PHYSICS

BOOKS - A2Z PHYSICS (HINGLISH)

MOTION IN TWO DIMENSION

Problems Based On Basic Concept Of Projectile Motion

1. Which of the following quantities remain constant during projectile motion?

A. Initial velocity inclined to the horizontal

B. Zero velocity at the highest point

C. Constant acceleration perpendicular to the velocity

D. None of the above

Answer: D

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2. In case of a projectile motion, what is the angle between the velocity and acceleration at the highest point?

A. 0°

B. 45°

C. 90°

D. 180°

Answer: C

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3. If air resistance is not considered in projectiles, the horizontal motion takes place with:

A. constant velocity

B. constant acceleration

C. constant retardation

D. variable velocity

Answer: A

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4. When a projectile is fired at an angle θ w.r.t horizontal with velocity u, then its vertical component:

A. remains same

B. goes on increasing with height

C. goes on decreasing with height

D. first increase then decreases with height

Answer: C

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5. Two bullets are fired simultaneously, horizontally and with different speeds from the same place. Which bullet will hit the ground first?

A. slower one

B. faster one

C. Both will reach simultaneously

D. it cannot be predicted

Answer: C

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6. In a projectile motion the velocity

A. no instance

B. one instant

C. two instant

D. all instant

Answer: b

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7. Which out of these does not affect the maximum height of a projectile?

A. Mass of projectile

B. Angle of projection

C. Acceleration due to gravity

D. Magnitude of initial velocity

Answer: A

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

A. A,B and C hava 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

Answer: b

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9. 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 charecterized by :

A. negative slope and zero curvature

B. zero slope and negative curvature

C. zero slope and positive curvature

D. positive slope and zero curvature

Answer: c

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10. When air resistance is taken into account while dealing with the motion of the projectile which of the following properties of the projectile, shows an increases?

A. range

B. maximum height

C. speed at which it strikes the ground

D. the angle at which the projectile strikes the ground

Answer: D

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11. Which of the following sets of factors will affect the horizontal distance covered by an converted by an athlete in a long- jump event?

A. Speed before he jumps and his weight

B. The direction in which he leaps and the initial speed

C. The force with which he pushes the ground and his speed

D. The direction in which he leaps and the weight

Answer: b

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12. A particle projected with velocity u at angle θ with horizontal at t=0. What is the magnitude of change in the velocity of the particle when it is at maximum height?

A. $\frac{u\cos\theta}{2}$

B. $u\cos\theta$

C. $u\sin\theta$

D. none of these

Answer: c

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13. Two projectiles are fired from the same point with the same speed at angles of projection 60° and 30° respectively. Which one of the following is true?

A. Their range will be the same

B. Their maximum heights will be the same

C. Their velocities at the highest point will be the same.

D. Their time of flight will be the same.

Answer: A

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14. For angles of projection of a projectile at angle $(45^\circ - \theta)$ and $(45^\circ + \theta)$, the horizontal ranges described by the projectile are in the ratio of :

A. $2:1$

B. $1:2$

C. $1:1$

D. $2:3$

Answer: C

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15. Four bodies A,B,C and D are projected with equal velocities having angles of projection $15^\circ, 30^\circ, 45^\circ$ and 60° with the horizontal respectively. The body having the shortest range is

A. A

B. B

C. C

D. D

Answer: A

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16. Two stones are projected with the same speed but making different angles with the horizontal. Their ranges are equal. If the angles of projection of one is $\pi/3$ and its maximum height is h_1 then the maximum height of the other will be:

A. $3h_1$

B. $2h_1$

C. $h_1/2$

D. $h_1 / 3$

Answer: D

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17. A gun is firing bullets with velocity v_0 by rotating it through 360° in the horizontal plane. The maximum area covered by the bullets is

A. $\pi\left(\frac{v_0^4}{g^2}\right)$

B. $\pi\left(\frac{v_0^2}{2g}\right)^2$

C. $\pi\left(\frac{v_0}{g}\right)^2$

D. $\pi\left(\frac{v_0}{2g}\right)^2$

Answer: A

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18. A particle is projected with a velocity u making an angle θ with the horizontal. At any instant its velocity becomes v which is perpendicular to the initial velocity u. Then v is

A. $u \cos \theta$

B. $u \tan \theta$

C. $u \sec \theta$

D. $u \cot \theta$

Answer: D

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19. The range of a projectile launched at an angle of 15° with horizontal is $1.5 km$. The range of projectile when launched at an angle of 45° to the horizontal is

A. $1.5km$

B. $3km$

C. $6km$

D. $0.75km$

Answer: B

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20. A gun fires two bullets at 60° and 30° with the horizontal. The bullets strike at some horizontal distance. The ratio of maximum height for the two bullet is

A. $2 : 1$

B. $3 : 1$

C. $4 : 1$

D. $1 : 1$

Answer: B

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

A. 25°

B. 30°

C. 45°

D. none of these

Answer: c

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22. In the previous problem, the velocity of the shell will be

A. $30ms^{-1}$

B. $30\sqrt{2}ms^{-1}$

C. $30\sqrt{3}ms^{-1}$

D. none of these

Answer: b

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23. If R is the maximum horizontal range of a particle, then the greatest height attained by it is :

A. R

B. $2R$

C. $R/2$

D. $R/4$

Answer: D

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24. A particle is projected with a velocity v, so that its range on a horizontal plane is twice the greatest height attained. If g is acceleration due to gravity, then its range is :

A. $\frac{4v^2}{5g}$

B. $\frac{4g}{5v^2}$

C. $\frac{4v^3}{5g^2}$

D. $\frac{4v}{5g^2}$

Answer: A

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25. During a projectile motion if the maximum height equal the horizontal range, then the angle of projection with the horizontal is :

A. $\tan^{-1}(1)$

B. $\tan^{-1}(2)$

C. $\tan^{-1}(3)$

D. $\tan^{-1}(4)$

Answer: D

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26. The point from where a ball is projected is taken as the origin of the coordinate axes. The x and y components of its displacement are given by $x = 6t$ and $y = 7t - 5t^2$. What is the velocity of projection?

A. $6ms^{-1}$

B. $8ms^{-1}$

C. $10ms^{-1}$

D. $14ms^{-1}$

Answer: c

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27. In the previous problem, What is the angle of projection ?

A. $\tan^{-1}\left(\frac{1}{4}\right)$

B. $\tan^{-1}\left(\frac{4}{3}\right)$

C. $\tan^{-1}\left(\frac{1}{8}\right)$

D. $\tan^{-1}\left(\frac{1}{6}\right)$

Answer: b

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28. A body is projected at an angle of 30° with the horizontal and with a speed of $30ms^{-1}$.

What is the angle with the horizontal after 1.5 second? $\left(g = 10ms^{-2}\right)$

A. 0°

B. 30°

C. 60°

D. 90°

Answer: A

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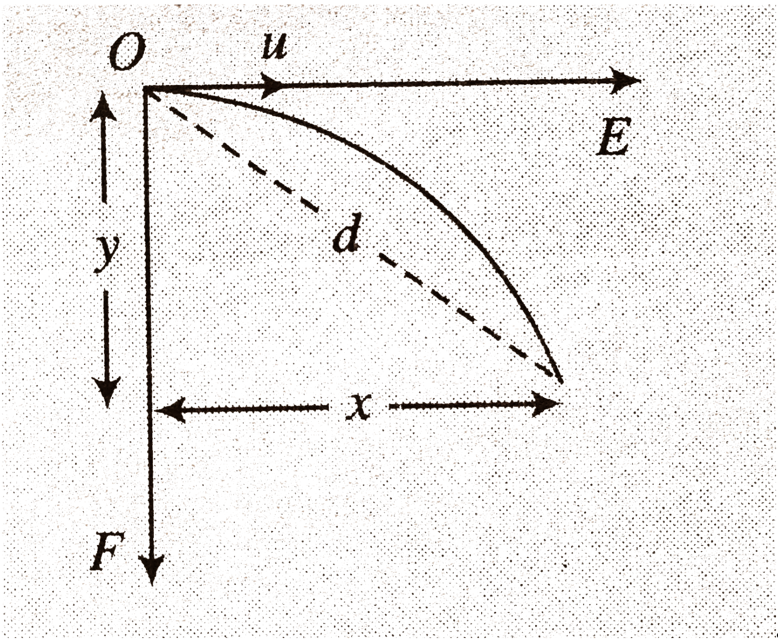
29. A body of mass $2kg$ has an initial velocity of $3ms^{-1}$ along OE and it is subjected to a force of $4N$ in OF direction perpendicular to OE. Find the distance of the body from O after $4s$.



A. $12m$

B. $28m$

C. $20m$

D. $48m$

Answer: c

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30. A body has an initial velocity of $3m/s$ and has an acceleration of $1m/\sec^2$ normal to the direction of the initial velocity. Then its velocity 4 seconds after the start is

A. $7m/\sec$ along the direction of initial velocity

B. $7m/\sec$ along the normal to the direction of initial velocity

C. $7m/\sec$ mid-way between the two directions

D. $5m/\sec$ at an angle of $\tan^{-1}(4/3)$ with the direction of initial velocity.

Answer: D

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31. A person can throw a stone to a maximum distance of h meter. The greatest height to which he can throw the stone is:

A. h

B. $h/2$

C. $2h$

D. $3h$

Answer: B

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32. A person can throw a stone to a maximum height of h meter. The maximum distance to which he can throw the stone is:

A. h

B. $h/2$

C. $2h$

D. $3h$

Answer: C

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33. A projectile can have the same range 'R' for two angles of projection . If $'T_1'$ and $'T_2'$ to be times of flights in the two cases, then the product of the two times of flights is directly proportional to .

A. $t_1 t_2 \propto R^2$

B. $t_1 t_2 \propto R$

C. $t_1 t_2 \propto \frac{1}{R}$

D. $t_1 t_2 \propto \frac{1}{R^2}$

Answer: B

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34. The equation of motion of a projectile is $y = 12x - \frac{3}{4}x^2$. The horizontal component of velocity is $3ms^{-1}$. What is the range of the projectile ?

A. $18m$

B. $16m$

C. $30.6m$

D. $21.6m$

Answer: B

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35. The trajectory of a projectile in a vertical plane is $y = ax - bx^2$, where a and b are constants and x and y are respectively horizontal and vertical distances of the projectile from the point of projection. The maximum height attained by the particle and the angle of projection form the horizontal are:

A. $\frac{b^2}{2a}, \tan^{-1}(b)$

B. $\frac{a^2}{b}, \tan^{-1}(2b)$

C. $\frac{a^2}{4b}, \tan^{-1}(a)$

D. $\frac{2a^2}{b}, \tan^{-1}(a)$

Answer: C

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

A. $y = 2x - 5x^2$

B. $y = x - 5x^2$

C. $4y = 2x - 5x^2$

D. $y = 2x - 25x^2$

Answer: A

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37. Two particles are projected obliquely from ground with same speed such that their range $'R'$ are same but they attain different maximum heights h_1 and h_2 then relation between R, h_1 and h_2 is:

A. $R = \sqrt{h_1 h_2}$

B. $R = \sqrt{2h_1 h_2}$

C. $R = 2\sqrt{h_1 h_2}$

D. $R = 4\sqrt{h_1 h_2}$

Answer: D

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38. A stone is 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. $\dfrac{\sqrt{2H\sin\theta}}{g}$

Answer: B

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39. A cricketer can throw a ball to a maximum horizontal distance of 100m. With the same speed how much high above the ground can the cricketer throw the same ball?

A. $50m$

B. $100m$

C. $150m$

D. $200m$

Answer: A

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40. The speed of a projectile at its maximum height is $\sqrt{3}/2$ times its initial speed. If the range of the projectile is n times the maximum height attained by it, n is equal to :

A. $\frac{4}{3}$

B. $2\sqrt{3}$

C. $4\sqrt{3}$

D. $\frac{3}{4}$

Answer: C

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41. A body is projected at an angle of 60° with ground. It covers a horizontal distance of 100m. If the same body is projected at 60°

with vertical with same velocity, the new range is

A. $50m$

B. $100m$

C. $200m$

D. $150m$

Answer: B

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42. Two paper screens A and B are separated by 150m. A bullet pierces A and B. The hole in B in 15 cm below the hole in A. If the bullet is travelling horizontally at the time of hitting A, then the velocity of the bullet at A is: $(g = 10ms^{-2})$

A. $100\sqrt{3}ms^{-1}$

B. $200\sqrt{3}ms^{-1}$

C. $300\sqrt{3}ms^{-1}$

D. $500\sqrt{3}ms^{-1}$

Answer: d

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

A. 25°

B. 30°

C. 45°

D. 60°

Answer: b

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44. In the previous problem, the maximum horizontal distance will be

A. $160\sqrt{3}m$

B. $140\sqrt{3}m$

C. $120\sqrt{3}m$

D. $100\sqrt{3}m$

Answer: a

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45. Two bodies are thrown with the same initial velocity at angles θ and $(90^\circ - \theta)$ respectively with the horizontal, then their maximum height are in the ratio

A. $1:1$

B. $\tan\theta : 1$

C. $1 : \tan\theta$

D. $\tan^2\theta : 1$

Answer: D

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46. If R and H represent horizontal range and maximum height of the projectile, then the angle of projection with the horizontal is

A. $\tan^{-1}\left(\frac{H}{R}\right)$

B. $\tan^{-1}\left(\frac{2H}{R}\right)$

C. $\tan^{-1}\left(\frac{4H}{R}\right)$

D. $\tan^{-1}\left(\frac{4R}{H}\right)$

Answer: c

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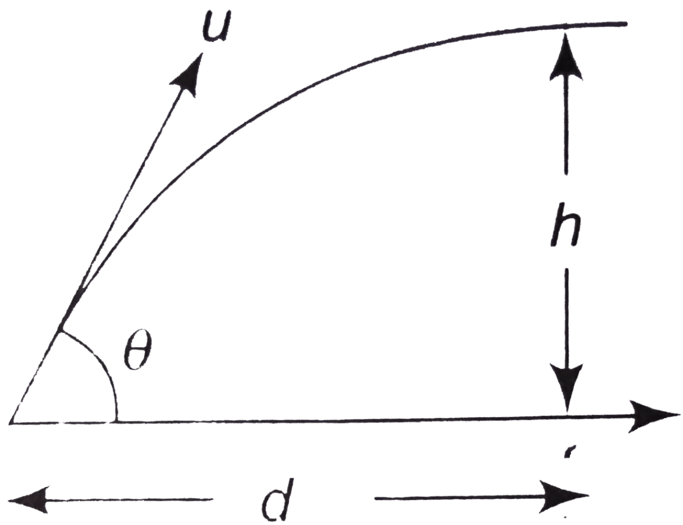
47. If a ston s to at a point which is at a distance d away and at a height h avove the point from where the stone starts, then what is the value of initial speed u if the stone is lauched at angle θ?



A. $\dfrac{g}{\cos\theta}\sqrt{\dfrac{d}{2(dtan\theta - h)}}$

B. $\dfrac{d}{\cos\theta}\sqrt{\dfrac{d}{2(dtan\theta - h)}}$

C. $\sqrt{\dfrac{gd^2}{(h\cos^2\theta)}}$

D. $\sqrt{\frac{gd^2}{(d-h)}}$

Answer: b

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48. A particle is projected from the ground with an initial speed of v at an angle θ with horizontal. The average velocity of the particle between its point of projection and highest point of trajectroy is :

A. $\frac{v}{2}\sqrt{1+2\cos^2\theta}$

B. $\frac{v}{2}\sqrt{1+2\cos^2\theta}$

C. $\frac{v}{2}\sqrt{1+3\cos^2\theta}$

D. $v\cos\theta$

Answer: c

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49. Two particls are projected in air with speed u at angles θ_1 and θ_2 (both acute) to the horizontal, respectively. If the height reached by the first particle is greater than that of the second, then which one of the following is correct? where T_1 and T_2 are the time of flight.

A. $\theta_1 > \theta_2$

B. $\theta_1 = \theta_2$

C. $T_1 < T_2$

D. $T_1 = T_2$

Answer: a

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Projectile From A Height And Movingframe

1. A ball is projected from the top of a tower at an angle 60° with the vertical. What happens to the vertical component of its velocity?

A. Increases continuously

B. Decreases continuously

C. Remain unchanged

D. Frist decreases and then increases

Answer: D

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2. From the top of a tower 20m high, a ball is thrown horizontally. If the line joining the point of projection to the point where it hits the ground makes an angle of 45° with the horizontal, then the initial velocity of the ball is:

A. $10ms^{-1}$

B. $4ms^{-1}$

C. $15ms^{-1}$

D. $3ms^{-1}$

Answer: a

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3. A body of mass m thrown horizontally with velocity v, from the top of tower of height h touches the level ground at a distance of 250m from the foot of the tower. A body of mass 2m thrown horizontally with velocity $v/2$, from the top of tower of height 4h will touch the level ground at a distance x from the foot of tower. The value of x is

A. $250m$

B. $500m$

C. $125m$

D. $250\sqrt{2}m$

Answer: a

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4. From the top of a tower of height 40m, a ball is projected upward with a speed of $20ms^{-1}$ at an angle of elevation of 30°. Then the ratio of the total time taken by the ball to hit the ground to the time taken to ball come at same level as top of tower.

A. $2:1$

B. $3:1$

C. $3:2$

D. $4:1$

Answer: a

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5. Two tall buildings are $30m$ apart. The speed with which a ball must be thrown horizontally from a window $150m$ above the ground in one building so that it enters a window $27.5m$ from the ground in the other building is.

A. $2ms^{-1}$

B. $6ms^{-1}$

C. $4ms^{-1}$

D. $8ms^{-1}$

Answer: b

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6. A body of mass m is projected horizontally with a velocity v from the top of a tower of height h and it reaches the ground at a distance x from the foot of the tower. If a second body of mass 2m is projected horizontally from the top of a tower of height 2h, it reaches the ground at a distance 2x from the foot of the tower. The horizontal velocity of the second body is :

A. v

B. $2v$

C. $\sqrt{2}v$

D. $v/2$

Answer: c

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7. A particle is projected under gravity with velocity $\sqrt{2ag}$ from a point at a height h above the level plane at an angle θ to it. The maximum range R on the grond is :

A. $\sqrt{\left(a^2+1\right)/h}$

B. $\sqrt{\left(a^2h\right)}$

C. $\sqrt{(ah)}$

D. $2\sqrt{a(a+h)}$

Answer: d

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8. A ball is thrown from the top of tower with an initial velocity of $10ms^{-1}$ at an angle of 30° with the horizontal. If it hits the ground of a distance of 17.3m from the back of the tower, the height of the tower is $(Take g = 10ms^{-2})$

A. $5m$

B. $20m$

C. $15m$

D. $10m$

Answer: D

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9. A ball rolls off top of a staircase with a horizontal velocity $u ms^{-1}$. If the steps are h metre high and b mere wide, the ball will just hit the edge of nth step. Find the value of n.

A. $n = \dfrac{2hu}{gb^2}$

B. $n = \dfrac{2hu^2}{gb}$

C. $n = \dfrac{2hu^2}{gb^2}$

D. $n = \dfrac{hu^2}{gb^2}$

Answer: C

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10. A man A is sitting in the rear end of a long compartment of a train running at constant horizontal velocity, tosses a coin to a person B, near the front end of the compartment. The trajectory of the coin is, as seen by B and a person C on the ground, will have:

A. different vertical ranges, but equal horizontal ranges

B. equal horizontal an equal vertical ranges

C. equal vertical ranges but different horizontal range

D. different vertical and different horizontal ranges

Answer: C

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11. A person sitting in the rear end of the compartment throws a ball towards the 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 observers the ball. How will the maximum heights (h_m) attained and the ranges (R) seen by thrower and the outside observer compare each other?

A. same h_m differente R

B. same h_m and R

C. different h_m same R

D. different h_m and R

Answer: a

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12. A bomber moving horizontally with $500 m / s$ drops a bomb which strikes ground in 10s. The angle of strike with horizontal is

A. $\sin^{-1}\left(\frac{1}{5}\right)$

B. $\tan^{-1}(1)$

C. $\tan^{-1}\left(\frac{1}{5}\right)$

D. $\tan^{-1}(5)$

Answer: c

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13. An airplane moving horizontally with a speed of $18km/hr$ drops a food packet while flying at a height of 500m. The horizontal range is:

A. $180m$

B. $980m$

C. $500m$

D. $670m$

Answer: C

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14. A helicopter is flying horizontally at $8m/s$ at an altitude 180m when a package fo emergency medical supplies is ejected horizontally backward with a speed fo $12m/s$ relative to the helicopter. Ignoring air resistance what is horizontal distance between the package and the helicopter when the package hits the ground?

A. $120m$

B. $24m$

C. $36m$

D. $72m$

Answer: d

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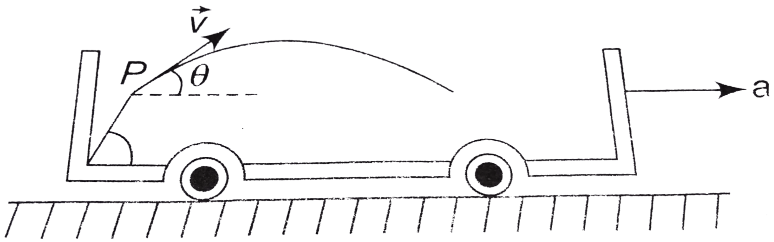
15. A particle is projected form a trolley car with a velocity $\overrightarrow{v}$. If the trolley can moves with an acceleration $\overrightarrow{a}$ towards right, which of the following remain unchanged relative to both ground and trolley car?



A. Range

B. Maximum range

C. Time of flight

D. horizontal velocity

Answer: c

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16. A boy projects a stone vertically perpendicular to the trolley car with a speed v. If the trolley car moves with a constant velocity u, the time of flight of the stone is :

A. $\frac{u+v}{g}$

B. $\frac{2v}{g}$

C. $\frac{2u}{g}$

D. none of these

Answer: B

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17. In previous problem, the horizontal range of the stone is:

A. $\dfrac{(u+v)^2}{g}$

B. $\dfrac{\left|\overrightarrow{u}+\overrightarrow{v}\right|^2}{g}$

C. $\dfrac{2v^2}{g}$

D. $\dfrac{2uv}{g}$

Answer: d

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18. The angle of projection relative to horizontal in previous problem is:

A. $\sin^{-1}\left(\frac{v}{u}\right)$

B. $\sin^{-1}\left(\frac{u}{v}\right)$

C. $\tan^{-1}\left(\frac{u}{v}\right)$

D. $\tan^{-1}\left(\frac{v}{u}\right)$

Answer: d

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19. A fighter plane is flying horizontally at an altitude of 1.5 km with speed $720 kmh^{-1}$. At what angle of sight (w.r.t horizontal) when the target is seen, should the pilot drop the bomb in order to attack the target? $(Take g = 10 ms^{-2})$

A. $\tan^{-1}\left(\frac{\sqrt{3}}{4}\right)$

B. $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

C. $\tan^{-1}\left(\frac{1}{2}\right)$

D. $\tan^{-1}(2)$

Answer: A

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Projection From Inclined Plane

1. A particle is projected up with a velocity of $v_0 = 10m/s$ at an angle of $\theta_0 = 60^\circ$ with horizontal onto an inclined plane. The angle of inclination of the plane is 30°. The time of flight of the particle till it strikes the plane is (take $g = 10ms^{-2}$)

A. $1s$

B. $1/2s$

C. $\frac{2}{\sqrt{3}}s$

D. $\frac{1}{2\sqrt{3}}s$

Answer: c

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2. the time after which the particle attains maximum height is :

A. $\frac{1}{2\sqrt{3}}s$

B. $\frac{\sqrt{3}}{2}s$

C. $\frac{2}{\sqrt{3}}s$

D. $1s$

Answer: b

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3. The ratio of the range of the particle and its maximum range in the inclined plane is:

A. $1:2$

B. $1:\sqrt{2}$

C. $1:\sqrt{3}$

D. $1:1$

Answer: d

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4. If the particle is projected down onto the inclined plane at same speed and angle with the inclined plane the ratio of the time of flight and time of flight for upward projection is :

A. $1 : \sqrt{2}$

B. $\sqrt{2} : 1$

C. $1 : 1$

D. none of these

Answer: C

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5. The ratio of the range for upward and down ward projections is:

A. $1:2$

B. $1:3$

C. $1:4$

D. $1:1$

Answer: a

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6. The ratio of component of velocity striking perpendicular to the plane for upward and downward projection is:

A. $1:1$

B. $1:3$

C. $1:3$

D. $1:\sqrt{3}$

Answer: a

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7. The ratio of speeds of striking for upward and downward projection is:

A. $1:1$

B. $1:\sqrt{3}$

C. $1:\sqrt{5}$

D. $1:\sqrt{7}$

Answer: d

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8. A particle is prjected up an inclined with initial speed $v = 20m/s$ at an angle $\theta = 30^{\circ}$ with the plane. The component of its velocity perpendicular to the plane when it strikes the plane is:

A. $10\sqrt{3}m/s$

B. $10m/s$

C. $5\sqrt{3}m/s$

D. data is insufficient

Answer: b

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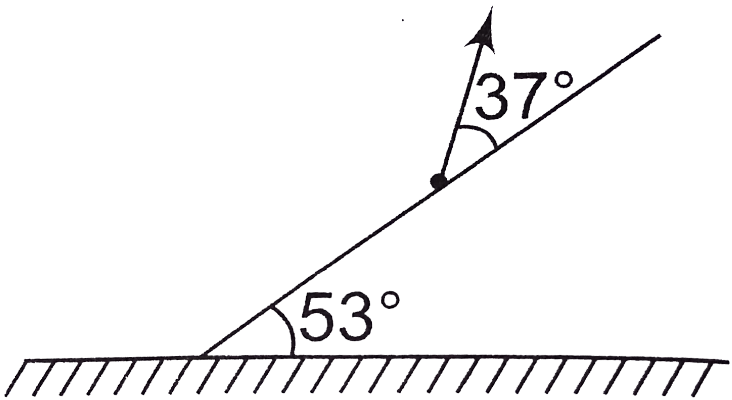
9. A particle is projected from the inclined plane at angle 37° with the inclined plane in upward direction with speed $10m/s$. The angle of inclined plane with horizontal is 53°. Then the maximum height attained by the particle from the inclined plane will be-



A. $3m$

B. $4m$

C. $5m$

D. zero

Answer: a

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10. The maximum range of a projectile is 500m. If the particle is thrown up a plane is inclined at an angle of 30° with the same speed, the distance (in meter) covered by it along the inclined plane will be:

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11. On an inclined plane of inclination 30°, a ball is thrown at angle of 60° with the horizontal from the foot of the incline with a velocity of $10\sqrt{3}ms^{-1}$. Then the ball will hit the inclined plane in

A. $1s$

B. $2s$

C. $2\sqrt{3}s$

D. $4\sqrt{3}s$

Answer: b

Watch Video Solution

12. A particle is projected with a certain velocity at an angle $\propto$ above the horizontal from the foot of an inclined plane of inclination 30°. If the particle strikes the plane normally, then $\propto$ is equal to.

A. $30^\circ + \tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

B. 45°

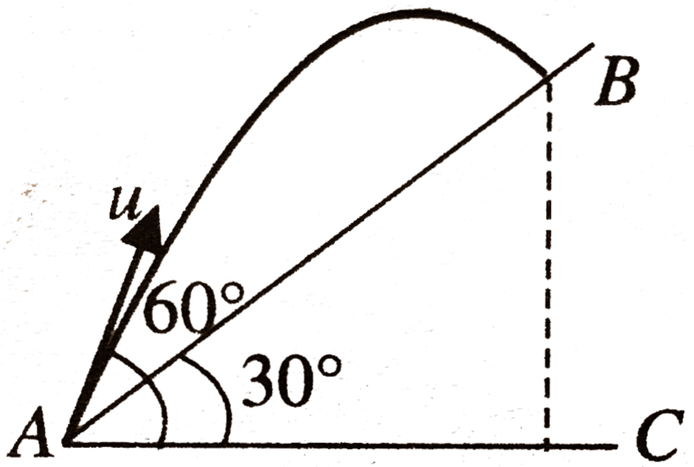
C. 60°

D. $30^\circ + \tan^{-1}(2\sqrt{3})$

Answer: a

Watch Video Solution

13. If the time taken by the projectile to reach from A to B is t. Then the distance AB is equal to



A. $\dfrac{ut}{\sqrt{3}}$

B. $\dfrac{\sqrt{3}ut}{2}$

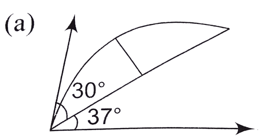
C. $\sqrt{3}ut$

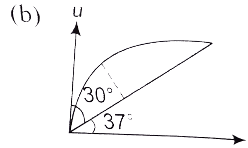
D. $2ut$

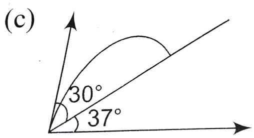
Answer: A

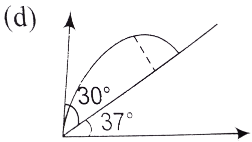
Watch Video Solution

14. A particle is projected with velocity 30° above on an inclined plane, inclination of which from horizontal is 37°. Choose the appropriate path (air resistance is negligible)

A. 

B. 

C. 

D. 

Answer: D

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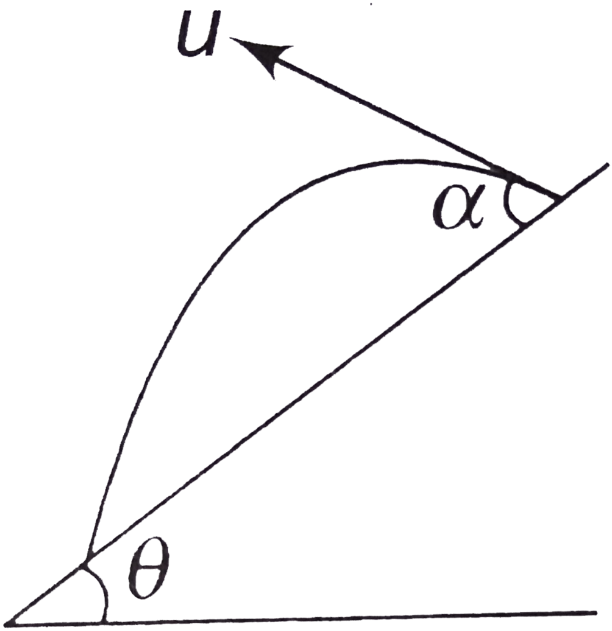
15. A ball is thrown at angle $\alpha(90^\circ > \alpha > \theta)$ on inclination plan as shown in figure. The minimum speed of the ball during the motion is:



A. $u \cos \alpha$

B. $u \cos \theta$

C. $u \cos(\alpha - \theta)$

D. zero

Answer: C

Watch Video Solution

16. A particle is projected from the bottom of an inclined plane of inclination 30°. At what angle α(from the horizontal) should the particle be projected to get the maximum range on the inclined plane.

A. 45°

B. 53°

C. 76°

D. 60°

Answer: D

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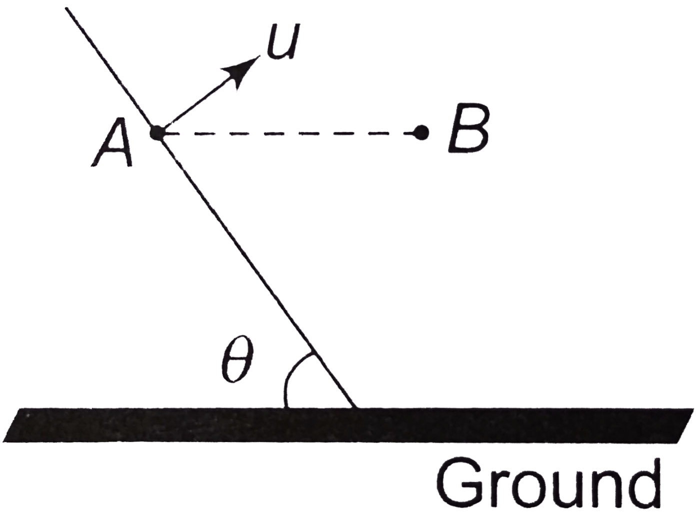
17. A particle is projected at point A from an inclination plane with inclination angle θ as shown in figure. The magnitude of projection velocity is $\overrightarrow{u}$ and its direction is perpendicular to the plane. After some time it passes from point B which is in the same horizontal level of A, with velocity $\vec{v}$. Then the angle between $\vec{u}$ and $\vec{v}$ will be



A. θ

B. 2θ

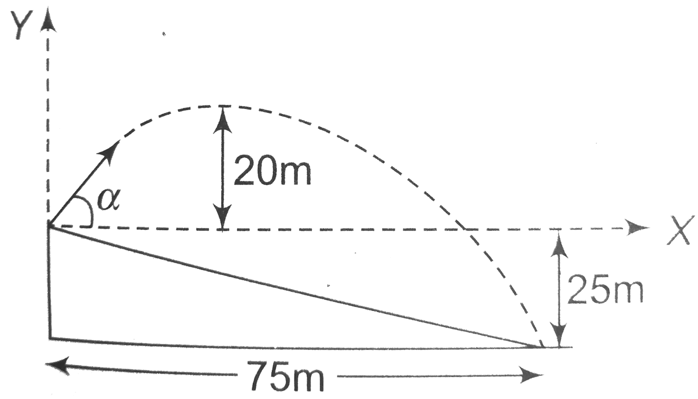
C. $\pi - 2\theta$

D. $90+\theta$

Answer: C

Watch Video Solution

18. A ball thrown down the incline strikes at a point on the incline 25m below the horizontal as shown in the figure. If the ball rises to a maximum height of 20m above the point of projection, the angle of projection α (with horizontal x axis) is



A. $\tan^{-1}\left(\frac{4}{3}\right)$

B. $\tan^{-1}\left(\frac{3}{4}\right)$

C. $\tan^{-1}\left(\frac{3}{2}\right)$

D. $\tan^{-1}\left(\frac{2}{3}\right)$

Answer: A

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19. A ball is projected horizontally with a speed v from the top of the plane inclined at an angle 45° with the horizontal. How far from the point of projection will the ball strikes the plane?

A. $\frac{2v^2}{g}$

B. $\sqrt{2}\left[\frac{2v^2}{g}\right]$

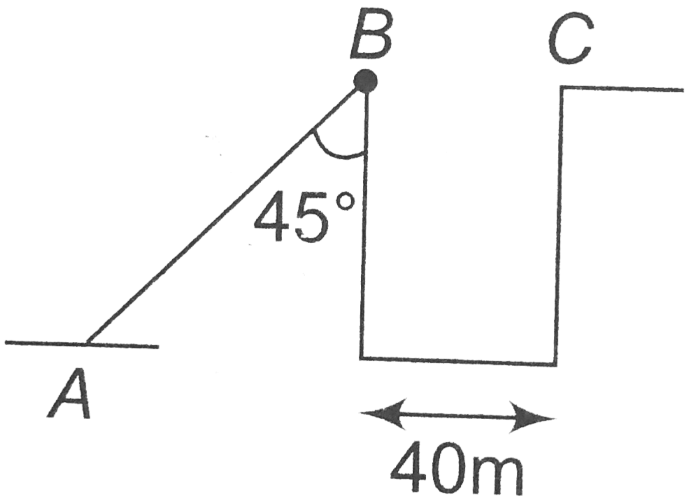
C. $\frac{v^2}{g}$

D. $\sqrt{2}\frac{v^2}{g}$

Answer: b

Watch Video Solution

20. A body is projected up a smooth inclined plane with velocity V from the point A as shown in the figure. The angle of inclination is 45° and the top is connected to a well of diameter 40m. If the body just manages to across the well, what is the value of V? Length of inclined plane is $20\sqrt{2}m$.



A. $40ms^{-1}$

B. $40\sqrt{2}ms^{-1}$

C. $20ms^{-1}$

D. $20\sqrt{2}ms^{-1}$

Answer: D

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Relative Velocity In Two Dimensions

1. A person standing on a moving truck, throws a stone vertically up relative to himself. To a person, standing on the ground, the stone appears to : (immediately after being thrown).

A. Rise vertically up and come down

B. Rise towards the rear of the truck

C. Move along a parabolic path

D. Rise straight and forward but inclined to the direction of motion of truck

Answer: c

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2. Two particles are projected, between a certain time gap. While both are in air, the velocity of one particle relative to the other:

A. Varies linearly with time

B. Is always constant in magnitude and direction

C. Is always constant in magnitude only

D. Is always constant in direction only

Answer: b

Watch Video Solution

3. A man runs along a horizontal road holding his umrella vertical in order to afford maximum protection form rain. The rain is actually.

A. Falling vertical

B. Comming from front of the man

C. Coming from the back of the man

D. Either of (a), (b) or (c)

Answer: c

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4. Two persons P and Q are flying in a helicopter horizontally at a constant speed. All of sudden, P falls down. During the fall of P, at any instant, Q locates P:

A. Vertically down

B. Down, at an angle (acute) to the front of vertical

C. Down at an angle (acute) to the rear of vertical

D. Whose position depends upon the speed of the helicopter

Answer: a

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5. To the captain of a ship A travelling with velocity $\overrightarrow{v}_A = \left(3\hat{i} - 4\hat{j}\right)km..h$, a second ship B appears to have a velocity $\left(5\hat{i} + 12\hat{j}\right)km/h$. What is the true velocity of the ship B?

A. $2\hat{i} + 16\hat{j}km/h$

B. $13\hat{i} + 8\hat{j}km/h$

C. $-2\hat{i} - 16\hat{j}km/h$

D. $8\left(\hat{i} + \hat{j}\right)km/h$

Answer: d

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6. A boat is moving with a velocity $3\hat{i} + 4\hat{j}$ with respect to ground. The water in the river is moving with a velocity $-3\hat{i} - 4\hat{j}$ with respect to ground. The relative velocity of the boat with respect to water is.

A. $6\hat{i} + 8\hat{j}$

B. $8\hat{j} + 6\hat{j}$

C. $6\hat{i} + 6\hat{j}$

D. none of these

Answer: A

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7. A car 'A' moves due north at a speed of $40 km / hr$, while another 'B' moves due east at a speed of $30 km / hr$. Find the velocity of car B relative to car A (both in magnitude and direction).

A. $40 km / hr$, at an angle $\tan^{-1}\left(\frac{3}{5}\right)$ east of south

B. $50 km / hr$, at an angle $\tan^{-1}\left(\frac{3}{5}\right)$ east of south

C. $40km/hr$, at an angle $\tan^{-1}\left(\frac{3}{4}\right)$ east of south

D. $50km/hr$, at an angle $\tan^{-1}\left(\frac{3}{4}\right)$ east of south

Answer: D

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8. 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

Answer: c

Watch Video Solution

9. A flag is mounted on a car moving due North with velocity of $20km/hr$. Strong winds are blowing due East with velocity of $20km/hr$. The flag will point in direction

A. East

B. North-East

C. South-East

D. South-West

Answer: C

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10. Wind is blowing in the north direction at speed of 2 m/s which causes the rain to fall at some angle with the vertical. With what velocity should a cyclist drive so that the rain appears vertical to him:

A. $2m/s$ south

B. $2m/s$ north

C. $4m/s$ west

D. $4m/s$ south

Answer: b

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11. A car is moving along a road with a speed of $45km/hr$. In what direction must a body be projected form it with a velocity of $25m/s$, so that its resultant motion is at right angles to the direction of car?

A. at an angle 120° with direction of motion of car.

B. at an angle 60° with direction of motion of car.

C. at an angle 90° with direction of motion of car.

D. at an angle 135° with direction of motion of car.

Answer: a

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12. Three ships A, B and C are in motion. The motion of A as seen by B is with speed v towards north-east . The motion. Of B as seen by C is with speed v towards the north-west. Then as seen by A, C will be moving towards

A. north

B. south

C. east

D. west

Answer: B

Watch Video Solution

13. A boat travels from south bank to north bank of a river with a maximum speed of $8km/h$. A river current flows from west to east with a speed of $4km/h$. To arrive at a point opposite to the point of start, the boat should start at an angle:

A. $\tan^{-1}(1/2)$ W of N

B. $\tan^{-1}(1/2)$ N of W

C. 30° W of N

D. 30° N of W

Answer: C

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14. A swimmer crosses a flowing stream of width d to and fro normal to the flow of the river at time t_1. The time taken to cover the same distance up and down the stream is t_2. If t_3 is the time the swimmer would take to swim a distance $2d$ in still water, then relation between $t_1, t_2 \& t_3$.

A. $t_1^2 = t_2 t_3$

B. $t_2^2 = t_1 t_3$

C. $t_3^2 = t_1 t_2$

D. $t_3 = t_1 + t_2$

Answer: a

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15. A boat which has a speed of $5 km / hr$ in still water crosses a river of width $1 km$ along the shortest possible path in $15 \min utes$. The velocity of the river water in km / hr is

A. 1

B. 3

C. 4

D. $\sqrt{41}$

Answer: B

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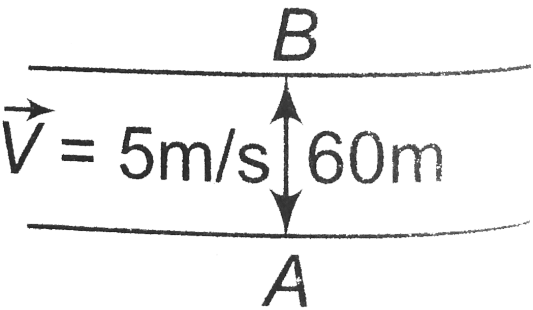
16. A man is crossing a river flowing with velocity of $5m/s$. He reaches a point directly across at a distance of $60m$ in 5 sec. His velocity in still water should be



A. $12m/s$

B. $13m/s$

C. $5m/s$

D. $10m/s$

Answer: B

Watch Video Solution

17. A river is flowing due east with a speed $3ms^{-1}$. A swimmer can swim in still water at a speed of $4ms^{-1}$. If swimmer starts swimming due north, then the resultant velocity of the swimmer is

A. $3ms^{-1}$

B. $5ms^{-1}$

C. $7ms^{-1}$

D. $2ms^{-1}$

Answer: B

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18. A boy can swim in still water at $1m/s$. He swims across a river flowing at $0.6m/s$ which is $336m$ wide. If the travels in shortest possible time, then what time he takes to cross the river?

A. $250s$

B. $420s$

C. $340s$

D. $336s$

Answer: D

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19. A man can swim in still water with a speed of $2ms^{-1}$. If he wants to cross a river of water current speed $\sqrt{3}ms^{-1}$ along the shortest possible path, then in which direction should he swim ?

A. at an angle 120° to the water current

B. at an angle 150° to the water current

C. at an angle 90° to the water current

D. none of these

Answer: B

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20. A river is flowing due east with a speed more than the maximum speed with which a person can swim in still water. He intends to cross the river by shortest possible path. Which of the following is correct?

A. He should start normal to the river bank.

B. He should start in such a way that, he moves normal to the bank, relative to the bank

C. He should starts in a particular (calculated) direction making an obtuse angle with the direction of water current

D. The man cannot cross the river, in that way.

Answer: D

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21. A man crosses a river in a boat. If he cross the river in minimum time he takes 10 min with a drift $120m$. If he crosses the river taking shortest path, he takes 12.5 min , find

(a) width of the river

(b) velocity of the boat with respect to water

(c) speed of the current

A. $20m / min$

B. $212m / min$

C. $10m / min$

D. $8m/min$

Answer: a

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22. A persons walks at the rate of 3km/hr. Rain appears to him in vertical direction at the rate of $3\sqrt{3}km/hr$. Find magnitude and direction of true velocity of rain.

A. $6km/hr$, inclined at an angle of 45° to the vertical towards the person's motion.

B. $3km/hr$, inclined at an angle of 30° to the vertical towards the person's motion.

C. $6km/hr$, inclined at an angle of 30° to the vertical towards the person's motion.

D. $6km/hr$, inclined at an angle of 60° to the vertical towards the person's motion.

Answer: C

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23. Rain is falling vertically with a speed of $35ms^{-1}$. Winds starts blowing after sometime with the speed of $12ms^{-1}$ in east to west direction. At what angles with the vertical should a boy waiting at a bus stop hold his umbrella to protect himself from rain?

A. $\sin^{-1}\left(\frac{12}{35}\right)$

B. $\cos^{-1}\left(\frac{12}{35}\right)$

C. $\tan^{-1}\left(\frac{12}{35}\right)$

D. $\cot^{-1}\left(\frac{12}{35}\right)$

Answer: c

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Kinematics Of Circular Motion

1. A particle moves in a plane with uniform acceleration having direction different form that of the instantaneous velocity. What is the nature of trajectroy?

A. straight line

B. parabola

C. Circle

D. Ellipse

Answer: b

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2. Velocity vector and acceleration vector in a uniform circular motion are related as

A. both in the same direction

B. perpendicular to each other

C. both in opposite direction

D. not related to each other

Answer: b

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3. A particle moves in a circle of radius 25 cm at two revolutions per sec. The acceleration of the particle in m/s^2 is:

A. π^2

B. $8\pi^2$

C. $4\pi^2$

D. $2\pi^2$

Answer: c

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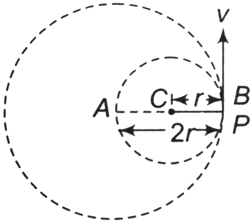
4. A particle P is moving in a circle of radius r with a uniform speed u. C is the centre of the circle and AB is diameter. The angular velocity of P about A and C are in the ratio :



A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: b

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5. A motor car is travelling at $60m/s$ on a circular road of radius 1200m. It is increasing its speed at the rate of $4m/s^2$. The acceleration of the car is:

A. $3m/s^2$

B. $5m/s^2$

C. $5m/s^2$

D. $7m/s^2$

Answer: c

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6. For a particle performing uniform circular motion, choose the incorrect statement form the following.

A. Magnitude of particle velocity (speed) remains constant.

B. Particle velocity remains directed perpendicular to radius vector.

C. Direction of acceleration keeps changing as particle moves.

D. Magnitude of acceleration does not remain constant.

Answer: D

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7. A particle covers equal distance around a circular path, in equal intervals of time. Which of the following quantities connected with the motion of the particle remains constant with time?

A. displacement

B. velocity

C. speed

D. acceleration

Answer: C

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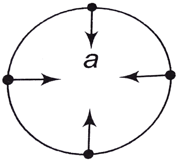
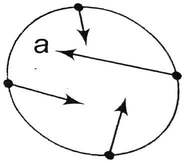
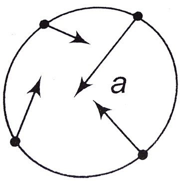
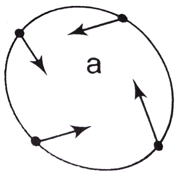
8. A car speeds up in a circular path. Which of the following figures illustrates the acceleration of the car?

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: b

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9. A train 1 moves from east to west and another train 2 moves from west to east on the equator with equal speeds relative to ground. The ratio of their centripetal accelerations $\frac{a_1}{a_2}$ relative to centre of earth is:

A. > 1

B. $= 1$

C. < 1

D. ≥ 1

Answer: c

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10. Two particles P and Q are located at distance r_p and r_Q respectively form the centre of rotating disc such that $r_P > r_Q$. The disc is rotating with constant angular acceleration. We can say

A. both P and Q have the same acceleration

B. both P and Q do not have the same acceleration

C. P has greater acceleration than Q

D. Q has greater acceleration than P

Answer: c

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11. A particle is moving along a circular path with uniform speed. Through what angle does its angular velocity change when it completes half of the circular path ?

A. 0°

B. 45°

C. 180°

D. 360°

Answer: a

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12. A cyclist is riding with a speed of $27 kmh^{-1}$. As he approaches a circular turn on the road of radius $80m$, he applies brakes and reduces his speed at the constant rate of $0.5 ms^{-2}$. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn ?

A. $0.68 ms^{-2}$

B. $0.86 ms^{-2}$

C. $0.56 ms^{-2}$

D. $0.76 ms^{-2}$

Answer: b

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13. A stone tied to the end of string 100cm long is whirled in a horizontal circle with a constant speed. If the stone makes 14 revolutions in 22s, then the acceleration of the stone is

A. $16ms^{-2}$

B. $4ms^{-2}$

C. $12ms^{-2}$

D. $8ms^{-2}$

Answer: a

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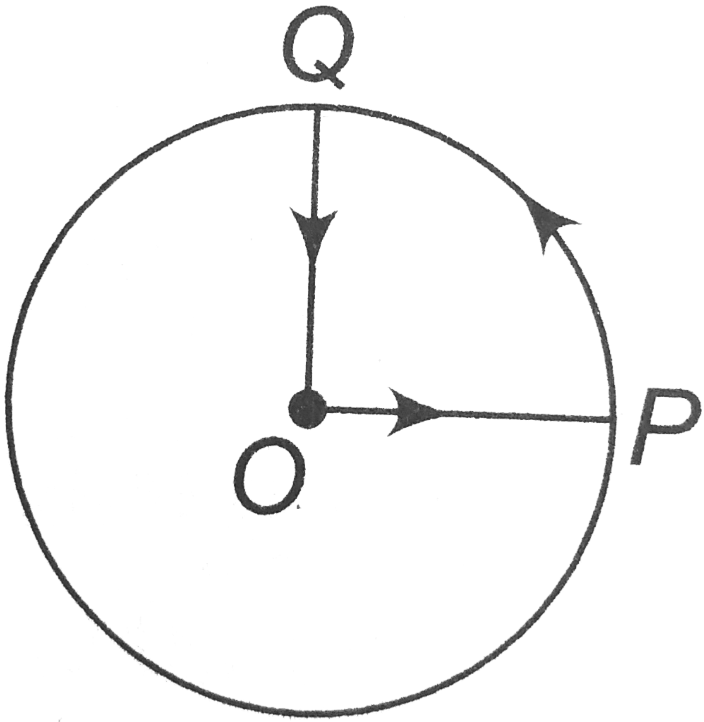
14. A cyclist starts from the centre O of a circular park of radius 1km, reaches the edge P of the park, then cycles along the PQ cicumference and returns to the centre along OQ as shown in fig. If the round trip taken ten minute, the net displacement and average speed of the cylists (in kilometer and kinetic per hour) is



A. $0, 2(\pi + 4)$

B. $\frac{\pi + 4}{2}, 0$

C. $21.4, \frac{\pi + 4}{2}$

D. $0, 3(\pi + 4)$

Answer: d

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15. A particle is moving on a circular path of radius r with uniform speed v. What is the displacement of the particle after it has described an angle of 60°?

A. $r\sqrt{2}$

B. $r\sqrt{3}$

C. r

D. $2r$

Answer: C

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16. What is approximately the centripetal acceleration (in units of acceleration due to gravity on earth, $g = 10ms^{-2}$) of an aircraft flying at a speed of $400ms^{-1}$ through a circular arc of radius 0.6 km?

A. 26.7

B. 16.9

C. 13.5

D. 30.2

Answer: a

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17. An insect trapped in circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100s. The linear speed of the insect is

A. $4.3cms^{-1}$

B. $5.3cms^{-1}$

C. $6.3cms^{-1}$

D. $7.3cms^{-1}$

Answer: b

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18. The magnitude of displacement of a particle moving in a circle of radius a with constant angular speed ω varries with time t is

A. $2a \sin \omega t$

B. $2a \sin\left(\frac{\omega t}{2}\right)$

C. $2a \cos \omega t$

D. $2a \cos\left(\frac{\omega t}{2}\right)$

Answer: b

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19. Position vectors of a particle moving in xy plane at time t is

$\overrightarrow{r} = a(1 - \cos om\eta t)\hat{i} + a \sin \omega t \hat{j}$. The path of the particle is

A. a circle of radius a and center at (a,0)

B. a circle of radius a and center at (0,0)

C. an ellipse

D. neither a circle nor an ellipse

Answer: a

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20. A particle moves in xy plane. The rate of changes of θ at time t=2 second (where θ is the angle which its velocity vector maks with positive x-axis) is

A. $\frac{2}{17} rad / s$

B. $\frac{1}{14} rad / s$

C. $\frac{4}{7} rad / s$

D. $\frac{6}{5} rad / s$

Answer: a

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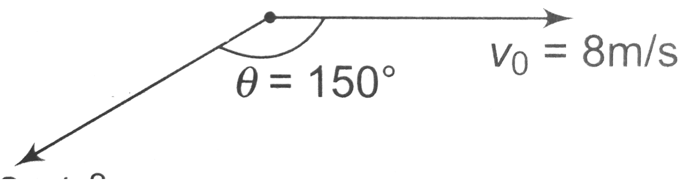
21. The figure shows th velocity and acceleration of a point like body at the initial moment of its motion. The acceleration vector of the body remain constant. The minimum radius of curvature of trajectory of the body is



A. $2m$

B. $3m$

C. $8m$

D. $16m$

Answer: c

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22. A partical is moving along a circular path of radius $5m$ and with uniform speed $5m/s$. What will be the avarage acceleration when the partical completes half revoluation?

A. zero

B. $10m/s^2$

C. $10 \pm /s^2$

D. $(10/\pi)m/s^2$

Answer: d

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23. A motor car travelling at $30m/s$ on a circular road of radius $500m$. It is increasing its speed at the rate of $2ms^{-2}$. What its accleration at that instant ?

A. $1.8ms^{-2}$

B. $2ms^{-2}$

C. $3.8ms^{-2}$

D. $2.7ms^{-2}$

Answer: d

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24. A car of mass m moves in a horizontal circular path of radius r meter. At an instant its speed is Vm/s and is increasing at a rate of a $m/\sec^2$. Then the acceleration of the car is:

A. $\frac{V^2}{r}$

B. a

C. $\sqrt{a^2 + \left(\frac{V^2}{r}\right)}$

D. $\sqrt{a + \frac{V^2}{r}}$

Answer: c

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25. A particle is acted upon by a force of constant magnitude which is always perpendiculr to the velocity of the particle. The motion of the particle takes place in a plane. It follows that

A. its velocity is constant

B. its acceleration is constant

C. its KE is constant

D. it moves in a straight line

Answer: c

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26. The magnitude of displacement of a particle moving in a circle of radius a with constant angular speed ω varries with time t is

A. $2a \sin \omega t$

B. $2a \frac{\sin(\omega t)}{2}$

C. $2a \cos \omega t$

D. $2a \frac{\cos(\omega t)}{2}$

Answer: b

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Problems Based On Mixed Concepts

1. A ball is thrown from a point with a speed 'v^(0)' at an elevation angle of θ . From the same point and at the same instant , a person starts running with a constant speed $\frac{'v_0'}{2}$ to catch the ball . Will the person be able to catch the ball ? If yes, what should be the angle of projection θ ?

A. yes, 60°

B. yes, 30°

C. No

D. yes, 45°

Answer: a

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2. The path of one projectile as seen by an observer on another projectile is a/an:

A. straight line

B. parabola

C. ellipse

D. circle

Answer: a

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3. A body is projected at 30° with the horizontal. The air offers resistance in proportional to the veclocity of the body.

Which of the following statements is correct?

A. The trajectroy is a symmetrical parabola

B. the time of rise to the maximum height is equal to the time of return to the ground

C. The velocity at the highest pint is directed along the horizontal

D. the sum of the kinetic and potential energies remains constant

Answer: c

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4. A projectile A is projected from ground. An observer B running on ground with uniform velocity of magnitude 'v' observes A to move along a straight line. The time of flight of A as measured by B is T. Then the the range R of projectile on ground is

A. $R = vT$

B. $R < vT$

C. $R > vT$

D. Information insufficient to draw inference

Answer: a

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5. The horizontal range and miximum height attained by a projectile are R and H, respectively. If a constant horizontal acceleration $a = g/4$ is imparted to the projectile due to wind, then its horizontal range and maximum height will be

A. $(R+H), \frac{H}{2}$

B. $\left(R+\frac{H}{2}\right), 2H$

C. $(R+2H), H$

D. $(R+H), H$

Answer: d

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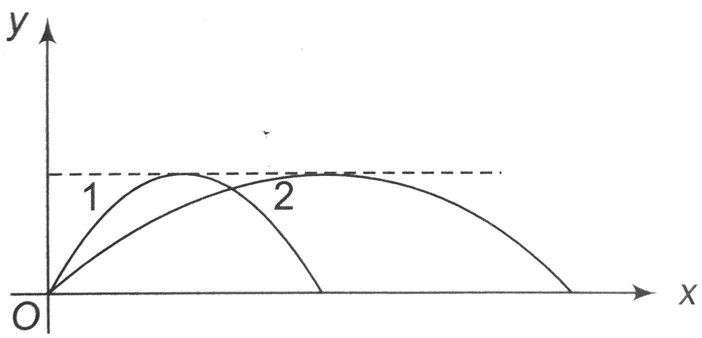
6. In the locus diagrams of two projectiles 1 and 2 as shown in the fig.



A. $T_1 > T_2$ and $v_{0_1} < v_{0_2}$

B. $T_1 = T_2$ and $v_{0_1} < v_{0_2}$

C. $T_1 = T_2$ and $v_{0_1} > v_{0_2}$

D. $T_1 < T_2$ and $v_{0_1} < v_{0_2}$

Answer: B

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7. A very broad elevator is going up vertically with a constant acceleration of $2m/s^2$. At the instant when its velocity is $4m/s$ a ball is projected form the floor of the lift with a speed of $4m/s$ relative to the floor at an elevation of 30°. Time taken by the ball to return the floor is $\left(g = 10ms^2\right)$

A. $\frac{1}{2}s$

B. $\frac{1}{3}s$

C. $\frac{1}{4}s$

D. $1s$

Answer: B

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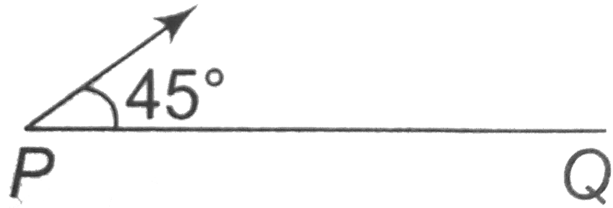
8. A projectile is fired with initial momentum p at an angle 45° from a point P as shown in figure. Neglecting air resistance, the magnitude of change in momentum between leaving P and arriving at Q is:



A. $p/2$

B. $p\sqrt{2}$

C. p

D. $2p$

Answer: b

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9. Two identical balls are projected, one vertically up and the other at an angle of 30° to the horizontal, with same initial speed. The potential energy at the highest point is in the ratio:

A. $4:3$

B. $3:4$

C. $4:1$

D. $1:4$

Answer: C

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10. Two point particles with masses m_1 and m_2 are thrown at angles θ_1 and θ_2 with horizontal with speeds v_1 and v_2 respectively. R, H and T are range, height and total time of flight respectively. Let $v_1 \sin\theta_1 = v_2 \sin\theta_2$. Then for both particles

A. T,H and R are different

B. H and R will be same but T will be different

C. T and R are same but H will be different

D. T and H are same but R is different.

Answer: D

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11. In horizontal level ground to projectile if at any instant velocity becomes perpendicular to initial velocity then what can you say about projection angle with horizontal.

A. $\theta = 45^\circ$

B. $\theta \geq 45^\circ$

C. $\theta \leq 45^\circ$

D. for any value of θ it is possible

Answer: b

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12. Two particles A and B projected simultaneously from a point situated on a horizontal place. The particle A is projected vertically up with a velcity v_A while the particle B is projected up at an angle 30° with horizontal with velocity v_B. After 5s the particles were observed moving mutually perpendicular to each other. The velocity of projection of the particle v_A and v_B respectively are:

A. $50ms^{-1}, 100m/s$

B. $100ms^{-1}, 50m/s$

C. v_A can have any value greater than a certain value, $100ms^{-1}$

D. none of these

Answer: c

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13. The friction of the air causes a vertical retardation equal to 10% of the acceleration due to gravity, take $(g = 10ms^{-2})$. The maximum height will be decreased by:

A. 8%

B. 9%

C. 10%

D. 11%

Answer: b

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14. In the previous problem, the time taken to reach the maximum height will be decreased by:

A. 19%

B. 5%

C. 10%

D. none of these

Answer: d

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15. In the problem 150, the time taken to return to the ground from the maximum height:

A. is almost same as in the absence of friction

B. decreases by 1%

C. increases by 1%

D. increases by 11%

Answer: a

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16. Two balls A and B are thrown with speeds u and $u/2$, respectively. Both the balls cover the same horizontal distance before returning to the plane of projection. If the angle of projection of ball $B is 15^{\circ}$ with the horizontal, then the angle of projection of A is.

A. $\sin^{-1}\left(\frac{1}{8}\right)$

B. $\frac{1}{2}\sin^{-1}\left(\frac{1}{8}\right)$

C. $\frac{1}{3}\sin^{-1}\left(\frac{1}{8}\right)$

D. $\frac{1}{4}\sin^{-1}\left(\frac{1}{8}\right)$

Answer: b

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17. A particle is projected with a velocity $\overrightarrow{v} = 8\hat{i} + 6\hat{j}m/s$. The time after which it will starts moving perpendicular to its initial direction of motions is

A. $0.5s$

B. $1.25s$

C. $1s$

D. $5/3s$

Answer: d

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18. The maximum height attained by a projectile is increased by 5%. Keeping the angle of projection constant, what is the percentage increases in horizontal range?

A. 5%

B. 10%

C. 15%

D. 20%

Answer: a

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19. The maximum height attained by a projectile is increased by 10%. Keeping the angle of projection constant, what is the percentage increases in the time of flight?

A. 5%

B. 10%

C. 20%

D. 40%

Answer: A

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20. The ceiling of a hall is 40m high. For maximum horizontal distance, the angle at which the ball may be thrown with a speed of

$56ms^{-1}$ without hitting the ceiling of the hall

is

A. 25°

B. 30°

C. 45°

D. 60°

Answer: b

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21. In the previous problem, the maximum horizontal distance will be

A. $160\sqrt{3}m$

B. $140\sqrt{3}m$

C. $120\sqrt{3}m$

D. $100\sqrt{3}m$

Answer: a

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22. A shell fired from the ground is just able to cross in a horizontal direction 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°

Answer: D

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23. In the previous problem, the velocity of the shell will be

A. $42ms^{-1}$

B. $52ms^{-1}$

C. $32ms^{-1}$

D. $62ms^{-1}$

Answer: a

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24. The angle of which the velocity vector of a projectile thrown with a velocity u at an angle θ to the horizontal will take with the horizontal after time t of its being thrown up is

A. θ

B. $\tan^{-1}\left(\frac{\theta}{t}\right)$

C. $\tan^{-1}\left(\frac{v\cos\theta}{v\sin\theta - \mathrm{gt}}\right)$

D. $\tan^{-1}\left(\frac{v\sin\theta - \mathrm{gt}}{v\cos\theta}\right)$

Answer: d

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25. Two particles move in a uniform gravitational field with an acceleration g. At the initial moment the particles were located over a tower at one point and moved with velocities $v_1 = 3m/s$ and $v_2 = 4m/s$ horizontally in opposite directions. Find the distance between the particles at the moment when their velocity vectors become mutually perpendicular.

A. $5m$

B. $7\sqrt{3}m$

C. $\frac{7\sqrt{3}}{5}m$

D. $\frac{7}{2}m$

Answer: c

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26. A boy throws a ball upward with velocity $v_0 = 20m/s$. The wind imparts a horizontal acceleration of $4m/s^2$ to the left. The angle θ

at which the ball must be thrown so that the ball returns to the boy's hand is : $(g = 10ms^{-2})$

A. $\tan^{-1}(1.2)$

B. $\tan^{-1}(0.2)$

C. $\tan^{-1}(2)$

D. $\tan^{-1}(0.4)$

Answer: D

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27. A particle is moving in a circle of radius R in such a way that any insant the total acceleration makes an angle of 45° with radius. Initial speed of particle is v_0. The time taken to complete the first revolution is:

A. $\frac{2R}{v_0}\left(1 - e^{-2\pi}\right)$

B. $\frac{R}{v_0}\left(1 - e^{-2\pi}\right)$

C. $\frac{R}{v_0}$

D. $\frac{2R}{v_0}$

Answer: b

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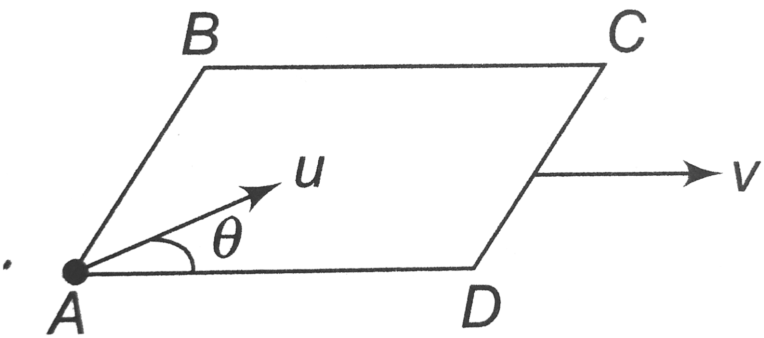
28. A smooth square platform ABCD is moving towards right with a uniform speed v. At what angle θ must a particle be projected from A with speed u so that it strikes the point B



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: b

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29. A train is travelling along a horizontal rail at the rate of $90km/hr$ and rain, driven by wind blowing in the direction of motion of trani, falls at a velocity of $12.5m/s$ making an angle of 30° to the vertical. Find the velocity of rain (in magnitude and direction) as seen from the train.

A. $\frac{25\sqrt{2}}{2} m / s$, inclined at an angle of 30° to the vertical away from train's motion.

B. $\frac{25\sqrt{3}}{2} m / s$, inclined at an angle of 30° to the vertical away from train's motion.

C. $\frac{35\sqrt{2}}{2} m / s$, inclined at an angle of 60° to the vertical away from train's motion.

D. $\frac{25\sqrt{3}}{2} m/s$, inclined at an angle of 60°

to the vertical away from train's motion.

Answer: d

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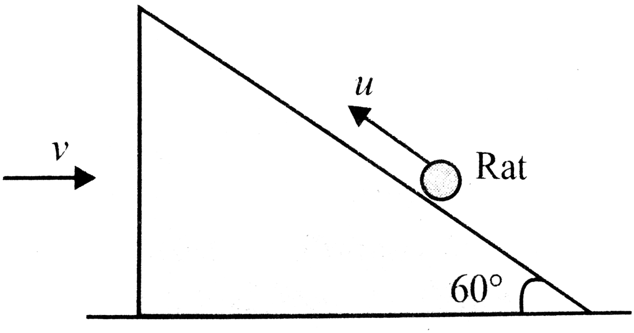
30. A wedge is placed on a smooth horizontal plain and a rat runs on its sloping side. The velocity of the wedge is $v = 4ms^{-1}$ towards the right. What should be the velocity of the rat with respect to the wedge (u), so that the rat appears to ,move in the vertical direction to an observer stading on the ground?



A. $2m/s$

B. $4m/s$

C. $8m/s$

D. $4\sqrt{2}m/s$

Answer: c

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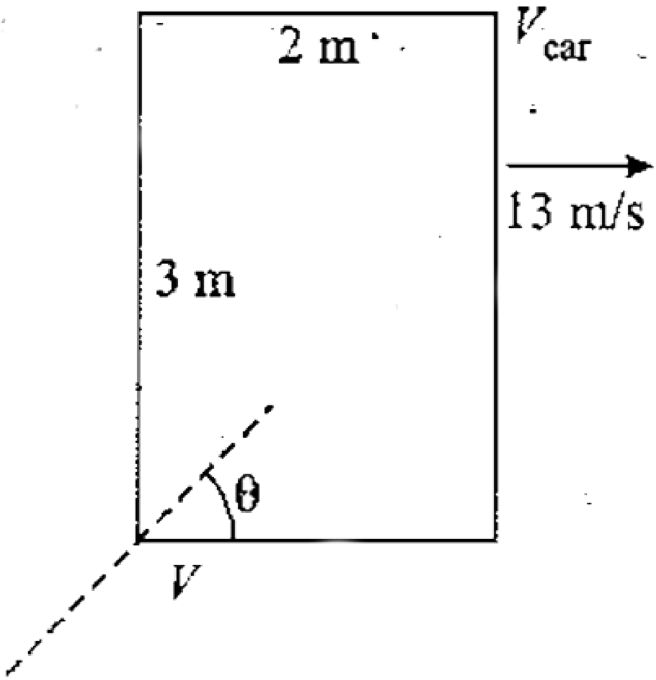
31. A car 2 m long and 3 m wide is moving at 13m/sec when a bullet hits it in a direction making an angle $\theta = \tan^{-1} 3/4$ with the car as seen from the street. The bullet enters one edge of the comer and passes out at the diagonally opposite comer. Neglectingany interaction between bullet and car find the time for the bullet to cross the car :



A. $1.0s$

B. $0.4s$

C. $0.2s$

D. $0.6s$

Answer: c

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32. Four person K,L,M and N are initally at the corners of a square of side of length d. If every person starts moving, such that K always heads towards L, L heads towards M, M heads directly towards N and N heads towards K, then the four perons will meet after

A. $\frac{d}{v}\sec$

B. $\frac{\sqrt{2d}}{v}\sec$

C. $\frac{d}{\sqrt{2v}}\sec$

D. $\frac{d}{2v}\sec$

Answer: c

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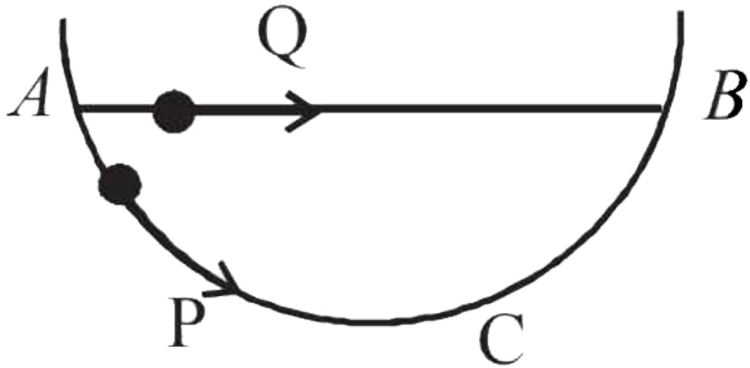
33. A particle P is sliding down a frictionless hemispherical bowl. It passes the point A at $t = 0$. At this instant of time, the horizontal component of its velocity is v. A bead Q of the same mass as P is ejected from A at $t = 0$ along the horizontal string AB, with the speed v. Friction between the bead and the string may be neglected. Let t_P and t_Q be the respective times taken by P and Q to reach the point B. Then:



A. $t_P < t_Q$

B. $t_P = t_Q$

C. $t_P > t_Q$

D. All of these

Answer: A

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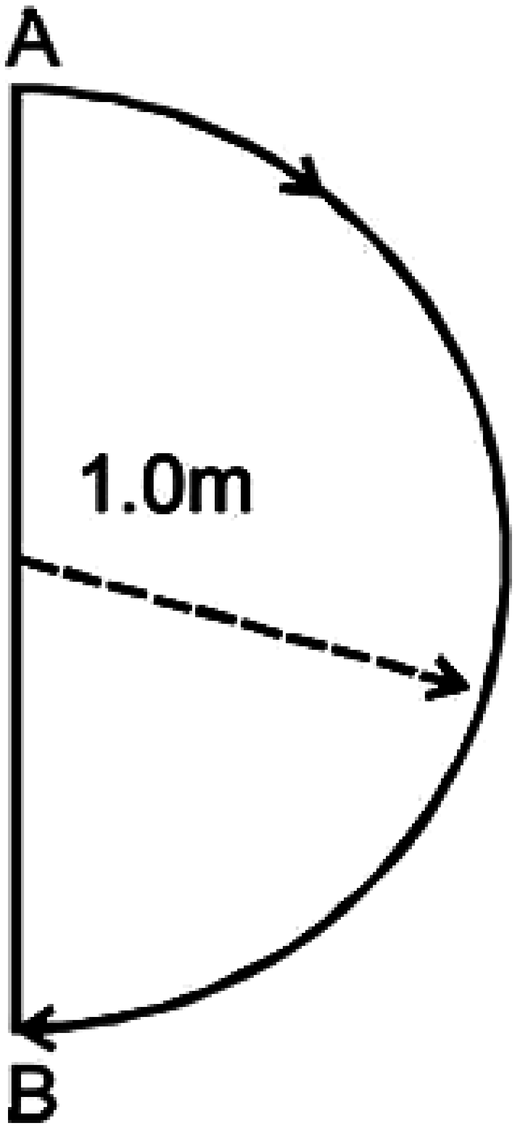
34. In $1.0s$, a particle goes from point A to point B, moving in a semicircle of radius $1.0m$ (see figure). The magnitude of the average velocity



A. $3.14m/s$

B. $2.0m/s$

C. $1.0m/s$

D. zero

Answer: b

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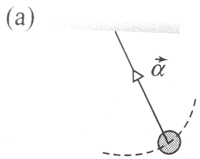
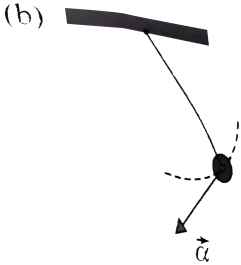
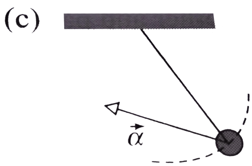
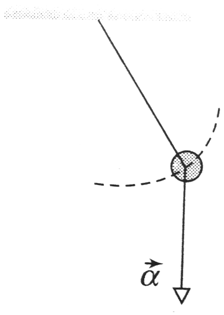
35. A simple pendulum is oscillating without damiping, When the displacement of the bob is less than maximum, its acceleration vector $\overrightarrow{a}$ is correctly show in:

A. 

B. 

C. 

D. 

Answer: c

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Assertion Reasoning

1. Assertion: When the velocity of projection of a body is made n times, its time of flight becomes n times.

Reason: Range of projectile does not depend on the initial velocity of a body.

A. If both the assertion and reason are true and reason is a true explantion of the

assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: C

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2. Assertion: Horizontal range is same for angle of projection θ and $(90^\circ - \theta)$.

Reason : Horizontal range is independent of angle of projection.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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3. Assertion: For projection angle $\tan^{-1}(4)$, the horizontal range and the maximum height of a projectile are equal.

Reason: The maximum range of projectile is directely proportional to square of velocity and inversely proportional to acceleration due to gravity.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: b

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4. Assertion: The trajectory of an object moving under the same accleration due to gravity can be straight line or a parabola depending on the initial conditions.

Reason: The shape of the trajectory of the motion of an object is determined by the acceleration alone.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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5. Assertion: Two particles of different mass, projected with same velocity at same angles. The maximum height attained by both the particle will be same.

Reason: The maximum height of projetile is independent of particle mass.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: a

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6. Assertion: The height attained by a projectile is twenty five percentage of range, when projected for maximum range.

Reason: The height is independent of initial velocity of projetile.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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7. Assertion: A projectile that traverses a parabolic path show deviation from its idealised trajectory in the presence of air resistance.

Reason: Air resistance affect the motion of the projectile.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: a

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8. Assertion: The maximum horizontal range of projectile is proportional to square of velocity.

Reason: The maximum horizontal range of projectile is equal to maximum height attained by projectile.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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9. Assertion: A uniform circular motion is an acceleration motion.

Reason: Direction of acceleration is parallel to velocity vector.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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10. Assertion: Centripetal acceleration is always direction towards the centre of rotation of an object undergoing uniform circular motion

Reason: Centripetal acceleration is a constant vector

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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11. Assertion: Rain is falling vertically with a certain speed. A boy holding an umbrella rides a bicycle in east to west direction and does not get wet.

Reason: The boy is holding his umbrella (at some angles) with the vertical towards the west.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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Neet Questions

1. Two particles of mass M and m are moving in a circle of radii R and r. if their time period are the same, what will be the ratio of their linear velocities?

A. $MR : mr$

B. $M : m$

C. $R : r$

D. $1 : 1$

Answer: c

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

A. Both partiles will reaches at ground simultaneously

B. Both particles will reaches at ground with the same speed

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

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

Answer: a

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3. From a 10 m high building a stone 'A' is dropped, and simultaneously another identical stone 'B' is thrown horizontally with an initial speed of $5ms^{-1}$. Which one of the following statement is true?

A. It is not possible to calculate which one of the two stones will reaches the ground first

B. Both the stones (A and B) will reaches the ground simultaneously

C. A' stone reaches the ground earlier then 'B'

D. B' stone reaches the ground earlier then 'A'

Answer: b

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4. Two boys are standing at the ends A and B of a ground, where $AB = a$. The boy at B starts running in a direction perpendicular to AB with velocity v_1. The boy at A starts running simultaneously with velocity v and catches the other boy in a time t, where t is :

A. $\dfrac{a}{\sqrt{v + v_1^2}}$

B. $\sqrt{\dfrac{a}{v^2 + v_1^2}}$

C. $\dfrac{a}{(v - v_1)}$

D. $\dfrac{a}{(v + v_1)}$

Answer: b

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5. A stone tied to the end of string 1m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolution in 44s, What is the magnitude and direction of acceleration of the ston is ?

A. $\frac{\pi^2}{4} ms^{-2}$ and direction along the radius

towards the centre

B. $\pi^2 ms^{-2}$ and direction along the radius

away from centre

C. $\pi^2 ms^{-2}$ and direction along the radius

towards the centre

D. $\pi^2 ms^{-2}$ and direction along the

tangent to the circle.

Answer: c

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6. A car runs at a constant speed on a circular track of radius 100m, taking 62.8s for every circular loop. The average velocity and average speed for each circular loop respectively is:

A. $0, 0$

B. $0, 10m/s$

C. $10m/s, 10m/s$

D. $10m/s, 0$

Answer: b

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7. For angles of projection of a projectile at angle $(45^\circ - \theta)$ and $(45^\circ + \theta)$, the horizontal ranges described by the projectile are in the ratio of :

A. $1:1$

B. $2:3$

C. $1:2$

D. $2:1$

Answer: a

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8. A paricle starting from the origin (0,0) moves in a straight line in (x, y) plane. Its coordinates at a later time are $(\sqrt{3}, 3)$. The path of the particle makes with the x-axis an angle of

A. 30°

B. 45°

C. 60°

D. 0°

Answer: c

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9. A particle moves in a circle of radius 5 cm with constant speed and time period $0.2\pi s$. The acceleration of the particle is

A. $25m/s^2$

B. $36m/s^2$

C. $5m/s^2$

D. $15m/s^2$

Answer: c

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10. A missile is fired for maximum range with an initial velocity of $20m/s$. If $g=10m/s^2$, the range of the missile is

A. $50m$

B. $60m$

C. $20m$

D. $40m$

Answer: d

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11. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projection at its highest point as seen from the point of projection is

A. 60°

B. $\tan^{-1}\left(\frac{1}{2}\right)$

C. $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

D. 45°

Answer: B

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12. Find the angle of projection of a projectile for which the horizontal range and maximum height are equal.

A. $\theta = 45^\circ$

B. $\theta = \tan^{-1}\left(\frac{1}{4}\right)$

C. $\theta = \tan^{-1}(4)$

D. $\theta = \tan^{-1}(2)$

Answer: c

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13. A particle has initial velocity $\left(2\hat{i} + 3\hat{j}\right)$ and acceleration $\left(0.3\hat{i} + 0.2\hat{j}\right)$. The magnitude of velocity after 10 second will be

A. $9 units$

B. $9\sqrt{2} units$

C. $5\sqrt{2} units$

D. $5 units$

Answer: c

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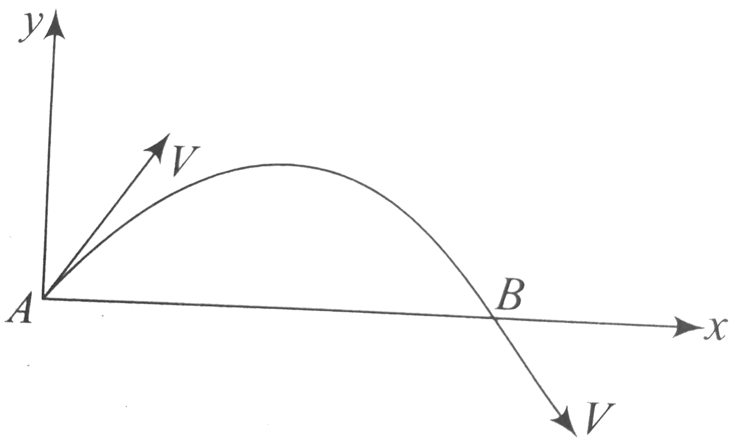
14. The velocity of a projectile at the initial point A is $\left(2\hat{i}+3\hat{j}\right)m/s$. Its velocity (in m/s) at point B is



A. $-2\hat{i}-3\hat{j}$

B. $-2\hat{i}+3\hat{j}$

C. $2\hat{i}-3\hat{j}$

D. $2\hat{i} + 3\hat{j}$

Answer: C

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15. A ship A is moving Westwards with a speed of $10kmh^{-1}$ and a ship B 100km South of A is moving northwards with a speed of $10kmh^{-1}$. The time after which the distance between them shortest is

A. $0h$

B. $5h$

C. $5\sqrt{2}h$

D. $10\sqrt{2}h$

Answer: b

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16. The x and y coordinates of the particle at any time are $x = 5t - 2t^2$ and $y = 10t$ respectively, where x and y are in meters and t in seconds. The acceleration of the particle at t=2s is:

A. $5m/s^2$

B. $-4m/s^2$

C. $-8m/s^2$

D. 0

Answer: b

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Aiims Questions

1. A stone tied to the a string of $80cm$ long is whirled in a horizontal circle with a constant speed. If the stone makes 25 revolutions in $14s$ then, magnitude of acceleration of the same will be:

A. $650cm/s^2$

B. $680cm/s^2$

C. $750cm/s^2$

D. $990cm/s^2$

Answer: d

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2. Two projectile are projected with the same velocity. If one is projected at an angle of 30° and other at 60° to the horizontal. The ratio of maximum heights reached, is:

A. $2:1$

B. $1:3$

C. $3:1$

D. $1:4$

Answer: B

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3. At the appermost point of a projectile its velocity and acceleration are at an angle of:

A. 45°

B. 60°

C. 90°

D. 180°

Answer: b

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4. A particle is projected with a velocity v so that its range on a horizontal plane is twice the greatest height attained. If g is acceleration due to gravity, then its range is

A. $\dfrac{4v^2}{5g}$

B. $\frac{4g}{5v^2}$

C. $\frac{v^2}{g}$

D. $\frac{4v^2}{\sqrt{5}g}$

Answer: a

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5. The length of a seconds hand in watch is $1cm$. The change in velocity of its tip in $15s$ is

A. zero

B. $\frac{\pi}{30\sqrt{2}} cm / \sec$

C. $\frac{\pi}{30} cm / \sec$

D. $\frac{\pi\sqrt{2}}{30} cm / \sec$

Answer: d

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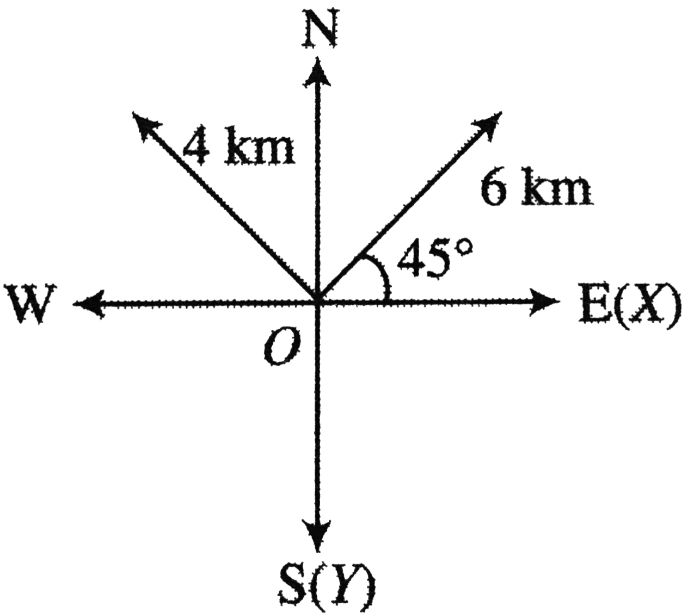
6. A car travles 6km towards north at an angle of 45° to the east and then travles distance of 4km towards north at an angle of 135° to east (figure). How far is the point from the starting point? What angle does the straight line joining its initial and final position makes with the east?



A. $\sqrt{50}$ km and $\tan^{-1}(5)$

B. $10km$ and $\tan^{-1}(\sqrt{5})$

C. $\sqrt{52}$ km and $\tan^{-1}(5)$

D. $\sqrt{52}$ km and $\tan^{-1}(\sqrt{5})$

Answer: c

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7. A stone projected with a velocity u at an angle q with the horizontal reaches maximum heights H_1. When it is projected with velocity u at an angle $\left(\frac{\pi}{2} - \theta\right)$ with the horizontal, it reaches maximum height H_2. The relations between the horizontal range R of the projectile, H_1 and H_2, is

A. $R = 4\sqrt{H_1 H_2}$

B. $R = 4(H_1 - H_2)$

C. $R = 4(H_1 + H_2)$

D. $R = \frac{H_1^2}{H_2^2}$

Answer: a

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8. A man sitting in a bus travelling in a direction from west to east with a speed of $40 km / h$ observes that the rain-drops are falling vertically down. To the another man standing on ground the rain will appear

A. The fall vertically down

B. To fall at an angle going from west to east

C. To fall at an angle going from east to west

D. The information given is insufficient to decided direction of rain

Answer: b

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9. A projectile can have same range R for two angles of projection. It $t_1 \text{ and } t_2$ are the times of flight in the two cases, then what is the product of two times of flight ?

A. $t_1 t_2 \propto R^2$

B. $t_1 t_2 \propto R$

C. $t_1 t_2 \propto \frac{1}{R}$

D. $t_1 t_2 \propto \frac{1}{R^2}$

Answer: B

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10. A particle is projected with initial velocity of $\hat{i} + 2\hat{j}$. The equation of trajectory is $(take g = 10 ms^{-2})$

A. $y = 2x - 15x^2$

B. $y = 2x - 25x^2$

C. $y = x - 5x^2$

D. $y = 2x - 5x^2$

Answer: B

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11. Assertion: When the body is dropped or thrown horizontally from the same height, it would reach the ground at the same time.

Reason: Horizontal velocity has no effect on the vertical direction.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: a

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12. Assertion: The maximum horizontal range of projectile is proportional to square of velocity.

Reason: The maximum horizontal range of

projectile is equal to maximum height attained by projectile.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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13. Assertion: When the velocity of projection of a body is made n times, its time of flight becomes n times.

Reason: Range of projectile does not depend on the initial velocity of a body.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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14. Assertion: For projection angle $\tan^{-1}(4)$, the horizontal range and the maximum height of a projectile are equal.

Reason: The maximum range of projectile is directely proportional to square of velocity and inversely proportional to acceleration due to gravity.

A. If both the assertion and reason are true and reason is a true explantion of the

assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: B

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15. Assertion: The trajectory of an object moving under the same accleration due to gravity can be straight line or a parabola depending on the initial conditions.

Reason: The shape of the trajectory of the motion of an object is determined by the acceleration alone.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: c

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Chapter Test

1. In a two dimensional motion,instantaneous speed v_0 is a positive constant.Then which of the following are necessarily true?

A. The acceleration of the particle is zero.

B. The acceleration of the particle is bounded

C. The acceleration of the particle is necessarily in the plane of motion.

D. The particle must be undergoing a uniform circular motion.

Answer: c

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2. A body is projected at 30° with the horizontal. The air offers resistance in proportional to the veclocity of the body. Which of the following statements is correct?

A. The trajectroy is a symmetrical parabola

B. the time of rise to the maximum height is equal to the time of return to the ground

C. The velocity at the highest pint is directed along the horizontal

D. the sum of the kinetic and potential energies remains constant

Answer: a

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3. If a body is projected with an angle θ to the horizontal, then

A. its velocity is always perpendicular to its acceleration

B. its velocity becomes zero at its maximum height.

C. its velocity makse zero angle with the horizontal at its maximum height

D. the body just before hitting the ground, the direction of velocity coincides with the acceleration

Answer: b

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4. Show that there are two values of time for which a projectile is at the same height. Also show mathematically that the sum of these two times is equal to the time of flight.

A. $\frac{3T}{2}$

B. $\frac{4T}{3}$

C. $\frac{3T}{4}$

D. T

Answer: b

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5. At a height $0.4m$ from the ground the velocity of a projectile in vector form is

$\vec{v} = \left(6\hat{i} + 2\hat{j}\right) ms^{-1}$. The angle of projection is

A. 45°

B. 60°

C. 30°

D. $\tan^{-1}\left(\frac{3}{4}\right)$

Answer: c

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6. A particle is projected from the ground with an initial speed of v at an angle θ with horizontal. The average velocity of the particle between its point of projection and highest point of trajectroy is :

A. $\frac{v}{2}\sqrt{1+2\cos^2\theta}$

B. $\frac{v}{2}\sqrt{1-4\cos^2\theta}$

C. $\frac{v}{2}\sqrt{1+3\cos^2\theta}$

D. $v\cos\theta$

Answer: C

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7. At what angle with the horizontal should a ball be thrown so that the range R is related to the time of flight as $R = 5T^2$? $\left(Take g = 10ms^{-2}\right)$.

A. 60°

B. 30°

C. 45°

D. 75°

Answer: a

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8. A projectile is fired at an angle of 30° with the horizontal such that the vertical component of its initial velocity is 80m/s. Find approximatly the velocity of the projectile at time $T/4$ where T is time of flight.

A. $180m/s$

B. $155m/s$

C. $145m/s$

D. $140m/s$

Answer: c

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9. An airplane is flying horizontally at a height of 490m with a velocity of $150ms^{-1}$. A bag containing food is to be dropped to the Jawans on the ground. How far (in meter) from them should the bag the dropped so that it directely reaches them?

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10. Jai is standing on the top of a building of height 25 m he wants to throw his gun to Veeru who stands on top of another building of height 20 m at distance 15 m from first building. For which horizontal speed of projectile, it is possible?

A. $5ms^{-1}$

B. $10ms^{-1}$

C. $15ms^{-1}$

D. $20ms^{-1}$

Answer: C

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11. The equations of motion of a projectile are given by $x = 36tm$ and $2y = 96t - 9.8t^2m$ .The angle of projection is

A. $\sin^{-1}\left(\frac{4}{5}\right)$

B. $\sin^{-1}\left(\frac{3}{5}\right)$

C. $\sin^{-1}\left(\frac{4}{3}\right)$

D. $\sin^{-1}\left(\frac{3}{4}\right)$

Answer: a

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12. A plane surface is inclined making an angle β above the horizon. A bullet is fired with the point of projection at the bottom of the inclined plane with velocity u, then the maximum range is given by:

A. $\frac{u^2}{g}$

B. $\frac{u^2}{g(1+\sin\beta)}$

C. $\frac{u^2}{g(1-\sin\beta)}$

D. $\frac{u^2}{g(1+\cos\beta)}$

Answer: b

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13. A player kicks a ball at a speed of $20ms^{-1}$ so that its horizontal range is maximum. Another players 24m away in the direction of kick starts running in the same direction at the same instant of hit. If he has to catch the ball just before it reaches the ground, he should run with a velocity equl to $(take g = 10ms^{-2})$

A. $2\sqrt{2}ms^{-1}$

B. $4\sqrt{2}ms^{-1}$

C. $6\sqrt{2}ms^{-1}$

D. $10\sqrt{2}ms^{-1}$

Answer: b

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14. Two tall buildings are $30m$ apart. The speed with which a ball must be thrown horizontally from a window $150m$ above the ground in one building so that it enters a window $27.5m$ from the ground in the other building is.

A. $2ms^{-1}$

B. $6ms^{-1}$

C. $4ms^{-1}$

D. $8ms^{-1}$

Answer: b

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15. Which of the following statements is incorrect?

A. In one dimension motion, the velocity and the acceleration of an object are always along the same line.

B. In two or three dimension, the angle between velocity and acceleration vectors may have any value of between 0° and 180°

C. The kinematic equations for uniform acceleration can applied in case of a uniform circular motion.

D. The resultant acceleration of an object in circular motion is towards the centre only if the speed is constant.

Answer: c

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16. A motor car travelling at $30m/s$ on a circular road of radius $500m$. It is increasing its speed at the rate of $2ms^{-2}$. What its accleration at that instant ?

A. $2.5ms^{-2}$

B. $2.7ms^{-2}$

C. $2ms^{-2}$

D. $4.5ms^{-2}$

Answer: b

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17. A particle moves along a circle of radius R =1m so that its radius vector $\overrightarrow{r}$ relative to a point on its circumference rotates with the constant angular velocity $\omega = 2 rad/s$. The linear speed of the particle is

A. $4m/s$

B. $2m/s$

C. $1m/s$

D. $0.5m/s$

Answer: a

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18. What remains constant in uniform circular motion ?

A. $\overrightarrow{r}$

B. $\overrightarrow{a}$

C. $\overrightarrow{v}$

D. $\left|\overrightarrow{a}\right|$

Answer: d

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19. A train is moving towards north. At one place it turn towards north -east. Here, we observe that:

A. the radius of curvature of outer rail will be greater than that of the inner rail

B. the radius of curvature of outer rail will be greater than that of the outer rail

C. the radius of curvature of one of the rails will be greater

D. the radius of curvature of outer and inner rail will be same

Answer: a

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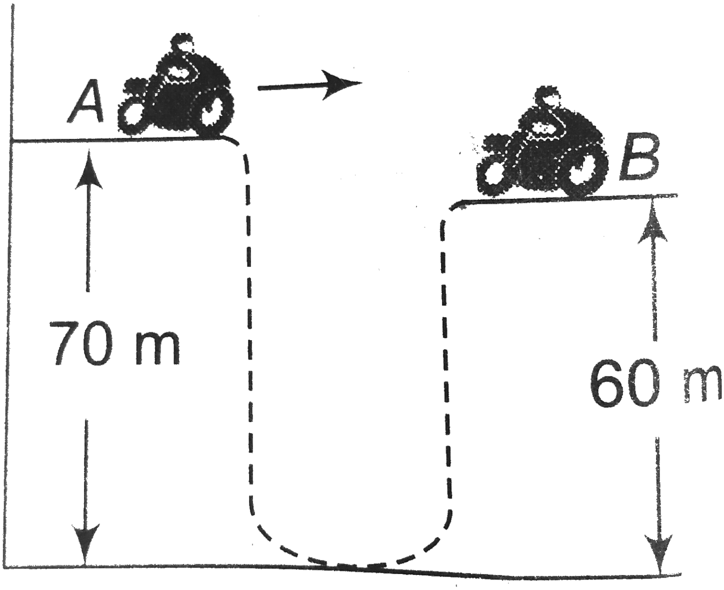
20. A motor cyclist is trying to jump across a path as shown by driving horizontally off a cliff A at a speed of $5ms^{-1}$. Ignore air resistance and take $g = 10ms^{-2}$. The speed with which he touches the peak B is:



A. $2.0ms^{-1}$

B. $15ms^{-1}$

C. $25ms^{-1}$

D. $20ms^{-1}$

Answer: B

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21. An aeroplane is flying vertically upwards. When it is at a height of $1000m$ above the ground and moving at a speed of $367m/s.$, a shot is fired at it with a speed of 567 ms^{-1} from a point directly below it. What should be the acceleration of aeroplane so that it may escape from being hit?

A. $> 5m/s^2$

B. $> 10m/s^2$

C. $< 10m/s^2$

D. Not possible

Answer: b

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22. A passenger in a train drops a ball from the window of a train running at an acceleration 'a'. A pedestrain, on the ground, by the side of the rails, observers the ball falling along

A. a parabola with an acceleration 'g'

B. a parabola with an acceleration $\sqrt{g^2 + a^2}$

C. a vertical with an acceleration $\sqrt{g^2 + a^2}$

D. a vertical with an acceleration $\sqrt{g^2 - a^2}$

Answer: a

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23. A man can swim with a speed of $4kmh^{-1}$ in still water. He crosses a river 1km wise that flows steadily at $3kmh^{-1}$. If he makes his strokes normal to the river current, how far down the river does he go when he reaches the other bank?

A. $500m$

B. $600m$

C. $750m$

D. $850m$

Answer: C

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24. A fighter plane flying horizontally at an altitude of $1.5km$ with speed of $720kmh^9-10$ passes directlu overhead an anticraft gun. At what anle fro the gun with muzzle speed $400ms^{-1}$ to hit the plane in shortest time ?`

A. $\sin^{-1}\left(\frac{1}{3}\right)$

B. $\sin^{-1}\left(\frac{2}{3}\right)$

C. $\cos^{-1}\left(\frac{1}{3}\right)$

D. $\cos^{-1}\left(\frac{2}{3}\right)$

Answer: a

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25. A bomber moving horizontally with $500m/s$ drops a bomb which strikes ground in 10s. The angle of strike with horizontal is

A. $\tan^{-1}\left(\frac{1}{5}\right)$

B. $\tan\left(\frac{1}{5}\right)$

C. $\tan^{-1}(1)$

D. $\tan^{-1}(5)$

Answer: a

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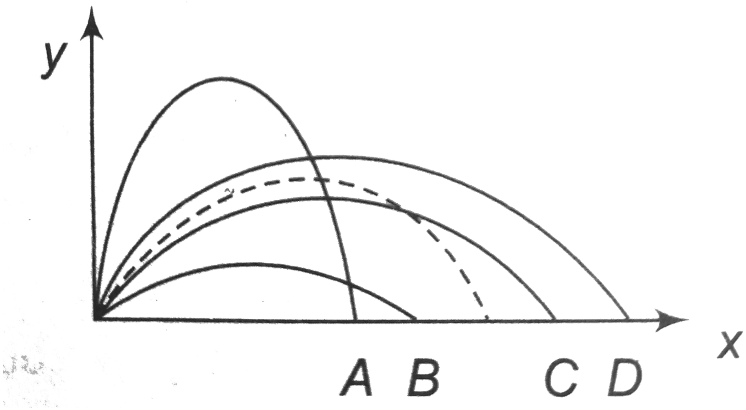
26. The path of a projectile in the absence of air drag is shown in the figure by dotted line. If the air resistance is not ignored then which one of the paths shown in the figure is appropriate for the projectile?



A. B

B. A

C. D

D. C

Answer: A

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27. Assertion: For motion in two or three diemensions, velocity and acceleration vecotrs must have any angle between 0° and 90° between them.

Reason: For such motion velocity and acceleration of an object is always in the opposite direction.

A. If both the assertion and reason are true and reason is a true explantion of the

assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: d

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28. Assertion: When range of a projectile is maximum , its angle of projection may be 45° or 135°.

Reason: Whether θ is 45° or 135°, value of range remains the same, only the sign changes.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: A

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29. Assertion: If the speed of a body is constant, the body cannot have path other than a circular or straight line path.

Reason: It is not possible for a body to have a constant speed in an accelerated motion.

A. If both the assertion and reason are true and reason is a true explanation of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explanation of the assertion.

C. If the assertion is true but reason false

D. If both the assertion and reason are false.

Answer: d

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