Physicsaholics

Exercise

Kinematics-2D

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Exercise-1

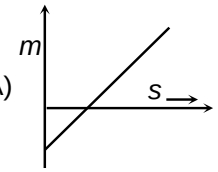
(Objective Type: Single Correct)

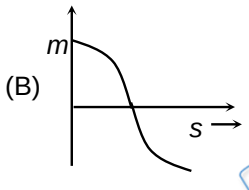
Level-2

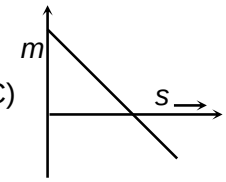
Q 1. A point moves in x–y plane according to the law x = 4sin6t and y = 4(1 – cos6t). The distance traversed by the particle in 4 seconds is (x and y are in metres)

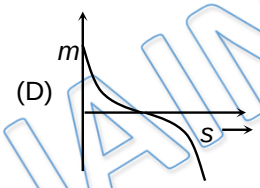
(A) 96 m (B) 48 m (C) 24 m (D) 108 m

Q 2. The graph which represents the variation of slope *m* of the trajectory of a projectile with horizontal displacement *s* is

(A) 

(B) 

(C) 

(D) 

Q 3. A particle moves in the x-y plane. It x and y coordinates vary with time t according to equations $x = t^2 + 2t$ and $y = 2t$. Possible shape of path followed by the particle is

(A) Straight line (B) Circle

(C) Parabola (D) More information is required to decide.

Q 4. Particle is dropped from the height of 20 m from horizontal ground. A constant force acts on the particle in horizontal direction due to which horizontal acceleration of the particle becomes 6 m/s^2. Find the horizontal displacement of the particle till it reaches ground.

(A) 6 m (B) 10 m (C) 12 m (D) 24 m

Q 5. A projectile is fired with a velocity u making an angle θ with the horizontal. What is the magnitude of change in velocity when it is at the highest point ?

(A) u cos θ (B) u (C) u sin θ (D) u cos θ – u

Q 6. A particle is projected at an angle of 45° from a point lying 2 m from the foot of a wall. It just touches the top of the wall and falls on the ground 4m from it. The height of the wall is

(A) 3/4 m (B) 2/3 m (C) 4/3m (D) 1/3 m

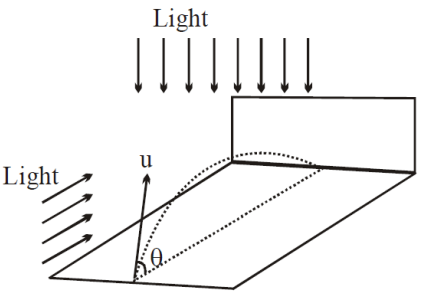
Q 7. A ball was thrown by a boy A at angle 60° with horizontal at height 1m from ground. Boy B is running in the plane of motion of ball and catches the ball at height 1m from ground. He finds the ball falling vertically. If the boy is running at a speed 20 km/hr. Then the velocity of projection of ball is-

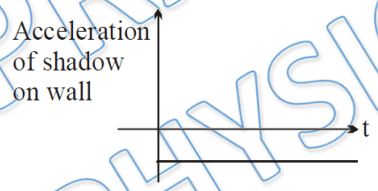
(A) 20 km/hr (B) 30 km/hr (C) 40 km/hr (D) 50 km/hr

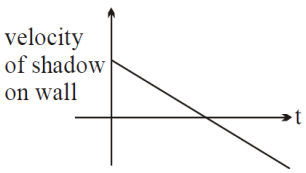
Q 8. A light body is projected with a velocity $(10\hat{i}+20\hat{j}+20\hat{k})$ ms^{-1}. Wind blows along X-axis with an acceleration of 2.5 ms^{-2}. If Y-axis is vertical then the speed of particle after 2 second will be (g = 10 ms^{-2})

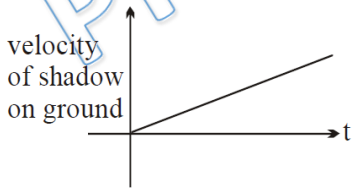
(A) 25 ms^{-1} (B) $10\sqrt{5}$ ms^{-1} (C) 30 ms^{-1} (D) None of these

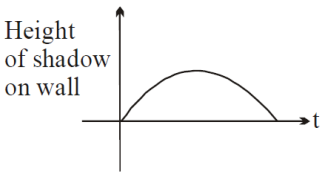
Q 9. A projectile is projected as shown in figure. A proper light arrangement makes a shadow on the wall as well as on the floor ? Which of the following graphs is incorrect.



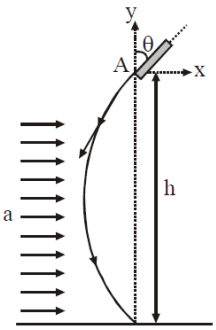
(A)


(B)


(C)


(D)


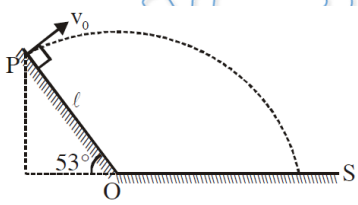
Q 10. A particle is ejected from the tube at A with a velocity v at an angle θ with the vertical y–axis. A strong horizontal wind gives the particle a constant horizontal acceleration a in the x–directions. If the particle strikes the ground at a point directly under its released position and the downward y–acceleration is taken as g then



(A) $h = \frac{2v^2 \sin\theta\cos\theta}{a}$ (B) $h = \frac{2v^2 \sin\theta\cos\theta}{g}$

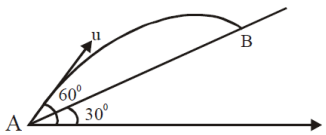
(C) $h = \frac{2v^2}{g}\sin\theta\left(\cos\theta + \frac{a}{g}\sin\theta\right)$ (D) $h = \frac{2v^2}{a}\sin\theta\left(\cos\theta + \frac{g}{a}\sin\theta\right)$

Q 11. A stone is projected from point P on the inclined plane with velocity v_0 = 10 m/s directed perpendicular to the plane. The time taken by the stone to strike the horizontal ground S is (Given PO = l = 10 meter)



(A) 1.5 sec (B) 1.4 sec (C) 2 sec (D) 2.3 sec

Q 12. Time taken by the projectile to reach from A to B is t. Then the distance AB is equal to :-



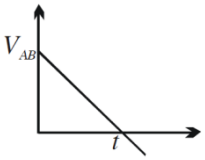
(A) $\frac{ut}{\sqrt{3}}$ (B) $\frac{\sqrt{3}ut}{2}$ (C) $\sqrt{3}ut$ (D)2 ut

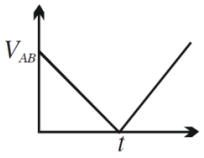
Q 13. A particle is projected from a point P (2 m, 0 m, 0 m) with a velocity 10 m/s making an angle 45° with the horizontal. The plane of projectile motion passes through a horizontal line PQ which makes an angle of 37° with positive x–axis and xy plane is horizontal. The coordinates of the point where the particle will strike the line PQ is (g = 10 m/s^2)

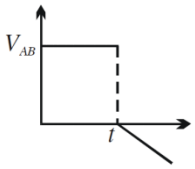
(A) (10 m, 6 m, 0 m) (B) (8 m, 6 m, 0 m)

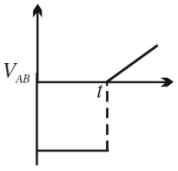
(C) (10 m, 8 m, 0 m) (D) (6 m, 10 m, 0 m)

Q 14. A body A is thrown vertically upwards with such a velocity that it reaches a maximum height of h. Simultaneously another body B is dropped from height h. It strikes the ground and does not rebound. The velocity of A relative to B v/s time graph is best represented by (upward direction is positive)

(A) 

(B) 

(C) 

(D) 

Q 15. An object moves to the East across a frictionless surface with constant speed. A person then applies a constant force to the North on the object. What is the resulting path that the object takes?

(A) A straight line path partly Eastward, partly Northward

(B) A straight line path totally to the North

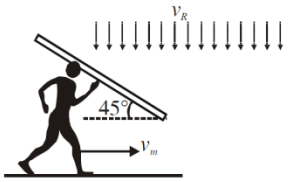
(C) A parabolic path opening toward the North

(D) A parabolic path opening toward the East

Q 16. A particle is thrown from a stationary platform with velocity v at an angle of 60° with the horizontal. The range obtained is R. If the platform moves horizontally in the direction of target with velocity v, the range will increase to :

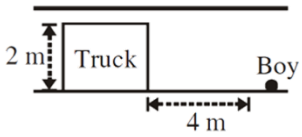
(A) $\frac{3R}{2}$ (B) $\frac{5R}{2}$ (C) 2R (D)3R

Q 17. On a particular day rain drops are falling vertically at a speed of 5 m/s. A man holding a plastic board is running to escape from rain as shown. The lower end of board is at a height half that of man and the board makes 45° with horizontal. The maximum speed of man so that his feet does not get wet, is



(A) 5 m/s (B) 5√2 m/s (C) 5/√2 m/s (D) zero

Q 18. A 2 m wide truck is moving with a uniform speed of 8 m/s along a straight horizontal road. A pedestrian starts crossing the road at an instant when the truck is 4 m away from him. The minimum constant velocity with which he should run to avoid an accident is :-



(A) $1.6\sqrt{5}$ m/s (B) $1.2\sqrt{5}$ m/s (C) $1.2\sqrt{7}$ m/s (D) $1.6\sqrt{7}$ m/s

Q 19. Two trucks are moving on parallel tracks. A person on one truck projects a ball vertically upward then path of the ball as seen by four observers: from the ground, from the second truck moving with same velocity as that first truck, from the second truck moving with speed greater than first one in same direction and from the second truck moving with speed less than the first truck in same direction are:

(A) Parabola, Parabola, Parabola and Parabola

(B) Straight line, Straight line, Parabola and Parabola

(C) Parabola, Straight line, Parabola and Parabola

(D) None of these

Q 20. Man A sitting in a car moving at 54 km/hr observes a man B in front of the car crossing perpendicularly the road of width 15 m in three seconds. Then the velocity of man B will be

(A) $5\sqrt{10}$ towards the car (B) $5\sqrt{10}$ away from the car

(C) 5 m/s perpendicular to the road (D) None

Q 21. A river is flowing east to west with velocity v. A man can swim with velocity v_0 in still water. He takes minimum time t_1 to cross the river. When he swims along shortest path, takes time t_2. The ratio of time t_1t_2 is 1 : 2, then $\frac{v_0}{v}$ is equal to

(A) $\frac{\sqrt{3}}{2}$ (B) 1:1 (C) 2 :$\sqrt{3}$ (D) 2 : 1

Q 22. A swimmer swims in still water at a speed = 5 km/hr. He enters a 200 m wide river, having river flow speed = 4 km/hr at point A and proceeds to swim at an angle of 127° with the river flow direction. Another point B is located directly across A on the other side. The swimmer lands on the other bank at a point C, from which he walks the distance CB with a speed = 3 km/hr. The total time in which he reaches from A to B is

(A) 5 minutes (B) 4 minutes (C) 3 minutes (D) None

Q 23. A man wishes to swim across a river 400 m wide flowing with a speed of 3m/s, such that he reaches the point just infront on the other bank in time not greater than 100s. The angle made by the direction he swims and river flow direction is :-

(A) 90° (B) 127° (C) 150° (D) 143°

Q 24. A boat is moving towards east with velocity 4 m/s with respect to still water and river is flowing towards north with velocity 2 m/s and the wind is blowing towards north with velocity 6 m/s. The direction of the flag blown over by the wind hoisted on the boat is:

(A) north-west (B) south-east

(C) $\tan^{-1}(1/2)$ with east (D) north

Q 25. An observer on ground sees a boat cross a river of width 800 m perpendicular to its stream in 200 seconds. He also finds a man on a raft floating at speed of 3 m/s with river. The distance travelled by boat as seen by man on the raft in crossing the river is-

(A) 800 m (B) 1000m (C) 1200m (D) 1600m

Q 26. A boatman moves his boat with a velocity 'v' (relative to water) in river and finds to his surprise that velocity of river 'u' (with respect to ground) is more than 'v'. He has to reach a point directly opposite to the starting point on another bank by travelling minimum possible distance. Then

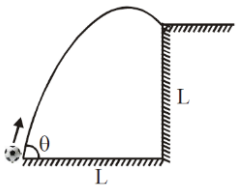
(A) he must steer the boat (with velocity v) at certain angle with river flow so that he can reach the opposite point on other bank directly.

(B) his velocity 'v' must be towards directly opposite point, So, that he can travel rest of distance by walking on other bank to reach the directly opposite point.

(C) boatman should maintain velocity v of boat at certain angle greater than 90° with direction of river flow to minimize drifting and then walk rest of distance on other bank.

(D) boat velocity 'v' should be at an angle less than 90° with direction of river flow to minimize the drift and then walk to the point.

Q 27. A ball is thrown at an angle q up to the top of a cliff of height L, from a point at a distance L from the base, as shown in figure. Assuming that one of the following quantities is the initial speed required to make the ball hit right at the edge of the cliff, which one is it :-



(A) $\sqrt{\frac{gL}{2(\tan\theta-1)}}$ (B) $\frac{1}{\cos\theta}\sqrt{\frac{gL}{2(\tan\theta-1)}}$

(C) $\frac{1}{\cos\theta}\sqrt{\frac{gL}{2(\tan\theta+1)}}$ (D) $\sqrt{\frac{gL\tan\theta}{2(\tan+1)}}$

Q 28. A particle is projected with a velocity of $\sqrt{20}$ m/s such that it strikes on the same level as the point of projection at a distance of $\sqrt{3}$ m. Which of the following options is/are incorrect (mass = 1kg) :

(A) The maximum height reached by the projectile can be 0.25 m.

(B) The minimum velocity during its motion can be $\sqrt{5}$ m/s

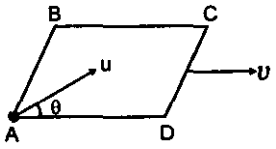
(C) The time taken for the flight can be $\sqrt{3/5}$s

(D) Minimum kinetic energy during its motion can be 6 J.

Q 29. An aircraft is descending to land at an airport in the morning. The aircraft is landing to the east so that the pilot has the sun in his eyes. The aircraft has a speed v and is descending at an angle α with the horizontal and the sun is at an angle β above the horizon. Find the angle with which the aircrafts shadow more over the ground

(A) $\frac{v\sin\alpha}{\sin\beta}$ (B) $\frac{v\sin(\alpha+\beta)}{\sin\beta}$ (C) $\frac{v\cos\alpha}{\sin(\alpha+\beta)}$ (D) none

Q 30. A smooth square platform ABCD is moving towards right with a uniform speed v. At what angle θ must a particle be projected from A with speed is so that it strikes the point B :



(A) $\sin^{-1}\left(\frac{u}{v}\right)$ (B) $\cos^{-1}\left(\frac{v}{u}\right)$ (C) $\cos^{-1}\left(\frac{u}{v}\right)$ (D) $\sin^{-1}\left(\frac{v}{u}\right)$

Answer Key

Q.1) A	Q.2) C	Q.3) C	Q.4) C	Q.5) C
Q.6) C	Q.7) C	Q.8) A	Q.9) C	Q.10) D
Q.11) C	Q.12) A	Q.13) A	Q.14) C	Q.15) C
Q.16) D	Q.17) A	Q.18) A	Q.19) C	Q.20) B
Q.21) C	Q.22) B	Q.23) B	Q.24) A	Q.25) B
Q.26) C	Q.27) B	Q.28) D	Q.29) B	Q.30) C