-2}	0 ms^{-2}
(3)	0 ms^{-2}	10 ms^{-2}
(4)	0 ms^{-2}	0 ms^{-2}.

22. A shell is fired vertically upwards with a velocity v_1 from the deck of a ship travelling at a speed of v_2. A person on the shore observes the motion of the shell as parabola, its horizontal range is given by :-
(1) $\frac{2v_1^2v_2}{g}$ (2) $\frac{2v_1v_2^2}{g}$ (3) $\frac{2v_1v_2}{g}$ (4) $\frac{2v_1^2v_2^2}{g}$

23. The velocity of projection of a projectile is $(6\hat{i} + 8\hat{j})$ ms^{-1}. The horizontal range of the projectile is
(1) 4.9 m (2) 9.6 m (3) 19.6 m (4) 14 m

24. The time of flight of a projectile is 10s and range is 500m. Maximum height attained by it is-[g = 10 m/s^2]
(1) 25 m (2) 50 m (3) 82 m (4) 125 m

25. An arrow is shot in air, its time of flight is 5 sec and horizontal range is 200m. The inclination of the arrow with the horizontal is-
(1) $\tan^{-1}\frac{5}{8}$ (2) $\tan^{-1}\frac{8}{5}$ (3) $\tan^{-1}\frac{1}{8}$ (4) 45°

26. A plane flying horizontally at a height of 1500 m with a velocity of 200 ms^{-1} passes directly overhead an antiaircraft gun. Then the angle with the horizontal at which the gun should be fired for the shell with a muzzle velocity of 400 m s^{-1} to hit the plane, is -
(1) 90º (2) 60º (3) 30º (4) 45º

27. At what angle with the horizontal a projectile be projected so that the horizontal range and maximum height become same –
(1) 76º (2) 60º (3) 45º (4) 24º

28. A ball of mass m is thrown vertically upwards, and at the same time another ball of mass 2m is thrown at an angle θ. If both the balls remain in our field of view for the same time, then the ratio of the maximum height attained by the balls is :
(1) 1 : 1 (2) 2 : 1 (3) 1 : cosθ (4) 1 : secθ

29. A body is projected with a velocity u. If the maximum height attained by it is half of its horizontal range, then its range must be :
(1) $4u / 5g_2$ (2) $4g/5u_2$ (3) $4u_2/5g$ (4) $4u_2/5g_2$

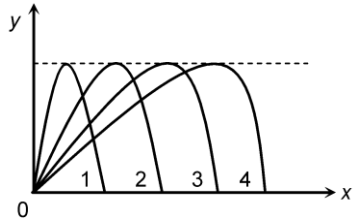
30. The velocity at the maximum height of a projectile is half its initial velocity of projection u. Then its horizontal range is :
(1) $u_2/2g$ (2) $3u_2/2g$ (3) $\frac{\sqrt{3}u^2}{2g}$ (4) u_2/g

31. Three balls of same mass are thrown with equal speeds at angle 15°, 45°, 75° and their ranges are respectively R_{15}, R_{45} and R_{75}, then :
(1) $R_{15} > R_{45} > R_{75}$ (2) $R_{15} < R_{45} < R_{15}$ (3) $R_{15} = R_{45} = R_{75}$ (4) $R_{15} = R_{75} < R_{45}$

32. If the maximum heights attained by the three balls in the previous question are respectively, h_{15} , h_{45}, h_{75}, then :
(1) $h_{15} > h_{45} > h_{75}$ (2) $h_{15} < h_{45} < h_{75}$ (3) $h_{15} = h_{45} = h_{75}$ (4) $h_{15} = h_{75} < h_{45}$

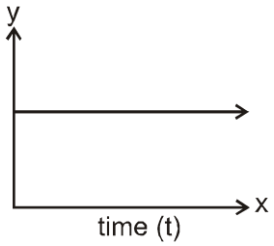
33. A ball is projected with velocity 80 m/s and an angle 30° from horizontal the range will be-
(1) 562 m (2) 286m (3) 188m (4) 1130m

34. Figure shows 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



(1) 1, 2, 3, 4 (2) 2, 3, 4, 1 (3) 3, 4, 1, 2 (4) 4, 3, 2, 1

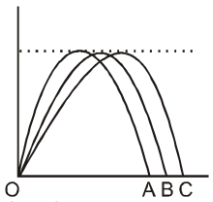
35. In the graph shown in figure, the time is plotted along x-axis. Which quantity associated with the projectle motion is plotted along the y-axis :-



(1) kinetic energy (2) Momentum
(3) horizontal velocity (4) None of the above

36. A student is able to throw a ball vertically to maximum height of 40 m. The maximum distance to which the student can throw the ball in the horizontal direction :-
(1) 40 $(2)_{1/2}$m (2) 20 $(2)_{1/2}$m (3) 20 m (4) 80 m

37. Three projectile A, B and C are thrown from the same point in the same plane. Their trajectories are shown in the figure. Then which of the following statement is true :-



(1) The time of flight is the same for all the three
(2) The launch speed is greatest for particle C
(3) The horizontal velocity component is greatest for particle C
(4) All of the above

38. A projectile is thrown with an intial velocity of $\vec{v} = a\hat{i} + b\hat{j}$, if the range of projectile is double of maximum height reached by it then : -
(1) a = 2 b (2) b = a (3) b = 2a (4) b = 4a

39. If a projectile is fired at an angle θ with the vertical with velocity u, then maximum height attained is given by :-
(1) $\frac{u^2 \cos\theta}{2g}$ (2) $\frac{u^2 \sin^2\theta}{2g}$ (3) $\frac{u^2 \sin^2\theta}{g}$ (4) $\frac{u^2 \cos^2\theta}{2g}$

40. If R is the maximum horizontal range of a particle, then the greatest height attained by it is : -
(1) R (2) 2R (3) $\frac{R}{2}$ (4) $\frac{R}{4}$

41. Two stones are projected with the same speed but making different angles with the horizontal. Their ranges are equal. If the angle of projection of one is $\frac{\pi}{3}$ and its maximum height is y_1 then the maximum height of the other will be : -
(1) $3y_1$ (2) $2y_1$ (3) $\frac{y_1}{2}$ (4) $\frac{y_1}{3}$

42. A projectile is thrown from a point in a horizontal plane such that its horizontal and vertical velocity component are 9.8 m/s and 19.6 m/s respectively. Its horizontal range is :-
(1) 4.9 m (2) 9.8 m (3) 19.6 m (4) 39.2 m

43. A particle is fired with velocity u making angle θ with the horizontal. What is the change in velocity when it is at the highest point ?
(1) u cos θ (2) u (3) u sin θ (4) (u cos θ – u)

44. In the above question, the change in speed is : -
(1) u cos θ (2) u (3) u sin θ (4) (u cos θ – u)

45. A ball is thrown at different angles with the same speed u and from the same point and it has the same range in both the case, If y_1 and y_2 be the height attained in the two cases, then y_1+y_2 = ...
(1) $\frac{u^2}{g}$ (2) $\frac{2u^2}{g}$ (3) $\frac{u^2}{2g}$ (4) $\frac{u^2}{4g}$

46. At what angle with the horizontal should a ball be thrown so that its range R is related to the time of flight as $R = 5T_2$. (Take $g = 10ms_{-2}$) : -
(1) 30º (2) 45º (3) 60º (4) 90º

47. If the range of a gun which fires a shell with muzzle speed v, is R, then the angle of elevation of the gun is
(1) $\cos^{-1}\left(\frac{v^2}{Rg}\right)$ (2) $\cos^{-1}\left(\frac{Rg}{v^2}\right)$ (3) $\frac{1}{2}\sin^{-1}\left(\frac{v^2}{Rg}\right)$ (4) $\frac{1}{2}\sin^{-1}\left(\frac{Rg}{v^2}\right)$

48. The maximum range of a projectile fired with some initial velocity is found to be 1000 metre. The maximum height (H) reached by this projectile is :-
(1) 250 metre (2) 500 metre (3) 1000 metre (4) 2000 metre

49. The angle with the velocity vector of a projectile thrown with a velocity v at an angle θ to the horizontal, will make with the horizontal after time t of its being thrown up is : -
(1) θ (2) $\tan^{-1}\left(\frac{\theta}{t}\right)$ (3) $\tan^{-1}\left(\frac{v\cos\theta}{v\sin\theta - gt}\right)$ (4) $\tan^{-1}\left(\frac{v\sin\theta - gt}{v\cos\theta}\right)$

50. The vertical height of the projectile at time t is given by $y = 4t - t_2$ and the horizontal distance covered is given by $x = 3t$. What is the angle of projection with the horizontal?
(1) $\tan_{-1}$ 3/5 (2) $\tan_{-1}$ 4/5 (3) $\tan_{-1}$ 4/3 (4) $\tan_{-1}$ 3/4

51. A bomb is fired from a cannon with a velocity of 1000 m/s making an angle of 30º with the horizontal. What is the time taken by the bomb to reach the highest point-
(1) 11 sec (2) 23 sec (3) 38 sec (4) 50 sec

52. For a projectile the ratio of maximum height reached to the square of flight time is- ($g = 10\ ms_{-2}$)
(1) 5 : 4 (2) 5 : 2 (3) 5 : 1 (4) 10 : 1

53. If a projectile is thrown such that range [R] is four times than the height [h] attained then angle of projection is-
(1) 30° (2) 45° (3) 60° (4) 90°

54. The range of projectile is 50 m when θ is inclined with horizontal at 15°. What is the range when θ becomes 45° -
(1) 400 m (2) 300 m (3) 200 m (4) 100 m

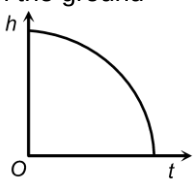
55. A particle moves in the xy plane with only an x-component of acceleration of 2 m s_{-2}. The particle starts from the origin at t = 0 with an initial velocity having an x-component of 8 m s_{-1} and y-component of –15 ms_{-1}. Velocity of particle after time t is :
(1) [(8 + 2t) – 15] m s_{-1} (2) zero
(3) 2t + 15 (4) directed along z-axis.

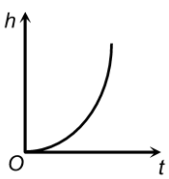
56. A ball is projected from a certain point on the surface of a planet at a certain angle with the horizontal surface. The horizontal and vertical displacement x and y vary with time t in second as:
$x = 10\sqrt{3}\ t$ and $y = 10t - t_2$
The maximum height attained by the ball is
(1) 100 m (2) 75 m (3) 50 m (4) 25 m.

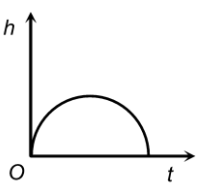
57. The horizontal and verticle distances travelled by a particle in time t are given by $x = 6t$ and $y = 8t - 5t_2$. If $g = 10\ m/sec_2$, then the initial velocity of the particle is-
(1) 8 m/sec (2) 10 m/sec (3) 5 m/sec (4) Zero

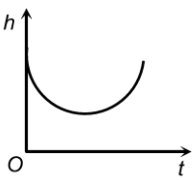
58. In the above question the angle with the horizontal at which the projectile is projected is :
(1) $\tan_{-1}$ (3/4) (2) $\tan_{-1}$ (4/3) (3) $\sin_{-1}$ (3/4) (4) cannot be determined

59. What is the value of acceleration due to gravity for the case described in above question
(1) 10 m/s_2 (2) 5 m/s_2 (3) 2.5 m/s_2 (4) 20 m/s_2

60. Which of the following is the graph between the height (h) of a projectile and time (t), when it is projected from the ground
(1) 

(2) 

(3) 

(4) 

61. In case of a projectile fired at an angle equally indined to the horizontal and vertical with velocity (u). The horizontal range is :-

(1) $\frac{u^2}{g}$ (2) $\frac{u^2}{2g}$ (3) $\frac{2u^2}{g}$ (4) $\frac{u^2}{g^2}$

62. The range of a projectile when fired at 75º with the horizontal is 0.5km. What will be its range when fired at 45º with same speed :-

(1) 0.5 km. (2) 1.0 km. (3) 1.5 km. (4) 2.0 km.

63. A particle is projected with a velocity u making an angle θ with the horizontal. At any instant, its velocity v is at right angles to its initial velocity u ; then v is :-

(1) u cos θ (2) u tan θ (3) u cot θ (4) u sec θ

64. The speed at the maximum height of a projectile is $\frac{\sqrt{3}}{2}$ time of its intial speed 'u' of projection. Its range on the horizontal plane :-

(1) $\frac{\sqrt{3u^2}}{2g}$ (2) $\frac{u^2}{2g}$ (3) $\frac{3u^2}{2g}$ (4) $\frac{3u^2}{g}$

65. What is the ratio of P.E. w.r.t. ground and K.E. at the top most point of the projectile motion :-

(1) $\cos^2\theta$ (2) $\sin^2\theta$ (3) $\tan^2\theta$ (4) $\cot^2\theta$

66. A ball is thrown at an angle θ with the horizontal and the range is maximum. The value of tanθ is :-

(1) 1 (2) $\sqrt{2}$ (3) $\frac{1}{\sqrt{3}}$ (4) 2

67. An arrow is shot into the air. Its range is 200 metres and its time of flight is 5 s. If the value of g assumed to be $10ms^{-2}$, then the horizontal component of the valocity of arrow is : -

(1) 25 m/s (2) 40 m/s (3) 31.25 m/s (4) 12.5 m/s

68. In previous question, the maximum height attained by arrow is : -

(1) 25 m/s (2) 40 m/s (3) 31.25 m/s (4) 12.5 m/s

69. In previous question, the vertical component of the velocity is :

(1) 25 m/s (2) 40 m/s (3) 31.25 m/s (4) 12.5 m/s

70. In previous question, the angle of projection with the horizontal is :

(1) $\tan^{-1}\left(\frac{4}{5}\right)$ (2) $\tan^{-1}\left(\frac{5}{4}\right)$ (3) $\tan^{-1}\left(\frac{5}{8}\right)$ (4) $\tan^{-1}\left(\frac{8}{5}\right)$

71. Two balls A and B are thrown with speed u and $\frac{u}{2}$ 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 15º with the horizontal, then the angle of projection of A is :

(1) $\sin^{-1}\left(\frac{1}{8}\right)$ (2) $\frac{1}{2}\sin^{-1}\left(\frac{1}{8}\right)$ (3) $\frac{1}{3}\sin^{-1}\left(\frac{1}{8}\right)$ (4) $\frac{1}{4}\sin^{-1}\left(\frac{1}{8}\right)$

72. A particle is projected at an angle of 45º from 8 m before the foot of a wall, just touches the top of wall and falls on the ground on the opposite side at a distance 4 m from it. The height of wall is :-

(1) $\frac{2}{3}$m (2) $\frac{4}{3}$m (3) $\frac{8}{3}$m (4) $\frac{3}{4}$m

SECTION - (B) PROJECTILE FROM A TOWER

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

(1) Straight path (2) Circular path
(3) Parabolic path (4) Hyperbolic path

2. A. bullet is dropped from the same height when another bullet is fired horizontally. They will hit the ground.

(1) One after the other (2) Simultaneously

(3) Depends on the observe (4) None of the above

3. A bomb is dropped from an aeroplane moving horizontally at constant speed. When air resistance is taken into consideration, the bomb
(1) Falls on earth exactly below the aeroplane (2) Fall on earth behind the aeroplane
(3) Falls on earth ahead of the aeroplane (4) Flies with the aeroplane

4. An aeroplane is flying horizontal with a velocity of 600 km/h and at a height of 1960 m. When it is vertically at a point A on the ground, a bomb is released from it. The bomb strikes the ground at point B. The distance AB is-
(1) 1200 m (2) 0.33 km (3) 3.33 km (4) 33 km

5. A particle is dropped from a tower of height 10m and simultaneously another particle is projected horizontally from the top of a tower with speed 5 m/sec-
(1) Both particles reach ground simultaneously (2) A reaches earlier than B
(3) B reaches earlier than A (4) None

6. At the height 80 m, an aeroplane is moving with 150 m/s. A bomb is dropped from it so as to hit a target. At what distance from the target should the bomb be dropped (given g = 10 m/s^2)
(1) 605.3 m (2) 600 m (3) 80 m (4) 230 m

7. A body playing on the roof of a 10 m high building throws a ball with a speed of 10 m/s at an angle of 30º with the horizontal. How far from the throwing point will the ball be at the height of 10 m from the ground?
[g = 10 m/s_2, sin 30º = 1/2, cos 30º = $\frac{\sqrt{3}}{2}$]
(1) 5.20 m (2) 4.33 m (3) 2.60 m (4) 8.66 m

8. An aeroplane flying 490 m above the ground level at 100 m/s, releases a block. How far on the ground will it strike-
(1) 0.1 km (2) 1 km (3) 2 km (4) None of the above

9. A stone is dropped from a running bus. It will hit the ground in a
(1) Straight path (2) Circular path (3) Parabolic path (4) None of these

10. 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 : -
(1) h (2) $\frac{h}{2}$ (3) 2 h (4) m

11. When a particle is thrown horizontally, the resultant velocity of the projectile at any time t is given by
(1) gt (2) $\frac{1}{2}$ gt (3) $\sqrt{u^2+g^2t^2}$ (4) $\sqrt{u^2-g^2t^2}$

12. An aeroplane moving horizontal with a speed of 180 km/hr. drops a food packet while flying at a height of 490m. The horizontal range of the packet is : -
(1) 180 m (2) 980 m (3) 500 m (4) 670m

13. A plane is flying horizontal at 98ms^{-1} and releases an object which reaches the ground in 10s. The angle made by it while hitting the ground is : -
(1) 55º (2) 45º (3) 60º (4) 75º

14. From the top of a tower 19.6 m high a ball thrown horizontally. If the line joining the point projection to the point where it hits the ground makes an angle of 45º with the horizontal, the initial velocity of the ball is : -
(1) 9.8 ms^{-1} (2) 4.9 ms^{-1} (3) 14.7 ms^{-1} (4) 2.8 ms^{-1}

15. 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?
(1) $-18ms^{-1}\hat{i}$ (2) $18\ ms^{-1}\hat{i}$ (3) $-9ms^{-1}\hat{i}$ (4) $9\ ms^{-1}\hat{i}$

SECTION - (C) EQUATION OF TRAJECTORY

1. Equation of motion of a projectile is-

(1) $y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$ (2) $y = x\tan\theta + \frac{gx^2}{2u^2\cos^2\theta}$

(3) $y = x\sin\theta - \frac{gx^2}{2u^2\cos^2\theta}$ (4) $y = x\sin\theta + \frac{gx^2}{2u^2\cos^2\theta}$

2. The trajectory of a projectile fired horizontally with velocity is parabola given by (Take vertical downward direction as positve)-

(1) $y = \frac{g}{2u^2}x^2$ (2) $y = -\frac{g}{2u^2}x^2$ (3) $y = \frac{g}{2u^2}x^2$ (4) $x = -\frac{g}{2u^2}y^2$

3. A cricketer hits a ball with a velocity 25 m/s at 60º above the horizontal. How far above the ground it passes over a fielder 50 m from the bat (assume the ball is struck very close to the ground)

(1) 8.2 m (2) 9.0 m (3) 11.6 m (4) 12.7 m

4. A particle reaches its highest point when it has covered exactly one half of its horizontal range. The corresponding point on the displacement time graph is characterised by

(1) Negative slope and zero curvature (2) Zero slope and negative curvature

(3) Zero slope and positive curvature (4) Positive slope and zero curvature

5. The equation of projectile is $y = 16x - \frac{x^2}{4}$ then the horizontal range is : -

(1) 16 m (2) 8 m (3) 64 m (4) 12.8 m

Exercise-2

1. A person standing at some distance from a high tree, throws a stone taking aim at a fruit hanging from that free, and at the same instant of time the fruit begins to fall freely. Of the following statement which is correct?

(1) the stone always remins above the falling fruit

(2) the stone strikes the fruit if the stone is thrown with a definite minimum velocity

(3) the stone moves below the falling stone

(4) the stone always hits the fruit.

2. The equation of motion of a projectile are given by x = 36 t metre and 2y = 96 t – 9.8 t_2 metre. The angle of projection is-

(1) $\sin^{-1}\left(\frac{4}{5}\right)$ (2) $\sin^{-1}\left(\frac{3}{5}\right)$ (3) $\sin^{-1}\left(\frac{4}{3}\right)$ (4) $\sin^{-1}\left(\frac{3}{4}\right)$

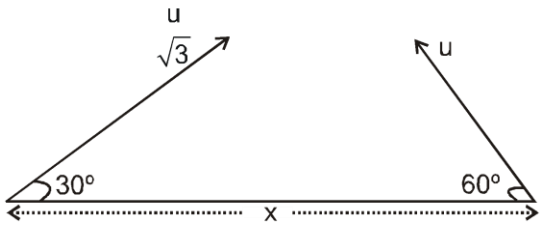
3. A projectile is thrown into space so as to have maximum possible horizontal range equal to 400m Taking the point of projection as the origin coordinates of the point where the velocity of projectile is minimum are :-

(1) (400, 100) (2) (200, 100) (3) (400, 200) (4) (200, 200)

4. The celling of a hall is 40m high. For maximum horizontal distance, the angle at which the ball can be thrown with a speed of 56ms_{-1} without hitting the celling of the hall is (take g = 9.8 $m.s_2$) :-

(1) 25º (2) 30º (3) 45º (4) 60º

5. Two particles separated at a horizontal distance x as shown in fig. they projected at the same line as shown in fig. with different initial speeds. The time after which the horizontal distance between them become zero :-

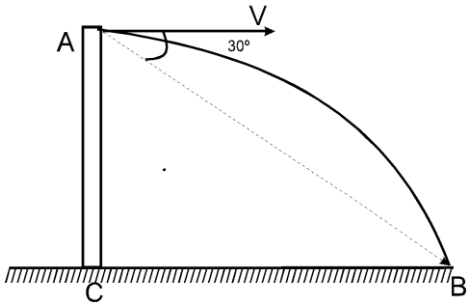


(1) $\frac{x}{u}$ (2) $\frac{u}{2x}$ (3) $\frac{2u}{x}$ (4) None of these

6. A stuntman plans to run across a roof top and then horizontally off it to land on the roof of next building. The roof of the next building is 4.9 metre below the first one and 6.2 metre away from it. What should be his minimum roof top speed in m/s, so that he can succesfully make the jump ?

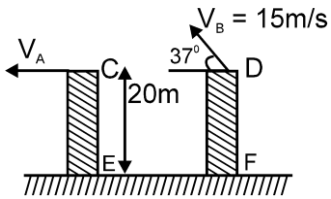
(1) 3.1 (2) 4.0 (3) 4.9 (4) 6.2

7. 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)



(1) $15\sqrt{3}$ m/s (2) 15 m/s (3) $\sqrt{3}$ 10 m/s (4) $25/\sqrt{3}$ m/s

8. CE and DF are two walls of equal height (20 meter) from which two particles A and B of same mass are projected as shown in the figure. A is projected horizontally towards left while B is projected at an angle 37_0 (with horizontal towards left) with velocity 15 m/sec. If A always sees B to be moving perpendicular to EF, then the range of A on ground is :



(1) 24 m (2) 30 m (3) 26 m (4) 28 m

Exercise-3

PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS)

1. A missile is fired for maximum range with an initial velocity of 20 m/s. If g = 10 m/s$_2$, the range of the missile is : **[AIPMT - 2011 Screening)]**

(1) 40 m (2) 50 m (3) 60 m (4) 20 m

2. A projectile is fired at an angle of 45º with the horizontal. Elevation angle of the projectile at its highest point as seen from the point of projection is : **[AIPMT - 2011(Mains)]**

(1) 60º (2) $\tan^{-1}\left(\frac{1}{2}\right)$ (3) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (4)45º

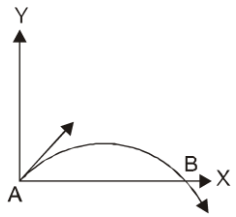
3. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectiles is : **[AIPMT_Pre_2012]**

(1) $\theta = \tan^{-1}\left(\frac{1}{4}\right)$ (2) $\theta = \tan^{-1}(4)$ (3) $\theta = \tan^{-1}(2)$ (4) $\theta = 45^\circ$

4. A particle has initial velocity $\left(2\vec{i}+3\vec{j}\right)$ and acceleration $\left(0.3\vec{i}+0.2\vec{j}\right)$. The magnitude of velocity after 10 seconds will be : **[AIPMT-2012]**

(1) $9\sqrt{2}$ units (2) $5\sqrt{2}$ units (3) 5 units (4) 9 units

5. The velocity of a projectile at the initial point A is $\left(2\ \hat{i}+3\ \hat{j}\right)$ m/s. It's velocity (in m/s) at point B is : **[NEET-2013]**



(1) $-2\ \hat{i}+3\ \hat{j}$ (2) $2\ \hat{i}-3\ \hat{j}$ (3) $2\ \hat{i}+3\ \hat{j}$ (4) $-2\ \hat{i}-3\ \hat{j}$

6. A projectile is fired from the surface of the earth with a velocity of 5ms^{-1} and angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is : (given = 9.8 ms^{-2}) **[AIPMT-2014]**

(1) 3.5 (2) 5.9 (3)16.3 (4)110.8

7. The x and y corrdinates of the particle at any time are $x = 5t - 2t^2$ and y = 410t respectively, where x and y are in meters and t in seconds. The acceleration of the particle at t = 2s is : **[NEET-2017]**

(1) 0 (2) 5 m/s^2 (3) – 4m/s^2 (4) – 8 m/s^2

8. Two bullets are fired horizontally and simultaneously towards each other from roof tops of two buildings 100 m apart and of same height of 200 m, with the same velocity of 25 m/s. When and where will the two bullets collide? (g = 10 m/s^2) **[NEET_2019-II]**

(1) after 2s at a height of 180 m (2) after 2s at a height of 20 m

(3) after 4s at a height of 120 m (4) they will not collide

PART - II : AIIMS QUESTION (PREVIOUS YEARS)

1. If R and H represent the horizontal range and the maximum height achieved by a projectile then which of the relation exists? **[AIIMS 2009]**

(1) $\frac{H}{R} = 4\cot\theta$ (2) $\frac{R}{H} = 4\cot\theta$ (3) $\frac{H}{R} = 4\tan\theta$ (4) $\frac{R}{H} = 4\tan\theta$

2. For a given angle of the projectile if the initial velocity is doubled the range of the projectile becomes **[AIIMS 2011]**

(1) Half (2) One-fourth (3) Two times (4) Four times

3. If we can throw a ball upto a maximum height H, the maximum horizontal distance to which we can throw it is **[AIIMS 2011]**

(1) 2H (2) $\sqrt{2}H$ (3) H (4) $\frac{H}{2}$

4. A projectile can have the same range for two angles of projection. If h_1 and h_2 are maximum heights when the range in the two cases is R, then the relation between R, h_1 and h_2 is : **[AIIMS 2013]**

(1) $R = 4\sqrt{h_1h_2}$ (2) $R = 2\sqrt{h_1h_2}$ (3) $R = \sqrt{h_1h_2}$ (4) None of these

5. A projectile thrown with velocity v making angle θ with vertical gains maximum height H in the time for which the projectile remains in air the time period is **[AIIMS 2013]**

(1) $\sqrt{H\cos\theta/g}$ (2) $\sqrt{2H\cos\theta/g}$ (3) $\sqrt{4H/g}$ (4) $\sqrt{8H/g}$

6. A bomb is released from a horizontal flying aeroplane. The trajectory of bomb is **[AIIMS 2013]**

(1) a parabola (2) a straight line (3) a circle (4) a hyperbola

7. Two projectiles are fired from the same point with the same speed at angles of projection 60º and 30º respectively. Which one of the following is true? **[AIIMS 2014]**

(1) Their maximum height will be same (2) Their range will be same

(3) Their landing velocity will be same (4) Their time of flight will be same

PART - III : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. A particle has an initial velocity of $3\hat{i} + 4\hat{j}$ and an acceleration of $0.4\hat{i} + 0.3\hat{j}$. Its speed after 10 s is : **[AIEEE-2009, 4/144]**

(1) $7\sqrt{2}$ units (2) 7 units (3) 8.5 units (4) 10 units

2. A particle is moving with a velocity $\vec{v} = K(y\hat{i} + x\hat{j})$, where K is a constant. The general equation for its path is : **[JEE MAIN - 2019]**

(1) $y = x^2$ + constant (2) $y^2 = x$ + constant (3) xy = constant (4) $y^2 = x^2$ + constant

3. A particle moves from the point $(2.0\hat{i} + 4.0\hat{j})$ m, at t = 0, with an initial velocity $(5.0\hat{i} + 4.0\hat{j})ms^{-1}$. It is acted upon by a constant force which produces a constant force which produces a constant acceleration $(4.0\hat{i} + 4.0\hat{j})ms^{-2}$. What is the distance of the particle from the origin at time 2 s? **[JEE MAIN-2019]**

(1) $20\sqrt{2}$ m (2) 15 m (3) $10\sqrt{2}$ m (4) 5 m

Answers

EXERCISE - 1

SECTION (A)

1.	(3)	**2.**	(3)	**3.**	(1)	**4.**	(4)	**5.**	(3)	**6.**	(2)	**7.**	(3)
8.	(3)	**9.**	(1)	**10.**	(1)	**11.**	(2)	**12.**	(2)	**13.**	(3)	**14.**	(4)
15.	(2)	**16.**	(1)	**17.**	(3)	**18.**	(2)	**19.**	(1)	**20.**	(3)	**21.**	(3)
22.	(3)	**23.**	(2)	**24.**	(4)	**25.**	(1)	**26.**	(1)	**27.**	(1)	**28.**	(1)
29.	(3)	**30.**	(3)	**31.**	(4)	**32.**	(2)	**33.**	(1)	**34.**	(4)	**35.**	(3)
36.	(4)	**37.**	(4)	**38.**	(3)	**39.**	(4)	**40.**	(4)	**41.**	(4)	**42.**	(4)
43.	(3)	**44.**	(4)	**45.**	(3)	**46.**	(2)	**47.**	(4)	**48.**	(1)	**49.**	(4)
50.	(3)	**51.**	(4)	**52.**	(1)	**53.**	(2)	**54.**	(4)	**55.**	(1)	**56.**	(4)
57.	(2)	**58.**	(2)	**59.**	(1)	**60.**	(3)	**61.**	(1)	**62.**	(2)	**63.**	(3)
64.	(1)	**65.**	(3)	**66.**	(1)	**67.**	(2)	**68.**	(3)	**69.**	(1)	**70.**	(3)
71.	(2)	**72.**	(2)										

SECTION - (B)

1.	(3)	**2.**	(2)	**3.**	(2)	**4.**	(3)	**5.**	(1)	**6.**	(1)	**7.**	(4)
8.	(2)	**9.**	(3)	**10.**	(3)	**11.**	(3)	**12.**	(3)	**13.**	(2)	**14.**	(1)
15.	(2)												

SECTION - (C)

1.	(1)	**2.**	(1)	**3.**	(1)	**4.**	(2)	**5.**	(3)

EXERCISE - 2

1.	(2)	**2.**	(1)	**3.**	(2)	**4.**	(2)	**5.**	(1)	**6.**	(4)	**7.**	(1)
8.	(1)												

EXERCISE - 3

PART – I

1.	(1)	**2.**	(2)	**3.**	(2)	**4.**	(2)	**5.**	(2)	**6.**	(1)	**7.**	(3)
8.	(1)												

PART – II

1.	(2)	**2.**	(4)	**3.**	(1)	**4.**	(1)	**5.**	(4)	**6.**	(1)	**7.**	(2)

PART – III

1.	(1)	**2.**	(4)	**3.**	(1)