PHYSICS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

MOTION IN A PLANE

Example

1. ABCDEF is a regular hexagon with point O as centre. The value of $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF}$

is

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2. A paricle is moving eastwards with a velocity of $5m/s$. In $10s$ the velocity changes to $5m/s$ northwards. Find the average acceleration in this time.

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3. Two vectors $\vec{A}$ and $\vec{B}$ have precisely equal magnitudes. For the magnitude of $\vec{A}+\vec{B}$ to be larger than the magnitude of $\vec{A}$ - $\vec{B}$ by a factor of n, what must be the angle between them?

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4. Two forces whose magnitudes are in the ratio $3:5$ give a resultant of 28N. If the angle of their inclination is 60°, find the magnitude of each force.

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5. What is the displacement of the point of a wheel initially in contact with the ground when the wheel rolls forward half a revolution? Take the radius of the wheel as R and the x-axis as the forward direction?

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6. An aircraft is flying at a height of $3400m$ above the ground, If the angle subtended at a ground observation point by the aircraft positions $10s$ apart is 30°, what is the speed of the aircraft ?

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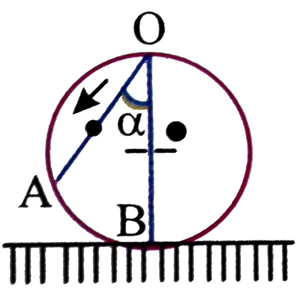

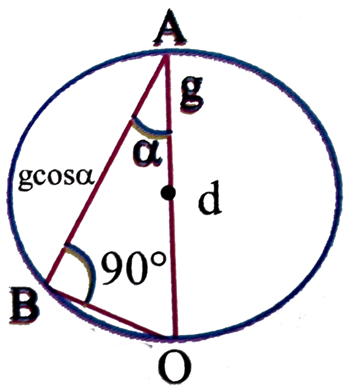

7.

A frictionless wire is fixed between A and B inside a circle of radius R. A small bead slips along the wire. Find the time taken by the bead to slip from A to B.

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8. Two particles 1 and 2 are allowed to descend on the two frictionless chord OA and OB of a vertical circle, at the same instant from point O. The ratio of the velocities of the particles 1 and 2 respectively, when they reach on the circumference will be (OB is the diameter).

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9. Velocity and acceleration of a particle at time $t = 0$are $u = \left(2\hat{i} + 3\hat{j}\right)m/s$ and $a = \left(4\hat{i} + 3\hat{j}\right)m/s^2$ respectively. Find the velocity and displacement if particle at $t = 2s$.

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10. A paarticle starts from origin at $t = 0$ with a velocity $5.0\hat{i}m/s$ and moves in x-y plane under action of a force which produces a constant

acceleration of $\left(3.0\hat{i} + 2.0j\right)m/s^2$.

(a) What is the y-cordinate of the particle at the instant its x-coordinate is `84 m ? (b) What is the speed of the particle at this time?

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11. The coordinates of a body moving in a plane at any instant of time t are $x = \alpha t^2$ and $y = \beta t^2$. The speed of the body is.

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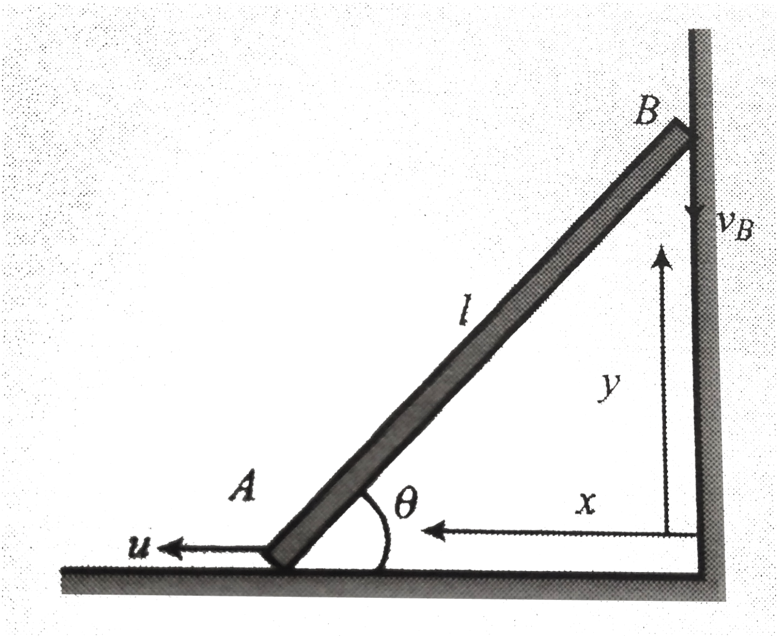
12. Figure shows a rod of length l resting on a wall and the floor. Its lower end A is pulled towards left with a constant velocity u. As a result of this, end A starts moving down along the wall. Find the velocity of the other end B downward when the rod makes an angle θ

with the horizontal.



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13. When two objects move uniformly towards each other, they get 4 metres closer each second and when they move uniformly in the same direction with original speed, they get 4 metres closer each $5s$. Find their individual speeds.

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14. A person walks up a stationary escalator in time t_1. If he remains stationary on the escalator, then it can take him up in time t_2. How much time would it take for him to walk up the moving escalator?

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15. Two ships A and B are $10km$ apart on a line running south to north. Ship A farther north is streaming west at $20km/h$ and ship B is streaming north at $20km/h$. What is their distance of closest approach and how long do they take to reach it?

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16. Rain is falling vertically with a speed of $20ms^{-1}$., A person is running in the rain with a velocity of $5ms^{-1}$ and a wind is also blowing with a speed of $15ms^{-1}$ (both from the west) The angle with the vertical at which the person should hold his umbrella so that he may not get drenched is:

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17. To a man walking at the rate of $3km/h$ the rain appear to fall vetically douwnwards. When he increases his speed $6km/h$ it appears to meet him at an angle of 45° with vertically. Find the speed of rain.

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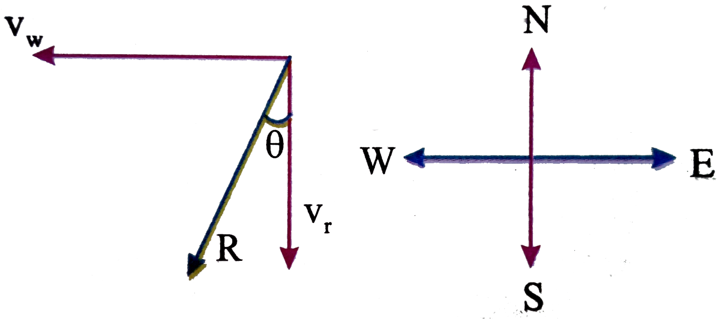
18. Rain is falling, vertically with a speed of $1m/s$.Wind starts blowing after sometime with a speed of $1.732m/s$ in east to west direction. In which direction should a boy waiting at a bus stop hold his umbrella?



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19. Rain is falling vertically with a speed of $1m/s$. A woman rides a bicycle with a speed of $1.732m/s$ in east to west direction. What is the direction in which she should hold her umbrella?

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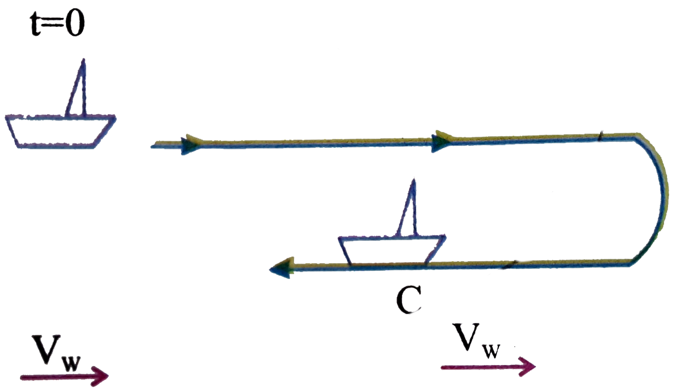
20. A boat is moving with a velocity $v_{bw} = 5km/hr$ relative to water. At time $t = 0$ .the boat passes through a piece of cork floating in water while moving down stream.If it turns back at time $t_1 = 30 \text{ min}$.

a) when the boat meet the cork again?

b) The distance travelled by the boat during this time.



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21. 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 $t_1, t_2 \& t_3$.

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22. Two persons P and Q crosses the river starting the point A on one side to exactly opposite point B on the other bank of the river. The person P crosses the river in the shortest path. The person Q crosses the river in shortest time and walks back to point B .Velocity of river is $3 kmph$ and speed of each person is $5kmph$ w.r.t river. If the two persons reach the point B in the same time, then the speed of walk of Q is .

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23. A bullet fired at an angle of 30° with the horizontal hits the ground 3.0 km away. By adjusting its angle of projection, can one hope to hit a target 5.0 km away? Assume the muzzle speed to be fixed and neglect air resistance.

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24. A cannon and a target are $5.10km$ apart and located at the same level. How soon will the shell launched with the initial velocity $240m/s$ reach the target in the absence of air drag?

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25. The ceiling of a long hall is $20m$ high. What is the maximum horizontal distance that a ball thrown with a speed of $40m$ can go without hitting the ceiling of hall $\left(g = 10ms^{-2}\right)$?

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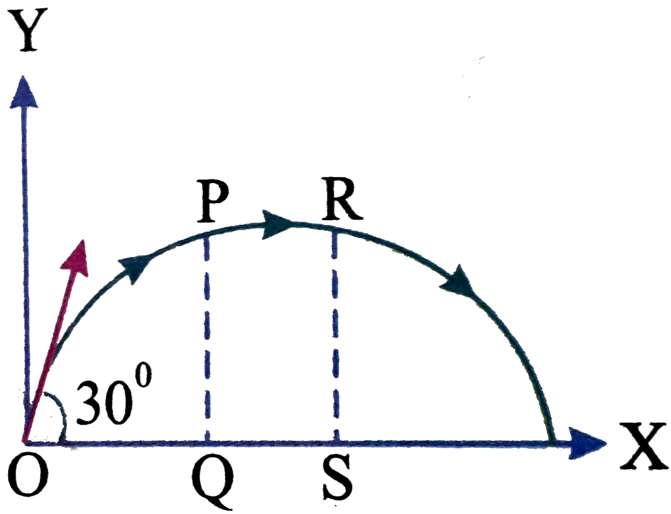
26. A ball projected with a velocity of $10m/s$ at angle of 30° with horizontal just clears two vertical poles each of height $1m$. Find separation between the poles.



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27. A body is projected with velocity u at an angle of projection θ with the horizontal. The direction of velocity of the body makes angle

30° with the horizontal at $t = 2s$ and then after $1s$ it reaches the maximum height. Then

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28. A particle is thrown over a triangle from one end of a horizontal base and after grazing the vertex falls on the other end of the base. If α and β be the base angles and θ the angle of projection, prove that $\tan\theta = \tan\alpha + \tan\beta$.

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29. The velocity of a projectile when it is at the greatest height is $\left(\sqrt{2/5}\right)$ times its velocity when it is at half of its greatest height. Determine its angle of projection.

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30. A foot ball is kicked off with an initial speed of $19.6m/s$ to have maximum range. Goal keeper standing on the goal line $67.4m$ away in the direction of the kick starts running opposite to the direction of kick to meet the ball at that instant. What must his speed be if he is to catch the ball before it hits the ground?

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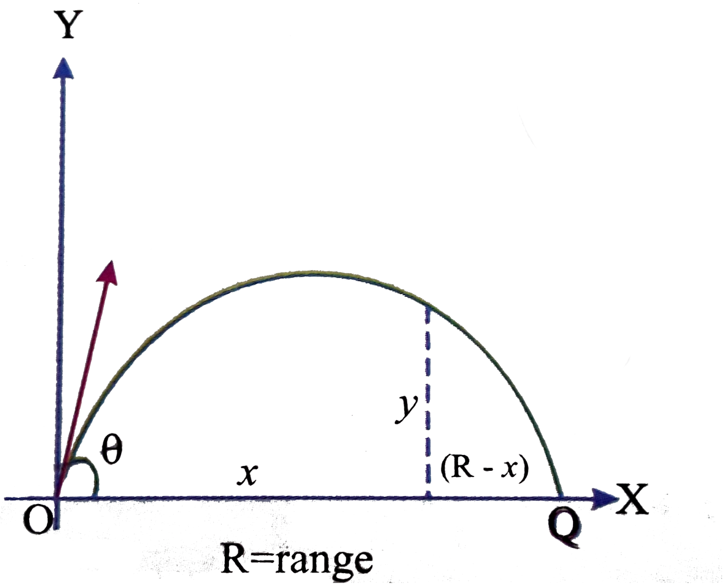
31. A body projected from a point O at an angle θ, just crosses a wall $y\ m$ high at a distance. $x\ m$ from the point of projection and strikes the ground at Q beyond the wall as shown, then find height of the wall



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32. A particle is projected with a velocity of $10\sqrt{2}m/s$ at an angle of 45° with the horizontal. Find the interval between the moments when speed is $\sqrt{125}m/s\left(g = 10m/s^2\right)$

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33. A projectile of $2kg$ has velocities $3m/s$ and $4m/s$ at two points during its flight in the uniform gravitational field of the earth. If these two velocities are $\perp$ to each other then the minimum KE of the particle during its flight is

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34. In the absence of wind the range and maximum height of a projectile were R and H. If wind imparts a horizontal acceleration $a = g/4$ to the projectile then find the maximum range and maximum height.

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35. A particle is projected from the ground with an initial speed v at an angle θ with horizontal. The average velocity of the particle between its point of projection and highest point of trajectory is $[EAM 2013]$

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36. A ball is thrown from the top of a tower of $61m$ high with a velocity $24.4ms^{-1}$ at an elevation of 30° above the horizontal. What is the distance from the foot of the tower to the point where the ball hits the ground?

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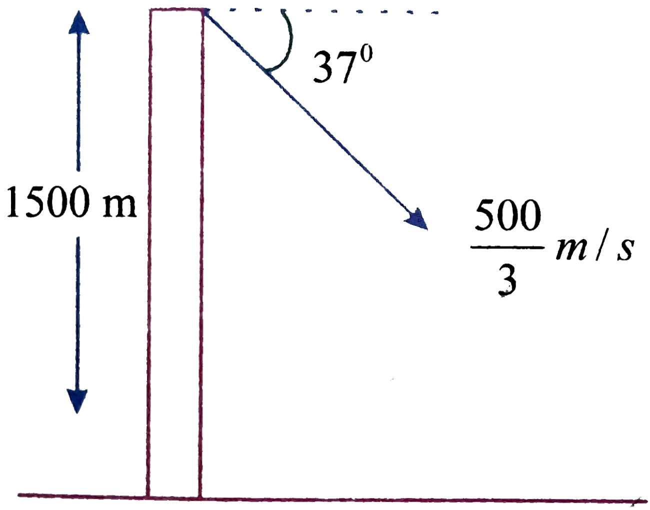
37. A particle is projected from a tower as shown in figure, then find the distance from the foot of the tower where it will strike the ground. $\left(g = 10m/s^2\right)$



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38. A golfer standing on the ground hits a ball with a velocity of $52 m/s$ at an angle θ above the horizontal if $\tan\theta = \frac{5}{12}$ find the time for which the ball is at least $15m$ above the ground?

$(g = 10m/s^2)$

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39. Two paper screens A and B are separated by a distance of $100m$. A bullet pierces A and B.

The hole in B is $10cm$ below the hole in A. If the bullet is travelling horizontally at the time of hitting the screen A, calculate the velocity of the bullet when it hits the screen A. Neglect resistance of paper and air.

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40. A boy aims a gun at a bird from a point, at a horizontal distance of $100m$. If the gun can impart a velocity of $500m/\sec$ to the bullet, at what height above the bird must he aim his gun in order to hit it?

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41. An enemy plane is flying horizontally at an altitude of $2km$ with a speed of $300ms^{-1}$.An army man with an anti-aircraft gun on the ground sights enemy plane when it is directly overhead and fires a shell with a muzzle speed of $600ms^{-1}$.At what angle with the vertical should the gun be fired so as to hit the plane?

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42. From the top of a tower, two balls are thrown horizontally with velocities u_1 and u_2 in opposite directions. If their velocities are perpendicular to each other just before they strike the ground, find the height of tower.

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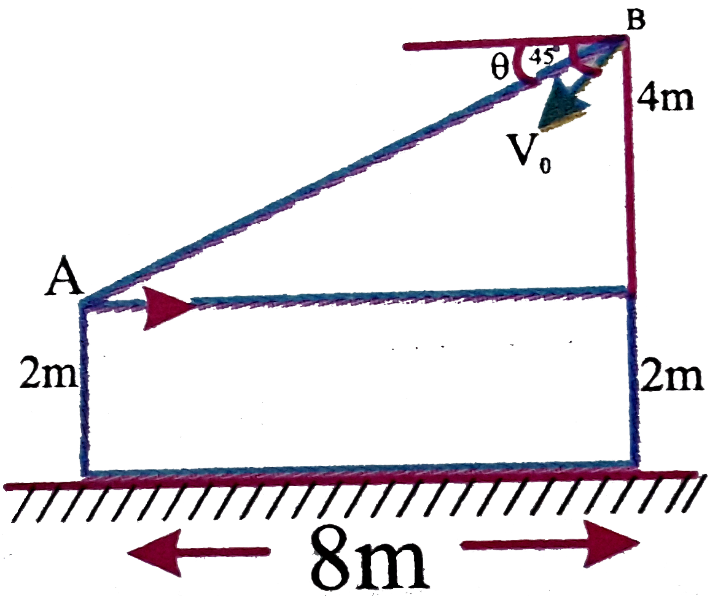
43. From points A and B, at the respective heights of $2m$ and $6m$, two bodies are thrown simultaneously towards each other, one is thrown horizontally with a velocity of $8m/s$ and the other, downward at an angle $45°$ to the horizontal at an initial velocity v_0 such that the bodies collide in flight. This horizontal distance between points A and B equal to $8m$ .Then find

a)The initial velocity V_0 of the body thrown at an angle $45°$

b)The time of flight t of the bodies before colliding

c) The coordinate (x, y) of the point of collision (consider the bottom of the tower A as origin

)is



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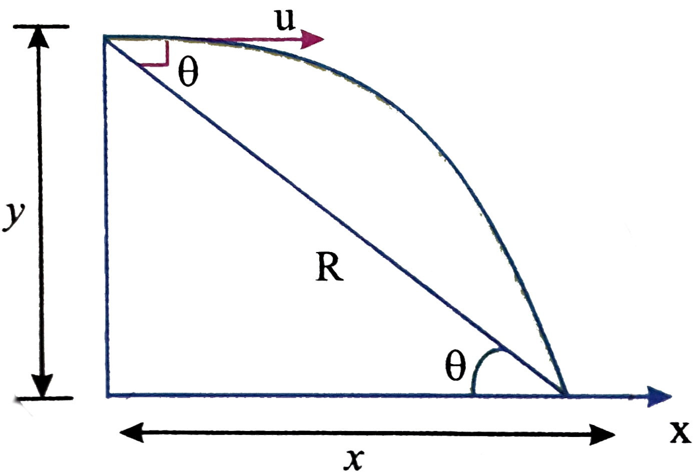
44. A particle is projected horizontally with a speed u from the top of plane inclined at an angle θ with the horizontal. How far from the point of projection will the particle strike the plane ?



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45. A projectile has the maximum range of $500m$. If the projectile is now thrown up on an inclined plane of 30° with the same speed, what is the distance covered by it along the inclined plane?

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46. When a motor cyclist takes a U - $turn$ in $4s$ what is the average angular velocity of the motor cyclist.

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47. What is the linear velocity of a person at equator of the earth due to its spinning motion? (Radius of the earth $= 6400 km$)

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Level-I(C.W)

1. The maximum resultant of two concurrent forces is $10N$ and their minimum resultant is $4N$. The magnitude of large force is

A. $5N$

B. $7N$

C. $3N$

D. $14N$

Answer: B

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2. The resultant of two vectors of magnitudes 3 units and 5 units is perpendicular to 3 units.The angle between the vectors is

A. 127°

B. 120°

C. 75°

D. 150°

Answer: A

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3. If the sum of two unit vectors is a unit vector,then find the magnitude of their differences.

A. 1 unit

B. 2 unit

C. $\sqrt{3}$ unit

D. zero

Answer: C

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4. Which of the following sets of forces acting simultaneously on a particle keep it in equilibrium?

A. $3N, 5N, 10N$

B. $4N, 5N, 12N$

C. $2N, 6N, 5N$

D. $5N, 8N, 1N$

Answer: C

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5. The magnitude of two vectors $\vec{P}$ and $\vec{Q}$ differ by 1. The magnitude of their resultant makes an angle of $\tan^{-1}\left(\frac{3}{4}\right)$ with $\vec{P}$. The angle between $\vec{P}$ and $\vec{Q}$ is

A. 45°

B. 0°

C. 180°

D. 90°

Answer: D

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6. Two vectors inclined at an angle θ have magnitude $3N$ and $5N$ and their resultant is of magnitude $4N$. The angle θ is

A. 90°

B. $\cos^{-1}\left(\frac{4}{5}\right)$

C. $\cos^{-1}\left(\frac{3}{5}\right)$

D. $\cos^{-1}\left(-\frac{3}{5}\right)$

Answer: D

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7. The plane which can be formed with the vectors

$\bar{a} = 3\bar{i} - 4\bar{j} + 2\bar{k}, \bar{b} = 2\bar{i} - \bar{j} + 6\bar{k}, \bar{c} = 5\bar{i} - 5\bar{j} + 4\bar{k}$

,is.

A. Quadrilateral

B. Triangle

C. Circle

D. Hyperbola

Answer: B

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8. Five equal forces each of $20N$ are acting at a point in the same plane. If the angles between them are same, the resultant of these forces is

A. 0

B. $40N$

C. $20N$

D. $20\sqrt{2}N$

Answer: A

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9. A boy is hanging from a horizontal branch of a tree. The tension in the arms will be maximum when the angle between the arms is

A. 0°

B. 30°

C. 60°

D. 120°

Answer: D

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10. A $10kg$ body is suspended by a rope is pulled by means of a horizontal force to make 60° by rope to vertical.The horizontal forces is

A. $10kgwt$

B. $30kgwt$

C. $10\sqrt{3}kgwt$

D. $30\sqrt{3}kgwt$

Answer: C

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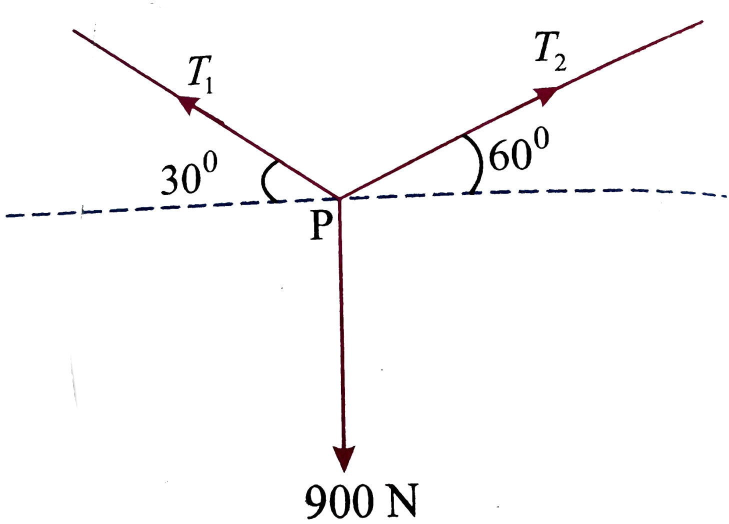
11. If P is in equilibrium then $\frac{T_1}{T_2}$ is



A. $\sqrt{3}$

B. 2

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{2}$

Answer: C

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12. A body starts with a velocity $\left(2\hat{i} + 3\hat{j} + 11\hat{k}\right)m/s$ and moves with an acceleration $\left(5\hat{i} + 5\hat{j} - 5\hat{k}\right)m/s^2$. What is its velocity after 0.2sec?

A. $7\hat{i} + 8\hat{j} + 6\hat{k}$

B. $2\hat{i} - 3\hat{j} + 11\hat{k}$

C. $3\hat{i} - 4\hat{j} - 10\hat{k}$

D. $3\hat{i} + 4\hat{j} + 10\hat{k}$

Answer: D

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13. The position vector of a particle is given by $\vec{r} = \left(3t^2\hat{i} + 4t^2\hat{j} + 7\hat{k}\right)m$ at a given time t.The net displacement of the particle after $10s$ is

A. $500m$

B. $400m$

C. $300m$

D. $700m$

Answer: A

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14. A particle is moving eastwards with a velocity $5ms^{-1}$, changes its direction northwards in 10 seconds and moves with same magnitude of velocity. The average acceleration is

A. zero

B. $\frac{1}{\sqrt{2}}ms^{-2}$ towards N - E

C. $\frac{1}{\sqrt{2}}ms^{-2}$ towards S - E

D. $\frac{1}{\sqrt{2}}ms^{-2}$ towards N - W

Answer: D

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15. A man is going due east with a velocity of $5ms^{-1}$.It is vertically rainging downwards with a velocity of $4ms^{-1}$.At what angle should he hold the umbrella to the vertical so as to protect him self from the rain?

A. $\tan^{-1}\left(\frac{5}{4}\right)$ in anti-clockwise direction

B. $\tan^{-1}\left(\frac{5}{4}\right)$ in clockwise direction

C. $\tan^{-1}\left(\frac{5}{4}\right)$North of East

D. $\tan^{-1}\left(\frac{5}{4}\right)$East of North

Answer: B

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16. Rain drops are falling downward vertically at 4 kmph. For a person moving forward at 3 kmph feels the rain falling at

A. 7 kmph

B. 1 kmph

C. 5 kmph

D. 25 kmph

Answer: C

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17. A man travelling at $10.8 kmph$ in topless car on a rainy day. He holds an umbrella at angle of 37° with the vertical so that he does not wet. If rain drops falls vertically downwards what is rain velocity.

A. $1m/s$

B. $2m/s$

C. $3m/s$

D. $4m/s$

Answer: D

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18. A man can row a boat in still water with a velocity of $8kmph$.Water is flowing in a river with a velocity of $4kmph$. At what angle should he row the boat so as to reach the exact opposite point

A. 150° to flow of water.

B. 120° to flow of water.

C. 30° to flow of water.

D. 90° to flow of water.

Answer: B

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19. A person can swim in still water at $5 m/s$.He moves in a river of velocity $3 m/s$, first down the steam and next same distance up the stream. The ratio of times taken are

A. $1:1$

B. $1:2$

C. $1:4$

D. $4:1$

Answer: C

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20. The velocity of water in a river is $2kmph$,while width is $400m$. A boat is rowed from a point rowing always aiming opposite point at $8kmph$ of still water velocity. On reaching the opposite bank the drift obtained is

A. $93m$

B. $100.8m$

C. $112.4m$

D. $100m$

Answer: D

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21. A man can swim in still water at a speed of $4kmph$. He desires to cross a river flowing at a speed of $3kmph$ in the shortest time interval. If the width of the river (in hours) and the horizontal distance travelled (in km) are respectively

A. $\frac{3}{4}, \frac{9}{4}$

B. $\frac{3}{5}, 3$

C. $\frac{1}{4}, \frac{15}{4}$

D. $\frac{3}{\sqrt{7}}, 7$

Answer: A

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22. A particle is projected in xy plane with y-axis along vertical, the point of projection is origin. The equation of the path is

$y = \sqrt{3}x - \frac{g}{2}x^2$.where y and x are in m.Then the speed of projection in ms^{-1} is

A. 2

B. $\sqrt{3}$

C. 4

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

Answer: A

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23. If a body is thrown with a speed of $19.6 m/s$ making an angle of 30° with the horizontal,then the time of flight is

A. $1s$

B. $2s$

C. $2\sqrt{3}s$

D. $5s$

Answer: B

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24. A particle is projected with an initial velocity of $200 m/s$ in a direction making an angle of 30° with the vertical. The horizontal distance covered by the particle in $3s$ is

A. $300m$

B. $150m$

C. $175m$

D. $125m$

Answer: A

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25. A body is projected with an initial velocity $20m/s$ at 60° to the horizontal. Its initial velocity vector is ___ $\left(g = 10m/s^2\right)$

A. $10\hat{i}$ - $20\hat{j}$

B. $10\sqrt{3}\hat{i} + 10\hat{j}$

C. $10\hat{i} + 10\sqrt{3}\hat{j}$

D. $5\hat{j} + 5\sqrt{3}\hat{j}$

Answer: C

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26. A body is projected at an angle of 30° with the horizontal with momentum P.At its highest point the magnitude of the momentum is:

A. $\frac{\sqrt{3}}{2}P$

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

C. P

D. $\frac{P}{2}$

Answer: A

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27. The potential energy of a projectile at its maximum height is equal to its kinetic energy there. If the velocity of projection is $20m/s^{-1}$,its time of flight is $\left(g = 10m/s^2\right)$

A. $2s$

B. $2\sqrt{2}s$

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

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

Answer: B

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28. From a point on the ground a particle is projected with initial velocity u,such that its horizontal range is maximum. The magnitude of average velocity during its ascent.

A. $\frac{\sqrt{5u}}{2\sqrt{2}}$

B. $\frac{5u}{4}$

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

D. None

Answer: A

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29. The horizontal and vertical displacements of a projectile are given as $x = at$ & $y = bt - ct^2$ .Then velocity of projection is

A. $\sqrt{a^2 + b^2}$

B. $\sqrt{b^2 + c^2}$

C. $\sqrt{a^2 + c^2}$

D. $\sqrt{b^2 - c^2}$

Answer: A

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30. Two bodies are thrown from the same point with the same velocity of $50ms^{-1}$.if their angles of projection are complimentary to each other and the difference of maximum heights is $30m$,the minimum and maximum heights are $\left(g = 10m/s^2\right)$

A. $50m \& 80m$

B. $47.5m \& 77.5m$

C. $30m \& 60m$

D. $25m \& 55m$

Answer: B

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31. 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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32. If $\vec{u} = a\hat{i} + b\hat{j} + c\hat{k}$ with $\hat{i}, \hat{j}, \hat{k}$are in east, north and vertical directions, horizontal component of velocity of projectile is

A. a

B. b

C. $\sqrt{a^2 + b^2}$

D. $\sqrt{b^2 + c^2}$

Answer: C

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33. If the time of flight of a projectile is doubled, what happens to the maximum height at tained?

A. halved

B. remains unchanged

C. doubled

D. become four times

Answer: D

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34. If $\vec{u} = a\hat{i} + b\hat{j} + c\hat{k}$ with $\hat{i}, \hat{j}, \hat{k}$are in east, north and vertical directions, the maximum height of the projectileis

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

B. $\frac{b^2}{2g}$

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

D. $\frac{b^2c^2}{2g}$

Answer: C

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35. A body projected horizontally with a velocity$v$ from a height h has a range R.With what velocity a body is to be projected horizontally from a height $h/2$ to have the same range ?

A. $\sqrt{2}v$

B. $2v$

C. $6v$

D. $8v$

Answer: A

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36. A stone is thrown horizontally with velocity gms^{-1} from the top of a tower of height g metre. The velocity with which it hits the ground is $\left(\text{in}ms^{-1}\right)$

A. g

B. $2g$

C. $\sqrt{3}g$

D. $4g$

Answer: C

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37. A body is thrown horizontally from the top of a tower. It reaches the ground after $4s$ at an angle 45° to the ground. The velocity of projection is

A. $9.8ms^{-1}$

B. $19.6ms^{-1}$

C. $29.4ms^{-1}$

D. $39.2ms^{-1}$

Answer: D

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38. Two cliffs of heights $120m$ and $100.4m$ are separated bya horizontal distance of $16m$ if a car has to reach from the first cliff to the second the horizontal velocity of car should be

A. $16m/s$

B. $4m/s$

C. $2m/s$

D. $8m/s$

Answer: D

Watch Video Solution

39. A circular disc is rotating about its own axis at the rate of 200 revolutions per minute. Two particles P, Q of disc are at distances

$5cm, 10cm$ from axis of rotation. The ratio of angular velocities of P and Q is

A. $1:2$

B. $1:1$

C. $2:1$

D. $4:1$

Answer: B

Watch Video Solution

40. A stationary wheel starts rotating about its own axis at uniform rate amgular acceleration $8 rad/s^2$.The time taken by its to complete 77 rotation is

A. 5.5sec

B. 7sec

C. 11sec

D. 14sec

Answer: C

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41. A circular disc is rotating about its own axis at uniform rate completes 30 rotations in one minute.The angular velocity of disc in rad s^{-1} is

A. 2π

B. π

C. $\frac{\pi}{2}$

D. $\frac{\pi}{4}i$

Answer: B

Watch Video Solution

42. A particle is moving at uniform speed $2ms^{-1}$ along a circle of radius $0.5m$.The centripetal acceleration of particle is

A. $1ms^{-2}$

B. $2ms^{-2}$

C. $4ms^{-2}$

D. $8ms^{-2}$

Answer: D

Watch Video Solution

43. A particle P is moving in a circle of radius 'a' with a uniform speed v. C is the centre of the circle and AB is a diameter. When passing through B the angular velocity of P about A and C are in the ratio

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:3$

Answer: B

Watch Video Solution

Level-II(C.W)

1. The greatest and least resultant of two forces acting at a point are $29 kgwt.$ and $5 kgwt.$ respectively . If each force is increased by $3kgwt$. the magnitude of the resultant of new forces acting at right angles to each other is

A. $45kgwt$.

B. $35kgwt$.

C. $25kgwt$.

D. $15kgwt$.

Answer: C

Watch Video Solution

2. Two forces P and Q act at an angle of 120° with each other. If the resultant is at right angles to P and P is equal to $4kg$ - wt, then the value of Q is

A. $4kgwt$.

B. $8kgwt$.

C. $6kgwt$.

D. $3kgwt$.

Answer: B

Watch Video Solution

3. The resultant of two vectors $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If the magnitude of $\vec{Q}$ is doubled, the new resultant vector becomes perpendicular to $\vec{P}$. Then, the magnitude of $\vec{R}$ is equal to

A. $\dfrac{P^2 - Q^2}{2PQ}$

B. $\dfrac{P + Q}{P - Q}$

C. Q

D. $\dfrac{P}{Q}$

Answer: C

Watch Video Solution

4. $\vec{P}, \vec{Q}, \vec{R}, \vec{S}$ are vector of equal magnitude. If $\vec{P} + \vec{Q} - \vec{R} = 0$ angle between $\vec{P}$ and $\vec{Q}$ is θ_1.If $\vec{P} + \vec{Q} - \vec{S} = 0$ angle between $\vec{P}$ and $\vec{S}$ is θ_2.The ratio of θ_1 toθ_2 is

A. $1:2$

B. $2:1$

C. $1:1$

D. $1:\sqrt{3}$

Answer: B

Watch Video Solution

5. If $ABCD$ is quadrilateral whose sides represent vectors in cyclic order, $\vec{AB}$ is equivalent is

A. $\overrightarrow{CA}+\overrightarrow{CB}$

B. $\overrightarrow{CD}$

C. $\overrightarrow{AD} + \overrightarrow{DC} + \overrightarrow{CB}$

D. $\overrightarrow{AD} + \overrightarrow{BD}$

Answer: C

Watch Video Solution

6. An iron sphere of mass $100kg$ is suspended freely from a rigid support by means of a rope of length $2m$.The horizontal force required to displace it horizontally through $50cm$ is nearly

A. $980N$

B. $490N$

C. $245N$

D. $112.5N$

Answer: C

Watch Video Solution

7. Three forces $\vec{A} = \left(\hat{i} + \hat{j} + \hat{k}\right), \vec{B} = \left(2\hat{i} - \hat{j} + 3\hat{k}\right)$ and $\vec{C}$ acting

on a body to keep it in equilibrium. Then $\vec{C}$ is

A. - $\left(3\hat{i} + 4\hat{k}\right)$

B. - $\left(4\hat{i} + 3\hat{k}\right)$

C. $\left(3\hat{i} + 4\hat{j}\right)$

D. $\left(2\hat{i} - 3\hat{k}\right)$

Answer: A

Watch Video Solution

8. The displacement of the point of a wheel initially in contact with the ground when the wheel rolls forward quarter revolution where perimeter of the wheel is $4\pi m$, is (Assume the forward direction as x-axis)

A. $\sqrt{(\pi + 2)^2 + 4}$along $\tan^{-1}\frac{2}{\pi}$ with x-axis

B. $\sqrt{(\pi + 2)^2 + 4}$along $\tan^{-1}\frac{2}{\pi - 2}$ with x-axis

C. $\sqrt{(\pi + 2)^2 + 4}$along $\tan^{-1}\frac{2}{\pi}$ with x-axis

D. $\sqrt{(\pi + 2)^2 + 4}$along $\tan^{-1}\frac{2}{\pi - 2}$ with x-axis

Answer: B

Watch Video Solution

9. A particle starts from the origin at $t = 0s$ with a velocity of $10.0\hat{j}m/s$ and moves in the xy-plane with a constant acceleration of $\left(8\hat{i} + 2\hat{j}\right)m/s^{-2}$. Then y-coordinate of the particle in 2sec is

A. $24m$

B. $16m$

C. $8m$

D. $12m$

Answer: A

Watch Video Solution

10. A car moving at a constant speed of $36kmph$ moves north wards for $20 \min utes$ then due to west with the same speed for $8\frac{1}{3}$ minutes. What is the average velocity of he car during this run in kmph

A. 27.5

B. 40.5

C. 20.8

D. 32.7

Answer: A

Watch Video Solution

11. Velocity of a particle at time $t = 0$ is $2ms^{-1}$. A constant acceleration of $2ms^{-2}$ acts on the particle for $1 second$ at an angle of 60° with its initial velocity. Find the magnitude of velocity at the end of $1 second$.

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

B. $2\sqrt{3}m/s$

C. $4m/s$

D. $8m/s$

Answer: B

Watch Video Solution

12. An aeroplane moving in a circular path with a speed $250 km/h$. The change in velocity in half of the revolution is.

A. $500 km/h$

B. $250 km/h$

C. $120 km/h$

D. zero

Answer: A

Watch Video Solution

13. A car starting from a point travels towards east with a velocity of $36kmph$. Another car starting from the same point travels towards north with a velocity of $24kmph$. The relative velocity of one with respect to another is

A. $12\sqrt{13}kmph$

B. 30 kmph

C. 12 kmph

D. 20 kmph

Answer: A

Watch Video Solution

14. A ship is moving due east with a velocity of $12m/\sec$, a truck is moving across on the ship with velocity $4m/\sec$.A monkey is climbing the vertical pole mounted on the truck with a velocity of $3m/\sec$.Find the velocity of the monkey as observed by the man on the shore $(m/\sec)$

A. 10

B. 15

C. 13

D. 20

Answer: C

Watch Video Solution

15. A man is walking due east at the rate of $2kmph$.The rain appears to him to come down vertically at the rate of $2kmph$.The actual velocity and direction of rainfall with the vertical respectively are

A. $2\sqrt{2}kmph, 45^{\circ}$

B. $\frac{1}{\sqrt{2}}kmph, 30^{\circ}$

C. $2kmph, 0^{\circ}$

D. $1kmph, 90^{\circ}$

Answer: A

Watch Video Solution

16. A boat takes two hours to travel 8 km and back in still water. If the velocity of water is 4 km/h, the time taken for going upstream 8 km and coming back is

A. 160 minutes

B. 80 minutes

C. 320 minutes

D. 180 minutes

Answer: A

Watch Video Solution

17. The velocity of water in a river is $2kmph$,while width is $400m$. A boat is rowed from a point rowing always aiming opposite point at $8kmph$ of still water velocity. On reaching the opposite bank the drift obtained is

A. $93m$

B. $100.8m$

C. $112.4m$

D. $100m$

Answer: D

Watch Video Solution

18. A particle is projected from ground with some initial velocity making an angle of 45° with the horizontal. It reaches a height of $7.5m$ above the ground while it travels a horizontal distance of $10m$ from the point of projection. The initial speed of the projection is

A. $5m/s$

B. $10m/s$

C. $20m/s$

D. $40m/s$

Answer: C

Watch Video Solution

19. A particle is projected from ground at an angle 45° with initial velocity $20\sqrt{2}ms^{-1}$.The magnitude of average velocity in a timer interval from $t = 0$ to $t = 3s$ in ms^{-1} is

A. 20.62

B. 10.31

C. 41.14

D. 5.15

Answer: A

Watch Video Solution

20. A ball is thrown with a velocity of u making an angle θ with the horizontal. Its velocity vector normal to initial vector (u) after a time interval of

A. $\dfrac{u\sin\theta}{g}$

B. $\dfrac{u}{g\cos\theta}$

C. $\dfrac{u}{g\sin\theta}$

D. $\dfrac{u\cos\theta}{g}$

Answer: C

Watch Video Solution

21. A stone is projected with a velocity $20\sqrt{2}m/s$ at an angle of 45° to the horizontal.The average velocity of stone during its motion from starting point to its maximum height is

A. $10\sqrt{5}m/s$

B. $20\sqrt{5}m/s$

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

D. $20m/s$

Answer: A

Watch Video Solution

22. A player kicks a football obliquely at a speed of $20m/s$ so that its range is maximum. Another player at a distance of $24m$ away in the direction of kick starts running at that instant to catch it, the speed with which the second player has to run is $\left(g = 10ms^{-2}\right)$

A. $4m/s$

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

C. $8\sqrt{2}m/s$

D. $8m/s$

Answer: B

Watch Video Solution

23. A particle is fired with velocity u making angle θ with the horizontal.What is the change in velocity when it is at the highest point?

A. $u\cos\theta$

B. u

C. $u\sin\theta$

D. $(u\cos\theta - u)$

Answer: C

Watch Video Solution

24. Two projectiles A and B are thrown from the same point with velocities v and $\frac{v}{2}$ respectively. If B is thrown at an angle 45° with horizontal.What is the inclination of A .when their ranges are the same?

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

B. $\frac{1}{2}\sin^{-1}\left(\frac{1}{4}\right)$

C. $2\sin^{-1}\left(\frac{1}{4}\right)$

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

Answer: B

Watch Video Solution

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

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

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

Answer: A

Watch Video Solution

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

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

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

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

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

Answer: A

Watch Video Solution

27. A ball is projected from the ground with velocity u such that its range is maximum Then

A. Its velocity at half the maximum height is $\frac{\sqrt{3}}{2}u$

B. Its velocity at the maximum height is u

C. Change in its velocity when it returns to the ground is u

D. all the above are true

Answer: A

Watch Video Solution

28. A staircase contains three steps each 10 cm high and 20 cm wide figure. What should be the minimum horizontal velocity of a bal rolling off the upper most plane so as to hit directly the lowest plane?

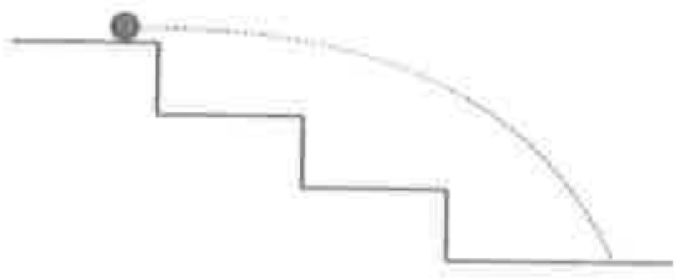


Figure 3-E9

A. $42ms^{-1}$

B. $4.2ms^{-1}$

C. $24ms^{-1}$

D. $2.4ms^{-1}$

Answer: B

Watch Video Solution

29. From certain height h two bodies are projected horizontally each with velocity v.One body is projected towards North and the other body is projected towards east. Their separation on reaching the ground

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

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

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

D. $\sqrt{\frac{8v^2h}{g}}$

Answer: B

Watch Video Solution

30. An object is projected horizontally from a top of the tower of height h.The line joining the point of projection and point of striking on the ground makes an angle $45°$ with ground,Then with what velocity the object strikes the ground

A. $\sqrt{\frac{1gh}{2}}$

B. $\sqrt{\frac{9gh}{2}}$

C. $\sqrt{\frac{7gh}{2}}$

D. $\sqrt{\frac{5gh}{2}}$

Answer: D

Watch Video Solution

31. A ball is thrown horizontally from a cliff such that it strikes the ground after $5s$.The line of sight makes an angle 37° with the horizontal.The initial velocity of projection in ms^{-1} is

A. 50

B. $\frac{100}{\sqrt{3}}$

C. $\frac{100}{\sqrt{2}}$

D. $\frac{100}{3}$

Answer: D

Watch Video Solution

32. An object is launched from a cliff $20m$ above the ground at an angle of 30° above the horizontal with an initial speed of $30m/s$. How far does the object travel before landing on the ground?(in metre)

A. 20

B. $20\sqrt{3}$

C. 60

D. $60\sqrt{3}$

Answer: D

Watch Video Solution

33. A bomber flying upward at an angle of $53\,^{\circ}$ with the vertical releases a bomb at an altitude of $800m$.The bomb strikes the ground

$20s$ after its release.If $g = 10ms^{-2}$, the velocity at the time of release of the bomb in ms^{-1} is

A. 400

B. 800

C. 100

D. 200

Answer: C

Watch Video Solution

34. Two particles move in a uniform gravitational field with an acceleration g.At the initial moment the particles were located at same point and moved with velocities $u_1 = 9ms^{-1}$ and $u_2 = 4ms^{-1}$ horizontally in opposite directions.The time between the particles at the moment when their velocity vectors are mutually perpendicular in s in (take $g = 10ms^{-2}$)

A. 0.36

B. 3.6

C. 0.6

D. 6

Answer: C

Watch Video Solution

35. An aeroplane is flying horizontally at a height of $980m$ with velocity $100ms^{-1}$ drops a food packet.A person on the ground is $414m$ ahead horizontally from the dropping point.At what velocity should he move so that he can catch the food packet.

A. $50\sqrt{2}ms^{-1}$

B. $\frac{50}{\sqrt{2}}ms^{-1}$

C. $100ms^{-1}$

D. $200ms^{-1}$

Answer: A

Watch Video Solution

36. A cylclist is riding with a speed of $27 kmh^{-1}$. As he approaches a circular turn on the road of radius $80 m$, 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. $0.5 m/s^2$

B. $0.87 m/s^2$

C. $0.56 m/s^2$

D. $1m/s^2$

Answer: C

Watch Video Solution

37. the length of seconds hand of a clock is $10cm$. The speed of the tip of the hand is ....

A. $\frac{\pi}{6000}$

B. $\frac{\pi}{18000}$

C. $\frac{\pi}{36000}$

D. $\frac{\pi}{1200}$

Answer: B

Watch Video Solution

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

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

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

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

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

Answer: C

Watch Video Solution

39. $\vec{A}$ and $\vec{B}$ are two vectors of equal magnitude and θ is the angle between them.The angle between $\vec{A}$ or $\vec{B}$ with their resultant is

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

B. $\frac{\theta}{2}$

C. 2θ

D. 0

Answer: B

Watch Video Solution

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

A. it’s velocity always perpendicular to its accerleration

B. it's velocity becomes zero at its maximum height

C. it’s velocity makes zero angle with the horizontalat its maximum height

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

Answer: C

Watch Video Solution

41. A body is projected at an angle θ so that its range is maximum.If T is the time of flight then the value of maximum range is (acceleration due to gravity $=g$)

A. $\dfrac{g^2T}{2}$

B. $\dfrac{gT}{2}$

C. $\dfrac{gT^2}{2}$

D. $\dfrac{g^2T^2}{2}$

Answer: C

Watch Video Solution

42. The trajectory of a projectile in a vertical plane is $y = ax - bx^2$, where a and b are constant 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 projectile from the horizontal are.

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

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

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

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

Answer: D

Watch Video Solution

43. A body is projected horizontally from the top of a tower with a velocity of $10m/s$.If it hits the ground at an angle 45°, th vertical component of velocity when it hits ground in m/s is

A. 10

B. $10\sqrt{2}$

C. $5\sqrt{2}$

D. 5

Answer: A

Watch Video Solution

44. A body is projected with an angle θ.The maximum height reached is h.If the time of flight is $4 \sec$ and $g = 10 m / s^2$,then the value of h is

A. $10 m$

B. $40 m$

C. $20 m$

D. $5 m$

Answer: C

Watch Video Solution

45. A person reaches on a point directly opposite on the other bank of a river.The velocity of the water in the river is $4m/s$and the velocity of the person in still water is $5m/s$ .If the width of the river is $84.6m$, time taken to cross the river in seconds is

A. 9.4

B. 2

C. 84.6

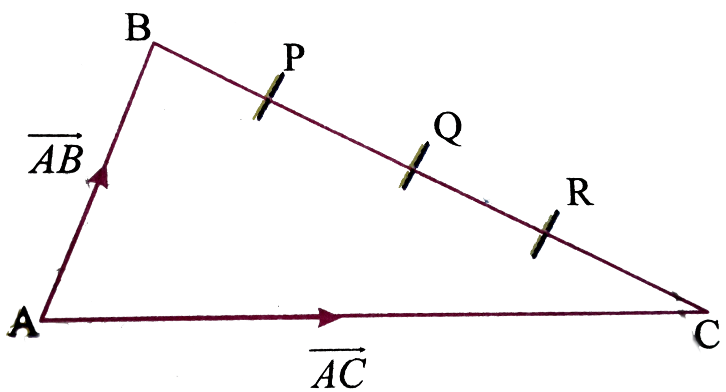
D. 28.2

Answer: D

Watch Video Solution

Level-III(C.W)

1. BC is divided into four equal parts by P, Q and R.The resultant of $\overrightarrow{AB}$ and $3\overrightarrow{AC}$ is



A. $\overrightarrow{AR}$

B. $4\overrightarrow{AR}$

C. $4\overrightarrow{AP}$

D. $\overrightarrow{PQ}$

Answer: B

Watch Video Solution

2. A particle moves in the x - y plane under the action of a force $\vec{F}$ such that the value of its linear momentum $\vec{P}$ at any time

$tisP_x = 2\cos t, P_y = 2\sin t.$

The angle θ between vecF and vecP

$atagiventime$t` will be:

A. $\theta = 0^\circ$

B. $\theta = 30^\circ$

C. $\theta = 90^\circ$

D. $\theta = 180^\circ$

Answer: C

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3. Three particles A, B and C start from the origin at the same time,A with a velocity a along x-axis, B with a velocity b along y-axis and C with velocity c in XY plane along the line $x = y$.The magnitude of c so that the three always remain collinear is:

A. $\frac{a+b}{2}$

B. $\sqrt{ab}$

C. $\frac{ab}{a+b}$

D. $\frac{\sqrt{2}ab}{a+b}$

Answer: D

Watch Video Solution

4. Two forces F_1 and F_2 are acting at a point, whose resultant is F.If F_2 is doubled F is also doubled. If F_2 is reversed then also F is doubled. Then $F_1 : F_2 : F$ is

A. $\sqrt{2} : \sqrt{2} : \sqrt{3}$

B. $\sqrt{3} : \sqrt{3} : \sqrt{2}$

C. $\sqrt{3} : \sqrt{2} : \sqrt{3}$

D. $\sqrt{2} : \sqrt{3} : \sqrt{2}$

Answer: D

Watch Video Solution

5. Two vectors of equal magnitude P are inclined at some angle such that the difference in magitude of resultant and magnitude of either of the vectors is 0.732 times either of the magnitude of vectors. If the angle between them is increased by half of its initial value then find the magnitude of difference of the vectors

A. $2P$

B. $\sqrt{2}P$

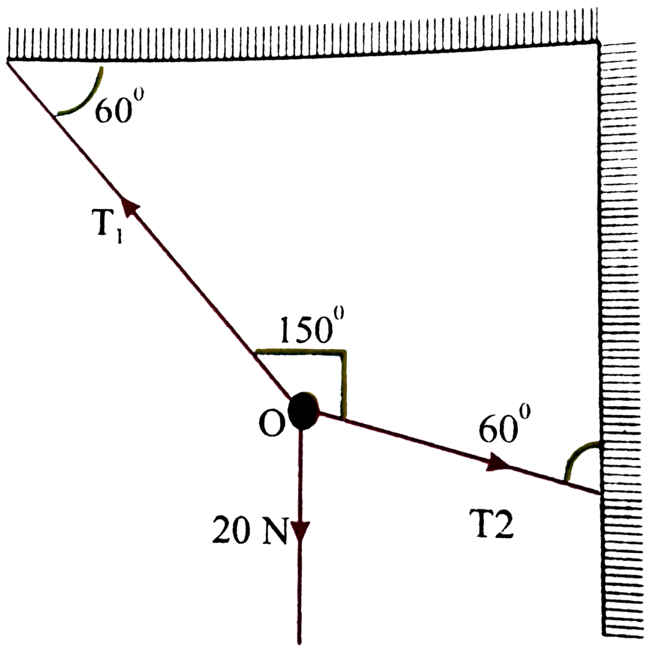
C. $3P$

D. $\sqrt{3}P$

Answer: B

Watch Video Solution

6. If O is at equilibrium then the values of the tension T_1 and T_2 are, ($20N$ is acting vertically downwards at O).



A. $20N$, $30N$

B. $20\sqrt{3}N, 20N$

C. $20\sqrt{3}N, 20\sqrt{3}N$

D. $10N, 30N$

Answer: B

Watch Video Solution

7. A particle starts from the origin at $t = Os$ with a velocity of $10.0\hat{j}m/s$ and moves in the xy-plane with a constant acceleration of

$\left(8\hat{i} + 2\hat{j}\right)m/s^{-2}$. What time is the x-coordinate of the particle $16m$?

A. $t = 2s$

B. $t = 4s$

C. $t = 3s$

D. $t = 1s$

Answer: A

Watch Video Solution

8. Resultant of two vectors of magnitude P and Q is of magnitude Q.If the magnitude of $\vec{Q}$ is doubled now the angle made by new resultant with $\vec{P}$ is

A. 30°

B. 90°

C. 60°

D. 120°

Answer: B

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Watch Video Solution

9. The two forces $2\sqrt{2}N$ and xN are acting at a point their resultant is perpendicular to $\hat{x}N$ and having magnitude of $\sqrt{6}N$.The angle between the two forces and magnitude of x are.

A. $\theta = 120^{\circ}, X = \sqrt{2}N$

B. $\theta = 30^{\circ}, X = \sqrt{2}N$

C. $\theta = 150^{\circ}, X = \sqrt{3}N$

D. $\theta = 150^{\circ}, X = \sqrt{2}N$

Answer: A

Watch Video Solution

10. The square of the resultant of two forces $4N$ and $3N$ exceeds the square of the resultant of the two forces by 12 when they are mutually perpendicular.The angle between the vectors is.

A. 30°

B. 60°

C. 90°

D. 120°

Answer: B

Watch Video Solution

11. An aeroplane flies along a straight line from A to B with a speed v_0. A steady wind v is blowing if $AB = l$ then

a)total time for the trip is $\frac{2v_0 l}{v_0^2 - v^2}$ if wind blows along the line AB

b)total time for the trip is $2\frac{l}{\sqrt{v_0^2 - v^2}}$,if wind blows perpendicular to the line AB

c)total time for the trip decrease because of the pressure of wind

d)total time for the trip increase because of the presence of wind

A. a, b, d are correct

B. a, b, c are correct

C. only a, d are correct

D. only b, d are correct

Answer: A

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12. Two particles, 1 and 2, move with constant velocities v_1 and v_2 along two mutually perpendicular straight lines toward the intersection point O. At the moment $t = 0$ the particles were located at the distances l_1 and l_2 from the point O. How soon will the distance between the particles become the smallest? What is it equal to?

A. $\dfrac{\left|l_1v_2 - l_2l_1\right|}{\sqrt{v_1^2 + v_2^2}}, \dfrac{l_1v_1 + l_2l_2}{v_1^2 + v_2^2}$

B. $\dfrac{\left|l_1v_1 - l_2l_2\right|}{\sqrt{v_1^2 + v_2^2}}, \dfrac{l_1v_2 + l_2l_1}{v_1^2 + v_2^2}$

C. $\dfrac{\left|l_1v_2 - l_2l_1\right|}{\sqrt{v_1^2 + v_2^2}}, \sqrt{\dfrac{l_1}{l_2}}, \dfrac{\left(l_1v_1 + l_2v_2\right)l_1}{\left(v_1^2 + v_2^2\right)l_2}$

D. $\dfrac{\left|l_1v_2 - l_2l_1\right|}{\sqrt{v_1^2 + v_2^2}}, \sqrt{\dfrac{l_2}{l_1}}, \dfrac{\left(l_1v_1 + l_2v_2\right)l_2}{\left(v_1^2 + v_2^2\right)l_1}$

Answer: A

Watch Video Solution

13. The distance between two moving particles P and Q at any time is a.If v_r be their relative velocity and if u and v be the components of v_r, along and perpendicular to PQ.The closest distance between P and Q and time that elapses before they arrive at their nearest distance is

A. $\dfrac{a\left(v+v_r\right)}{v}, a\left(1+\dfrac{v_r}{v}\right)^2$

B. $\dfrac{av}{\left(v+v_r\right)}, a\left(1+\dfrac{u}{v_2}\right)^2$

C. $\dfrac{av_r}{v}, \dfrac{av_r}{u^2}$

D. $\frac{av}{v_r}, \frac{au}{v_r^2}$

Answer: D

Watch Video Solution

14. Two ships are $10km$ apart on a line from south to north.The one farther north is moving towards west at $40kmph$ and the other is moving towards north at $40kmph$.Then distance of their closest approach is

A. $10km$

B. $10\sqrt{2}km$

C. $\frac{10}{\sqrt{2}}km$

D. $20km$

Answer: C

Watch Video Solution

15. Two stones are projected from the top of a tower in opposite direction, with the same velocity V but as 30° and 60° with horizontal respectively.The relative velocity of first stone relative to second stone is

A. $2v$

B. $\sqrt{2}v$

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

D. $\frac{V}{\sqrt{3}}$

Answer: B

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16. A motor boat going down stream comes over a floating body at a point A. 60 minutes later it turned back and after some time passed the floating body at a distance of $12km$ from the point A.Find the velocity of the stream assuming constant velocity for the motor boat in still water.

A. $2km/hr$

B. $3km/hr$

C. $4km/hr$

D. $6km/hr$

Answer: D

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17. It is raining at a speed of $5m/s^{-1}$ at an angle 37° to vertical, towards east.A man is moving to west with a velocity of $5m/s^{-1}$.The angle with the vertical at which he has to hold the umbrella to protect himself from rain is.

A. $\tan^{-1}(2)$ to west

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

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

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

Answer: A

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18. Rain, pouring down at an angle α with the vertical has a speed of $10ms^{-1}.A$ girl runs against the rain with a speed of $8ms/^{-1}$ and sees that the rain makes an angle β with the vertical, then relation between α and β is

A. $\tan\alpha = \dfrac{8 + 10\sin\beta}{10\cos\beta}$

B. $\tan\beta = \dfrac{8 + 10\sin\alpha}{10\cos\alpha}$

C. $\tan\alpha = \tan\beta$

D. $\tan\alpha = \cot\beta$

Answer: B

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19. A man can swim directly a stream of width $100m$ in 4 minutes, when there is no current of water and in $5 \min utes$ when there is current of water. The velocity of the current of water in the stream is

A. $15ms^{-1}$

B. $5ms^{-1}$

C. $2.5ms^{-1}$

D. $0.25ms^{-1}$

Answer: D

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20. The velocity of a boat in still water is $10m/s$ .If water flows in the river with a velocity of $6m/s$ what is the difference in times taken to cross the river in the shortest path and the shortest time.The width of the river is $80m$.

A. $1s$

B. $10s$

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

D. $2s$

Answer: D

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21. A boat takes $4hrs$ to travel certain distance in a river in down stream and it takes $6hrs$ to travel the same distance in upstream. Then the time taken by the boat to travel the same distance in still water is

A. $4.8hrs$

B. $9.8hrs$

C. $24hrs$

D. $10hrs$

Answer: A

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22. A boatman finds that he can save $6s$ in crossing a river by the quickest path than by the shortest path. If the velocity of the boat and the river be, respectively, $17ms^{-1}$ and $8ms^{-1}$, find the river width.

A. $675m$

B. $765m$

C. $567m$

D. $657m$

Answer: B

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23. A boy playing on the roof of a $10m$ high building throws a ball with a speed of $10m/s$ at an angle of $30(\circ)$ with the horizontal. How far from the throwing point will the ball be at the height of $10m$ from the ground ?

$$\left[g = 10m/s^2, \sin 30^{\circ} = \frac{1}{2}, \cos 30^{\circ} = \frac{\sqrt{3}}{2}\right]$$

A. $5.2m$

B. $4.33m$

C. $2.66m$

D. $8.66m$

Answer: D

Watch Video Solution

24. At a given instant of time the position vector of a particle moving in a circle with a velocity $3\hat{i} - 4\hat{j} + 5\hat{k}$ is $\hat{i} + 9\hat{j} - 8\hat{k}$. Its anglular velocity at that time is:

A. $\dfrac{\left(13\hat{i} - 29\hat{j} - 31\hat{k}\right)}{\sqrt{146}}$

B. $\dfrac{\left(13\hat{i} - 29\hat{j} - 31\hat{k}\right)}{146}$

C. $\dfrac{\left(13\hat{i} + 29\hat{j} - 31\hat{k}\right)}{\sqrt{146}}$

D. $\dfrac{\left(13\hat{i} + 29\hat{j} - 31\hat{k}\right)}{146}$

Answer: B

Watch Video Solution

25. A projectile is given an initial velocity of $\left(\hat{i} + 2\hat{j}\right)$ The Cartesian equation of its path is $\left(g = 10ms^{-1}\right)$ (Here , $\hat{i}$ is the unit vector along horizontal and $\hat{j}$ is unit vector vertically upwards)

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

B. $9y = 12x - 5x^2$

C. $y = 9x - 5x^2$

D. $5y = x - 9x^2$

Answer: A

Watch Video Solution

26. A projectile has initially the same horizontal velocity as it would acquire if it had moved from rest with uniform acceleration of $3ms^{-2}$ for 0.5 min. If the maximum height reached by it is $80m$, then the angle of projection is $\left(g = 10ms^{-2}\right)$.

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

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

C. $\tan^{-1}\left(\frac{4}{9}\right)$

D. $\sin^{-1}\left(\frac{4}{9}\right)$

Answer: C

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27. A ball is thrown from a point with a speed V_0,at an angle of projection θ.From the same point and at the same instance a person starts running with a constant speed $\frac{V_0}{\sqrt{2}}$ to catch the ball will the person be able to catch the ball? If yes, what should be the angle of projection

A. yes, $60°$

B. yes, $30°$

C. No

D. yes, $45°$

Answer: D

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28. The coach throws a baseball to a player with an initial speed at $20ms^{-1}$ at an angle of $45°$ with the horizontal.At the moment the ball is thrown, the player is $50m$ from coach.The speed and the direction that the player has to run to catch the ball at the same height at which it was released in ms^{-1} is

A. $\frac{5}{\sqrt{2}}$away from coach

B. $\frac{5}{\sqrt{2}}$ towards from coach

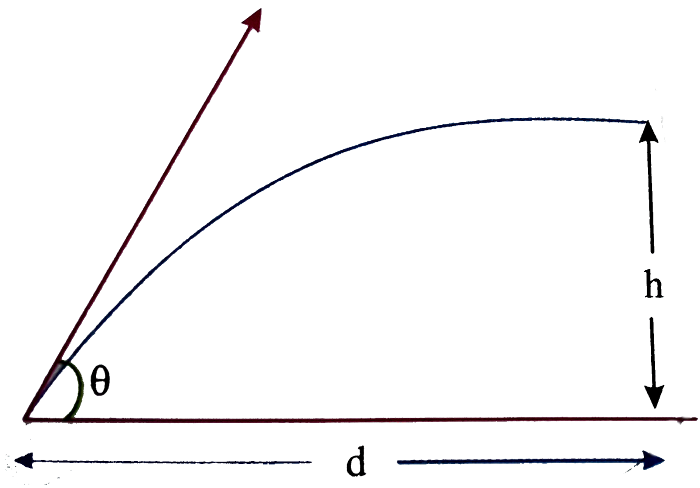
C. $\frac{\sqrt{2}}{5}$towards the coach

D. $\frac{\sqrt{2}}{5}$away from the coach

Answer: B

Watch Video Solution

29. If a stone is to hit at a point which is at a distance d away and at a height h (see fig) above the point from where the stone starts,then what is the value of initial speed u if the stone is launched at an angle θ?



A. $\frac{d}{\sin\theta}\sqrt{\frac{g}{2(d\tan\theta - h)}}$

B. $\frac{d}{\cos\theta}\sqrt{\frac{g}{2(d\tan\theta - h)}}$

C. $\sqrt{\frac{gd}{h\cos^2\theta}}$

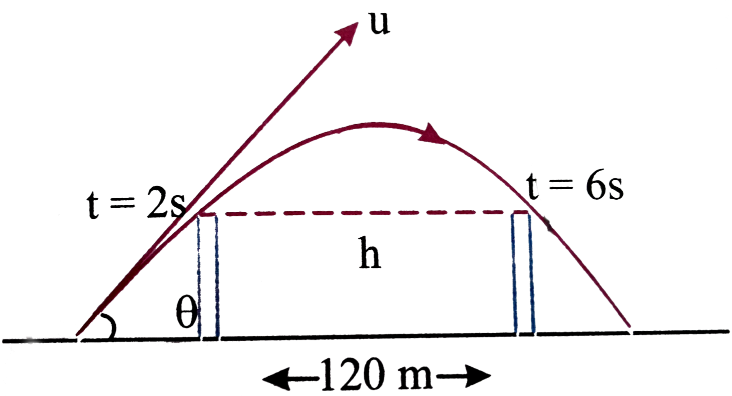
D. $\sqrt{\frac{gd}{(d - h)}}$

Answer: B

Watch Video Solution

30. If a projectile crosses two walls of equal height h symmetrically as shown in the fig.Choose the correct statement (s)

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



A. The time of flight is 8sec

B. The height of each wall is $60m$

C. The maximum height of projectile is $80m$

D. All the above

Answer: D

Watch Video Solution

31. A particle is dropped from a height h .Another particle which is initially at a horizontal distance d from the first is simultaneously projected with a horizontal velocity u and the two particles just collide on the ground.Then

A. $d^2 = \frac{u^2 h}{2}$

B. $d^2 = \frac{2u^2 h}{g}$

C. $d = h$

D. $gd^2 = u^2h$

Answer: B

Watch Video Solution

32. A ball is projected from the top of a tower with a velocity $3\hat{i} + 4\hat{j} + 5\hat{k}ms^{-1}$,where $\hat{i} + \hat{j} + \hat{k}$ are unit vectors along east, north and vertical upwards respectively. If the height of the tower is $30m$, its range is $\left(g = 10ms^{-1}\right)$

A. $12m$

B. $9m$

C. $15m$

D. $25m$

Answer: C

Watch Video Solution

33. A ball is projected from the top of a tower with a velocity $3\hat{i} + 4\hat{j} + 5\hat{k} ms^{-1}$,where $\hat{i} + \hat{j} + \hat{k}$ are unit vectors along east, north and vertical upwards respectively. If the height of the tower is $30m$, its time is $\left(g = 10ms^{-1}\right)$

A. 5

B. 3

C. 0.3

D. 0.5

Answer: B

Watch Video Solution

34. A cricketer of height $2.5m$ thrown a ball at an angle of $30\,^\circ$ with the horizontal such that it is received by another crickerter of same height standing at distance of $50m$ from the first one.Find the maximum height attained by the ball.

A. $10m$

B. $9m$

C. $10.7m$

D. $9.7m$

Answer: D

Watch Video Solution

35. A particle when fired at an angle $\theta = 60^\circ$ along the direction of the breadth of a rectangular building of dimension $9m \times 8m \times 4m$ so as to sweep the edges.Find the range of the projectile.

A. $8\sqrt{3}$

B. $4\sqrt{3}$

C. $\dfrac{8}{\sqrt{3}}$

D. $\dfrac{4}{\sqrt{3}}$

Answer: A

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36. A hiker stands on the edge of a cliff $490m$ above the ground and throwns a stone horiozontally with an initial speed of $15ms^{-1}$ neglecting air resistance.The time taken by the stone to reach the ground in seconds is

$\left(g = 9.8ms^2\right)$

A. 5

B. 10

C. 1

D. 5

Answer: B

Watch Video Solution

37. A hiker stands on the edge of a cliff $490m$ above the ground and throwns a stone horiozontally with an initial speed of $15ms^{-1}$ neglecting air resistance.The speed with which it hits the ground in ms^{-1} is $\left(g = 9.8ms^2\right)$

A. 9.8

B. 99

C. 4.9

D. 49

Answer: B

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38. The direction of a projectile at a certain instant is inclined at an angle $\propto$ to the horizontal , after t second, it is inclined at an angle β. Prove that the horizontal component of the velocity of the projectile is $\frac{\text{gt}}{\tan \propto - \tan\beta}$.

A. $\frac{g}{\tan\alpha - \tan\beta}$

B. $\frac{gt}{\tan\alpha - \tan\beta}$

C. $\frac{t}{(\tan\alpha - \tan\beta)}$

D. $\frac{gt}{\tan\alpha + \tan\beta}$

Answer: B

Watch Video Solution

39. Two bodies are projected from the same point with same speed in the directions making an angle α_1 and α_2 with the horizontal and strike at same point in the horizontal plane through a point of projection. If t_1 and t_2 are their time of flights.Then $\frac{t_1^2 - t_2^2}{t_1^2 + t_2^2}$

A. $\dfrac{\tan(\alpha_1 - \alpha_2)}{\tan(\alpha_1 + \alpha_2)}$

B. $\dfrac{\sin(\alpha_1 + \alpha_2)}{\sin(\alpha_1 - \alpha_2)}$

C. $\dfrac{\sin(\alpha_1 - \alpha_2)}{\sin(\alpha_1 + \alpha_2)}$

D. $\dfrac{\sin^2(\alpha_1 - \alpha_2)}{\sin^2(\alpha_1 + \alpha_2)}$

Answer: C

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40. At high altitude , a body explodes at rest into two equal fragments with one fragment receiving horizontal velocity of $10 m/s$. Time taken by the two radius vectors connecting of explosion to fragments to make $90\,^{\circ}$ is

A. $1 s$

B. $2 s$

C. $1.5 s$

D. $1.7 s$

Answer: A

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41. At a certain height a shell at rest explodes into two equal fragments one of the fragments receives a horizontal velocity u.The time interval after which the velocity vectors will be inclined at 120° to each other is

A. $\frac{u}{\sqrt{3}g}$

B. $\frac{\sqrt{3}u}{g}$

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

D. $\frac{u}{2\sqrt{3g}}$

Answer: A

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42. A bomb is rest at the summit of a cliff breaks into two equal fragments.One of the fragments attains a horizontal velocity of $20\sqrt{3}ms^{-1}$.The horizontal distance between the two fragments, when their displacement vectors is inclined at 60° relative to each other is $\left(g = 10 ms^{-2}\right)$

A. $40\sqrt{3}$

B. $80\sqrt{3}$

C. $120\sqrt{3}$

D. $480\sqrt{3}$

Answer: D

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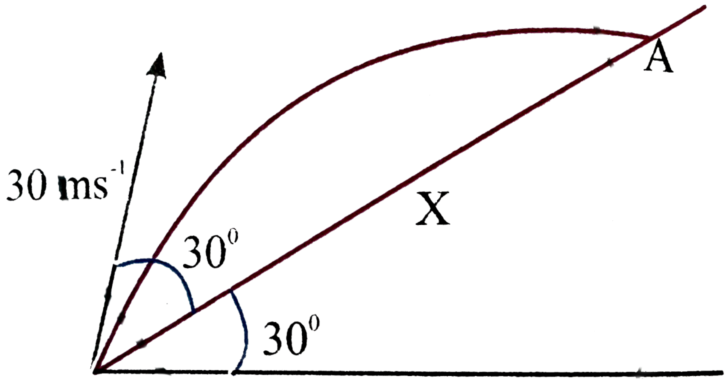
43. An object in projected up the inclined at the angle shown in the figure with an initial velocity of $30ms^{-1}$.The distance x up the incline at with the object lands is



A. $600m$

B. $104m$

C. $60m$

D. $208m$

Answer: C

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44. A projectile is fired with a velocity u at right angles to the slope, which is inclined at an angle θ with the horizontal. Derive an expression for the distance R to the point of impact.

.

A. $\frac{2u}{g}\tan\theta$

B. $\frac{2u}{g}\sec\theta$

C. $\frac{u^2}{g}\tan^2\theta$

D. $\frac{2u}{g}\tan\theta\sec\theta$

Answer: A

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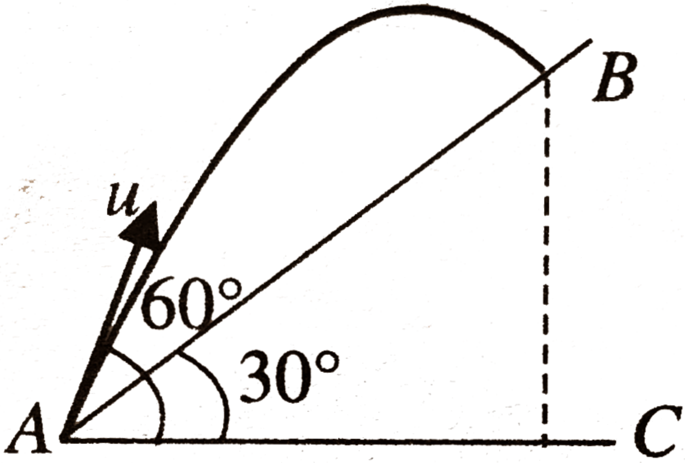
45. In the time taken by the projectile to reach from A to B is t. Then the distance AB is equal to.



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

B. $\sqrt{3}u\frac{t}{2}$

C. $\sqrt{3}ut$

D. $2ut$

Answer: A

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46. A particle moves on a circle of radius r with centripetal acceleration as function of time as $a_c = k^2rt^2$, where k is a positive constant. Find the following quantities as function of time at an instant :

(a) The speed of the particle

(b) The tangential acceleration of the particle

(c) The resultant acceleration, and

(d) Angle made by the resultant with tangential direction.

A. kt^2

B. kr

C. $kr\sqrt{k^2t^4 + 1}$

D. $kr\sqrt{k^2t^2 - 1}$

Answer: C

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47. A particle moves in a circular path such that its speed v varies with distance s as $v = \propto \sqrt{s}$, where $\propto$ is a positive constant.

Find the acceleration of the particle after traversing a distance s.

A. $\alpha^2\sqrt{\frac{1}{4}-\frac{S^2}{R^2}}$

B. $\alpha^2\sqrt{\frac{1}{4}+\frac{S^2}{R^2}}$

C. $\alpha\sqrt{\frac{1}{4}+\frac{S^2}{R^2}}$

D. $\alpha^2\sqrt{\frac{1}{4}+\frac{S^2}{R^2}}$

Answer: B

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48. A particle moves in a circle of radius 20 cm. Its linear speed is given by v=2t, where t is in second and v in metre/ second. Find the radial and tangential acceleration at t=3s.

A. only a, b, c are correct

B. only a, b, d are correct

C. only a, c, d are correct

D. all a, b, c, d are correct

Answer: D

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NCERT BASED QUES. SINGLE ANS.

1. the angle between the vectors $\left(\hat{i}+\hat{j}\right)$ and $\left(\hat{j}+\hat{k}\right)$ is

A. 45°

B. 90°

C. -45°

D. 180°

Answer: B

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2. Which one of the following statements is true?

A. A scalar quantity is the one that is conserved in a process

B. A scalar quantity is the one that can never take negative values

C. A scalar quantity is the one that does not vary from one point to another in space.

D. A scalar quantity has the same value for observes with different orientations of the axes.

Answer: D

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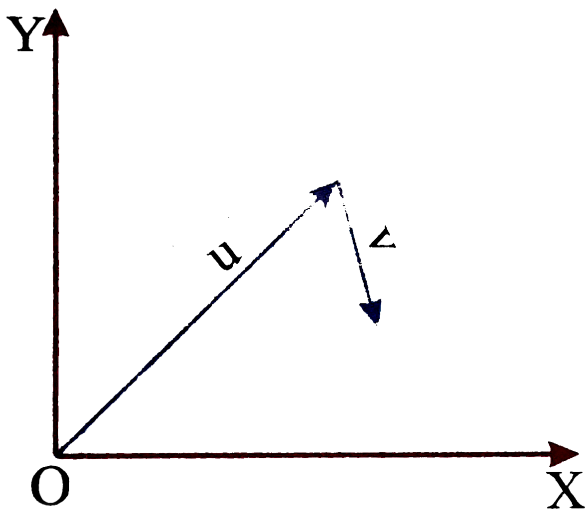
3. Figure shows the orientation of two vectors

u and $v$in the XY plane.

if$\vec{u} = a\hat{i} + b\hat{j}$ and $\vec{v} = p\hat{i} + q\hat{j}$

which of the following is correct?



A. a and p are positive while b and q are negative

B. a, p and b are positive while q is negative

C. a, q and b are positive while p is negative

D. a, b, q and q are all positive

Answer: B

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4. The component of a vector r along X-axis will have maximum value if

A. $\vec{r}$ is along positive Y-axis

B. $\vec{r}$ is along positive X-axis

C. $\vec{r}$ makes an angle of 45° with the X-axis

D. $\vec{r}$ is along negitive Y-axis

Answer: B

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5. The range of a projectile fired at an angle of 15° is 50 m. If it is fired with the same speed at an angle of 45° its range will be

A. $60m$

B. $71m$

C. $100m$

D. $141m$

Answer: C

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6. Pick out the only vector quantity in the following list : temperature, pressure, impulse, time, power. Total path-length, energy. Gravitational potential, coefficient of friction, charge,

A. Impulse, pressure and area

B. Impulse an area

C. Area and gravitational potential

D. Impulse and pressure

Answer: B

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

A. The average velocity is not zero at any time

B. Average acceleration must always vanish.

C. Displacements in equal time intervals are equal

D. Equal path lengths are traversed in equal intervals.

Answer: D

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

A. The acceleration of th particle is zero

B. The acceleration of th particle is bounded.

C. The acceleration of th particle is necessarly in the plane of motion.

D. The particle must be undergoing a uniform circular motion

Answer: C

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NCERT BASED QUES. MORE THAN ONE OPTION

1. Three vectors $\vec{A}, \vec{B}$ and $\vec{C}$ add up to zero.Find which is false.

A. $\left(\vec{A} \times \vec{B}\right) \times \vec{C}$ is not zero unless $\vec{B}, \vec{C}$ are parallel

B. $\left(\vec{A} \times \vec{B}\right). \vec{C}$ is not zero unless $\vec{B}, \vec{C}$ are parallel

C. If $\vec{A}, \vec{B}, \vec{C}$ define a plane, $\left(\vec{A} \times \vec{B}\right) \times \vec{C}$ is in that plane

D. $\left(\vec{A} \times \vec{B}\right). \vec{C} = \left|\vec{A}\right|\left|\vec{B}\right|\left|\vec{C}\right| \rightarrow C^2 = A^2 + B^2$

Answer: B::D

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2. It is found that $|A + B| = |A|$,This necessarily implies.

A. $\vec{B} = 0$

B. $\vec{A}, \vec{B}$ are antiparallel

C. $\vec{A}, \vec{B}$ are perpendicular

D. $\vec{A}, \vec{B} \leq 0.$

Answer: A::B

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3. Two particles are projected in air with speed v_0 at angles θ_1 and θ_2 (both acute) to the horizontal,respectively.If the height reached by the first particle greater than that of the second,then thick the right choices

A. angle of projection:$\theta_1 > \theta_2$

B. time of flight:$T_2 > T_1$

C. horizontal range:$R_1 > R_2$

D. total energy : $U_1 > U_2$

Answer: A::B::C

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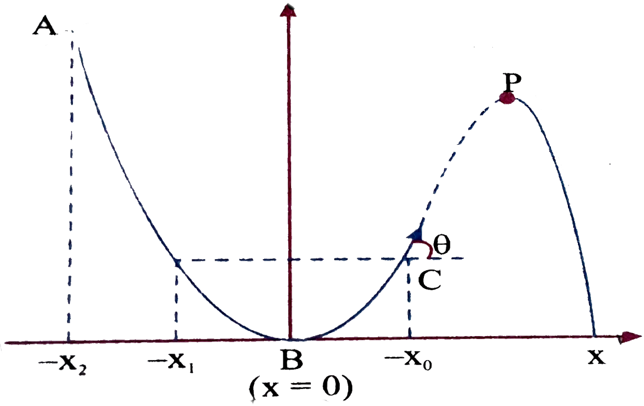
4. A particle slides down a frictionless paraboli $\left(y = x^2\right)$ track $(A - B - C)$ starting from rest at point A.Point B is at the vertex of parabola and point C is at a height less than that of point A.After C,the particle moves freely in air as a projectile. If the particle reaches highest point at P,then



A. KE at P = KE at B

B. height at P=height at A

C. total energy at P=total energy at A

D. time of travel from A to B =time of travel from B to P

Answer: C

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5. Following are four different relations about displacement, velocity and acceleration for the motion of a particle in general. Choose the incorrect one (s)

A. $v_{av} = \frac{1}{2}\left[v\left(t_1\right) - v\left(t_2\right)\right]$

B. $v_{av} = \frac{r\left(t_2\right) - r\left(t_1\right)}{t_2 - t_1}$

C. $r = \frac{1}{2}\left(v\left(t_2\right) - v\left(t_1 t\right)t_2 - t_1\right)$

D. $a_{av} = \frac{v\left(t_2\right) - v\left(t_1\right)}{t_2 - t_1}$

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 particles moves

D. Angular momentum is constant in magnitude but direction keeps changing.

Answer: A::B::C

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NCERT BASED QUES. PASSAGE

1. A cricket fielder can throw the cricket ball with a speed v_0.If the throws the ball while running with speed u at an angle θ to the horizontal.

The effective angle to the horizontal at which the ball is projected in air as seen by a spector is

A. $\theta = \tan^{-1}\left(\frac{v_0\sin\theta}{u + v_0\cos\theta}\right)$

B. $\theta = \tan^{-1}\left(\frac{v_0\cos\theta}{u + v_0\sin\theta}\right)$

C. $\theta = \cot^{-1}\left(\frac{v_0\cos\theta}{u + v_0\sin\theta}\right)$

D. $\theta = \cot^{-1}\left(\frac{v_0\cos\theta}{u + v_0\sin\theta}\right)$

Answer: A

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2. A cricket fielder can throw the cricket ball with a speed v_0. If he throws the ball while running with speed (u) at angle θ to the horizontal, find

(b) what will be time of flight ?

(c) what is the distance (horizontal range) form the point of projection at which the ball will land ?

(d) find θ at which he should throw the ball that would maxmise the horizontal range range as found in (c).

(e) how does θ for maximum range change if

$u > v_0, u = v_0, \underline{t} v_0$?

(f) how does θ in (e) compare with that for `

u=0 (i.e., 45^@) ?

A. $T = \dfrac{2v_0}{g}$

B. $T = \dfrac{2\left(u + v_0 \sin\theta\right)}{g}$

C. $T = \dfrac{2v_0 \sin\theta}{g}$

D. $T = \dfrac{2u}{g}$

Answer: C

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3. A cricket fielder can throw the cricket ball with a speed v_0. If he throws the ball while running with speed (u) at angle θ to the horizontal, find

(b) what will be time of flight ?

(c) what is the distance (horizontal range) form the point of projection at which the ball will land ?

(d) find θ at which he should throw the ball that would maxmise the horizontal range range as found in (c).

(e) how does θ for maximum range change if

$u > v_0, u = v_0, \underline{t}v_0$?

(f) how does θ in (e) compare with that for `

u=0 (i.e., 45^@) ?

A. $R = \frac{v_0}{g}\left[u\sin 2\theta + v_0 \sin\theta\right]$

B. $R = \frac{v_0}{g}\left[2u\sin\theta + v_0 \sin 2\theta\right]$

C. $R = \frac{v_0}{g}\left[u\sin\theta + v_0 \sin\theta\right]$

D. $R = \frac{v_0^2 \sin 2\theta}{g}$

Answer: B

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4. A cricket fielder can throw the cricket ball with a speed v_0. If he throws the ball while running with speed (u) at angle θ to the horizontal, find

(b) what will be time of flight ?

(c) what is the distance (horizontal range) form the point of projection at which the ball will land ?

(d) find θ at which he should throw the ball that would maxmise the horizontal range range as found in (c).

(e) how does θ for maximum range change if

$u > v_0, u = v_0, \underline{t}v_0$?

(f) how does θ in (e) compare with that for `

u=0 (i.e., 45^@) ?

A. $\theta_{max} = \cos^{-1}\left[\dfrac{-u + \sqrt{u^2 + 8v_0^2}}{4v_0}\right]$

B. $\theta_{max} = \cos^{-1}\left[\dfrac{u + \sqrt{u^2 + 8v_0^2}}{4v_0}\right]$

C. $\theta_{max} = \cos^{-1}\left[\dfrac{-u + \sqrt{u^2 - 8v_0^2}}{4v_0}\right]$

D. $\theta_{max} = \cos^{-1}\left[\frac{-u + \sqrt{u^2 - 4v_0^2}}{4v_0}\right]$

Answer: A

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5. A cricket fielder can throw the cricket ball with a speed v_0. If he throws the ball while running with speed (u) at angle θ to the horizontal, find

(b) what will be time of flight ?

(c) what is the distance (horizontal range) form the point of projection at which the ball will land ?

(d) find θ at which he should throw the ball that would maxmise the horizontal range range as found in (c).

(e) how does θ for maximum range change if $u > v_0, u = v_0, \underline{t}v_0$?

(f) how does θ in (e) compare with that for ` u=0 (i.e., 45^@) ?

A. $\frac{\pi}{2}$

B. 0

C. $\frac{\pi}{3}$

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

Answer: A

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6. A cricket fielder can throw the cricket ball with a speed v_0. If he throws the ball while running with speed (u) at angle θ to the horizontal, find

(b) what will be time of flight ?

(c) what is the distance (horizontal range) form the point of projection at which the ball will land ?

(d) find θ at which he should throw the ball that would maxmise the horizontal range range as found in (c).

(e) how does θ for maximum range change if $u > v_0, u = v_0, \underline{t}v_0$?

(f) how does θ in (e) compare with that for ` u=0 (i.e., 45^@) ?

A. $\frac{\pi}{2}$

B. 0

C. $\frac{\pi}{3}$

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

Answer: C

Watch Video Solution

7. A cricket fielder can throw the cricket ball with a speed v_0.If the throws the ball while running with speed u at an angle θ to the horizontal.

The $\theta_{\max}$ for which maximum range change if

$u << v_0$ is

A. $\frac{\pi}{2}$

B. 0

C. $\frac{\pi}{3}$

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

Answer: D

View Text Solution

8. A cricket fielder can throw the cricket ball with a speed v_0. If he throws the ball while running with speed (u) at angle θ to the horizontal, find

(b) what will be time of flight ?

(c) what is the distance (horizontal range) form the point of projection at which the ball will land ?

(d) find θ at which he should throw the ball that would maxmise the horizontal range range as found in (c).

(e) how does θ for maximum range change if

$u > v_0, u = v_0, \underline{t}v_0$?

(f) how does θ in (e) compare with that for `

u=0 (i.e., 45^@) ?

A. $\frac{\pi}{2}$

B. 0

C. $\frac{\pi}{3}$

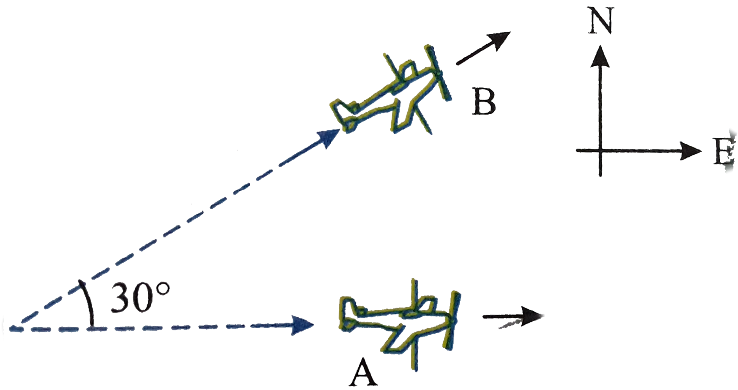
D. $\frac{\pi}{4}$

Answer: D

Watch Video Solution

Level -V Single answer

1. An aeroplne A is flying horizontally due east at a speed of $400 km/hr$.Passengers in A, observe another aeroplane B moving perpendicular to direction of motion of A .Aeroplane B is actually moving in a direction 30° north of east in the same horizontal plane as shown in the figure.Determine the velocity of B



A. $400\sqrt{3}\hat{i} + 400\sqrt{3}\hat{j}$

B. $400\hat{i} + \frac{400}{\sqrt{3}}\hat{j}$

C. $400\hat{i} + 400\hat{j}$

D. $\frac{400}{\sqrt{3}}\hat{i} + 400\hat{j}$

Answer: B

Watch Video Solution

2. A boat moves relative to water with a velocity v which is n times less than the river flow velocity u. At what angle to the stream direction must the boat move to minimize drifting ?

A. $\theta = \sin^{-1}\left(\frac{v}{u}\right)$ from normal direction

B. $\theta = \cos^{-1}\left(\frac{v}{u}\right)$ from normal direction

C. $\theta = \tan^{-1}\left(\frac{v}{u}\right)$ from normal direction

D. $\theta = \sin^{-1}\left(\frac{u}{v}\right)$ from normal direction

Answer: A

Watch Video Solution

3. A man wishes to cross a river flowing with velocity u swims at an angle θ with the river flow.If the man swims with speed $v$and if the width of the river is d, then the drift travelled by him is

A. $(u + v\cos\theta)\dfrac{d}{v\sin\theta}$

B. $(u - v\cos\theta)\dfrac{d}{v\sin\theta}$

C. $(u - v\cos\theta)\dfrac{d}{v\cos\theta}$

D. $(u + v\cos\theta)\dfrac{d}{v\cos\theta}$

Answer: A

Watch Video Solution

4. A boat moves relative to water with a velocity which is $n = 2.0$ times less than the river flow velocity. At what angle to the stream direction must the boat move to minimize drifting?

A. 45°

B. 60°

C. 120°

D. 90°

Answer: C

Watch Video Solution

5. Two bodies were thrown simultaneously from the same point, one, straight up, and the other, at an angle of $\theta = 60\,°$ to the horizontal. The initial velocity of each body is equal to $v_0 = 25 m/s$. Neglecting the air drag, find the distance between the bodies $t = 1.70 s$ later.

A. $20m$

B. $18m$

C. $22m$

D. $24m$

Answer: C

Watch Video Solution

6. A sailor in a boat, which is going due east with a speed of $8m/s$ observes that a submarine is heading towards north at a speed of $12m/s$ and sinking at a rate of $2m/s$ .The commander of submarine observes a helicopter ascending at a rate of $5m/s$ and heading towards west with $4m/s$.Find the speed of the helicopter with respect to boat.

A. $10m/s$

B. $11m/s$

C. $12m/s$

D. $13m/s$

Answer: D

Watch Video Solution

7. Consider a collection of a large number of particles each with speed v in a plane.The direction of velocity is randomly distributed in the collection.The magnitude of the average relative velocity of a particle with velocities of all other particles is

A. $> v$

B. $< v$

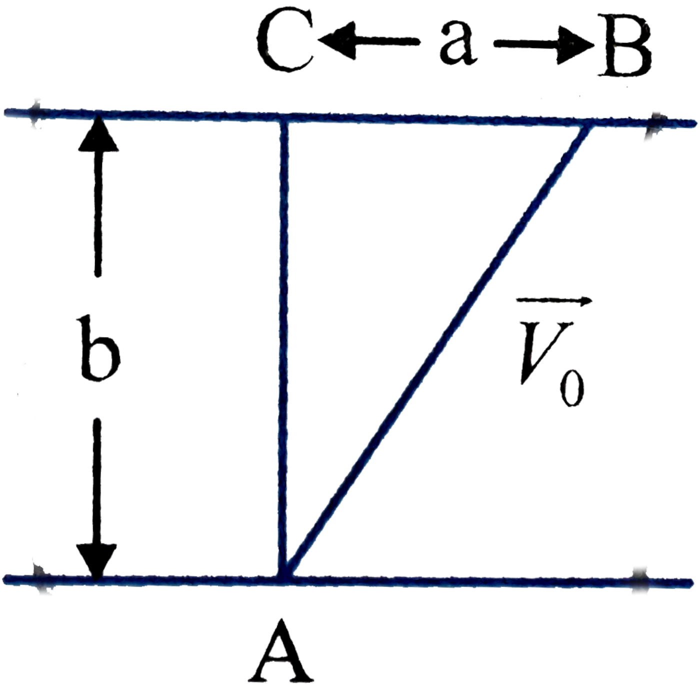
C. $= v$

D. none of these

Answer: A

Watch Video Solution

8. A man in a row boat must get from point A to point B on the opposite bank of the river (see figure).The distance $BC = a$.The width of the river $AC = b$.At what minimum speed u relative to the still water should the boat travel to reach the point B?The velocity of flow of the river is v_0



A. $\dfrac{v_0 b}{\sqrt{a^2+b^2}}$

B. $\dfrac{v_0 a}{\sqrt{a^2+b^2}}$

C. $\dfrac{v_0 b}{\sqrt{2}a}$

D. $\frac{v_0 a}{\sqrt{2}b}$

Answer: A

Watch Video Solution

9. A man standing on a road has to hold his umbrella at 30^0 with the vertical to keep the rain away. The throws the umbrella and starts running at 10 km/h. He finds that raindrops are hitting his head vertically. Find the speed of raindrops with respect to a. the road, b. the moving man.

A. $12km/hr$

B. $14km/hr$

C. $16km/hr$

D. $18km/hr$

Answer: C

Watch Video Solution

10. A motor boat has a speed of $5 m/s$.At time $t = 0$,its position vector relative to a origin is $\left(-11\hat{i} + 16\hat{j}\right)m$,having the aim of getting as close as possible to a steamer.At time $t = 0$,the steamer is at the point $\left(4\hat{i} + 36\hat{j}\right)m$ and is moving with constant velocity $\left(10\hat{i} - 5\hat{j}\right)m/s$ .Find the direction in which the motorboat must steer

A. $3\hat{i} + 3\hat{j}$

B. $3\hat{i} + 4\hat{j}$

C. $4\hat{i} + 3\hat{j}$

D. $4\hat{i} + 4\hat{j}$

Answer: C

Watch Video Solution

11. A river $400m$ wide is flowing at a rate of $2.0m/s$. A boat is sailing at a velocity of $10.0m/s$ with respect to the water In a direction perpendicular to the river.

(a) Find the time taken by the boat to reach the opposite bank.

(b) How far from the point directly opposite to the starting point does the boat reach the opposite bank?

A. $40 \sec, 80m$

B. $30 \sec, 40m$

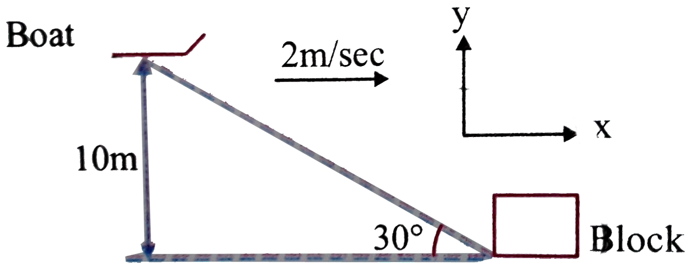
C. $20 \sec, 20m$

D. $35 \sec, 80m$

Answer: A

Watch Video Solution

12. A block of mass m in floating in a river flowing with a velocity of $2m/s$.A boat is moving behind the block with a velocity of $5m/s$ with respect to the block as shown.From the boat a stone is thrown with a velocity $\vec{v} = v_1\hat{i} - v\hat{j} + v_3\hat{k}$ with respect to the river such that it hits the block.If $v_1 : v_2 : v_3 = 2\sqrt{3} : 2 : 3$ then the velocity of the stone with respect to the ground is $\left(g = 10m/s^2\right)$



A. $10\hat{i} - \dfrac{10}{\sqrt{3}}\hat{j} + 5\sqrt{3}\hat{k}$

B. $12\hat{i} - \dfrac{10}{\sqrt{3}}\hat{j} + 5\sqrt{3}\hat{k}$

C. $10\hat{i} - 10\hat{j} + 5\sqrt{3}\hat{k}$

D. $10\sqrt{3}\hat{i} - \dfrac{10}{\sqrt{3}}\hat{j} + 5\sqrt{3}\hat{k}$

Answer: B

Watch Video Solution

13. From a point on the ground at a distance a from the foot of a pole, a ball is thrown at an angle of 45°, which just touches the top of the pole and strikes the ground at a distance of b, on the outer side of it. Find the height of the pole.

A. $\dfrac{ab}{a - b}$

B. $\dfrac{ab}{a + b}$

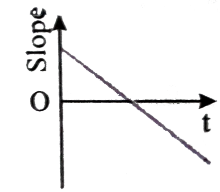
C. $\dfrac{2ab}{a + b}$

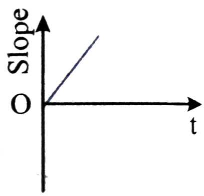
D. $\dfrac{ab}{a + 2b}$

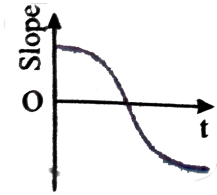
Answer: B

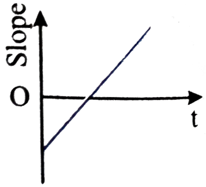
Watch Video Solution

14. A heavy particle is projected with a velocity at an angle with the horizontal into the uniform gravitational field. The slope of the trajectory of the particle varies as

A. 

B. 

C. 

D. 

Answer: A

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15. A fixed morter fires a bomb at an angle of 53° above the horizontal with a muzzle velocity of $80ms^{-1}$. A tank is advancing directly towards the mortar on level ground at a constant speed of $5m/s$. The initial separation (at the instant mortar is fired) between the mortar and tank, so that the tank would be hit is $\left[Take g = 10ms^{-2}\right]$

A. $662.4m$

B. $526.3m$

C. $486.6m$

D. $678.4m$

Answer: D

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16. The angular elevation of an enemy's position on a hill 'h' ft height is α.Wha should be the minimum velocity of the projectile in order to hit the enemy?

A. $u = \sqrt{gh(\cos\alpha + 1)}$

B. $u = \sqrt{gh(\sin\alpha + 1)}$

C. $u = \sqrt{gh(\operatorname{cossec}\alpha + 1)}$

D. $u = \sqrt{gh(\sec\alpha + 1)}$

Answer: C

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17. Two particles are projected simultaneously with the same speed v in the same vertical plane with angles of elevation θ, and 2θ, where $\theta < 45°$ .At what time will velocities be parallel?

A. $t = \frac{v}{g}\tan\frac{\theta}{2}\operatorname{cosec}\frac{3\theta}{2}$

B. $t = \frac{v}{g}\cos\frac{\theta}{2}\cot\frac{3\theta}{2}$

C. $t = \frac{v}{g}\cos\frac{\theta}{2}\tan\frac{3\theta}{2}$

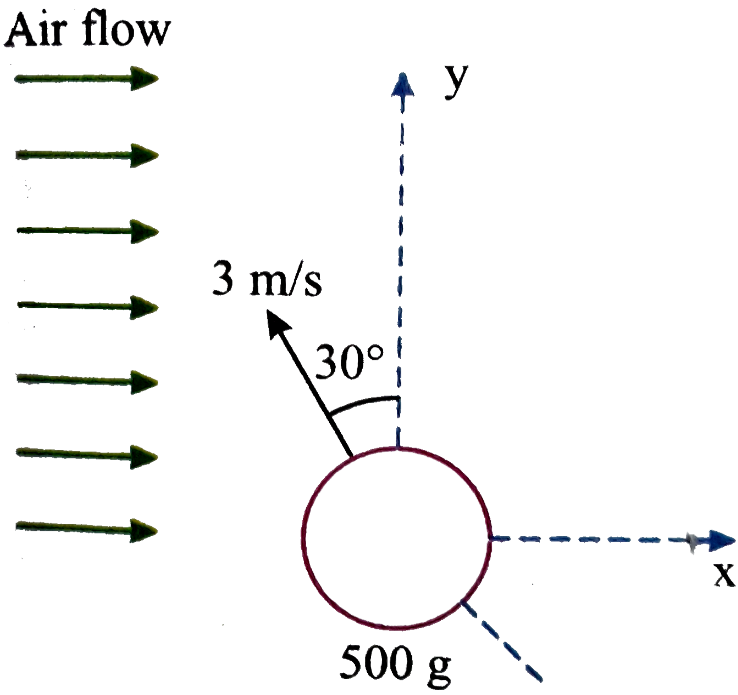
D. $t = \frac{v}{g}\cos\frac{\theta}{2}\operatorname{cosec}\frac{3\theta}{2}$

Answer: D

Watch Video Solution

18. Figure shows a sphere moving in a steady flow of air in the x-direction on a horizontal plane.The air stream exerts an essentially constant acceleration $1.8 m/\sec^2$ on the sphere in the x-direction.If at $t = 0$ the sphere is moving as shown in figure, determine the time

t required for the sphere to cross the y-axis



again.

A. $1/3$sec

B. $2/3$sec

C. $4/3$sec

D. $5/3$sec

Answer: D

Watch Video Solution

19. 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

Watch Video Solution

20. 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 : $\left(g = 10ms^{-2}\right)$

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

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

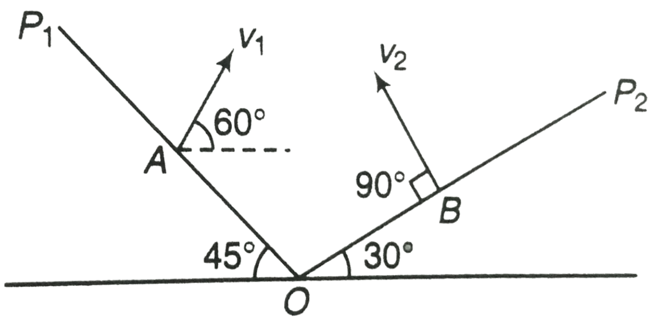
C. $\tan^{-1}(2)$

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

Answer: D

Watch Video Solution

21. A particle is projected from an inclined plane OP_1 from A with velocity $v_1 = 8ms^{-1}$ at an angle $60°$ with horizontal. An another particle is projected at the same instant from B with velocity $v_2 = 16ms^{-1}$ and perpendicular to the plane OP_2 as shown in figure. After time $10(\sqrt{3})$ s there separation was minimum and found to be 70m. Then find distance AB.



A. $250m$

B. $500m$

C. $750m$

D. $1000m$

Answer: A

Watch Video Solution

22. 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. $30° + \tan^{-1}\left(\frac{1}{2\sqrt{3}}\right)$

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

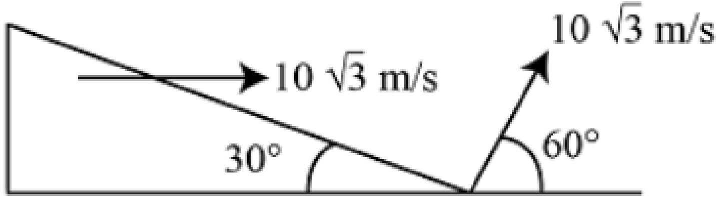
C. $60°$

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

Answer: B

Watch Video Solution

23. A particle is projected at an angle 60° with speed $10\left(\sqrt{3}\right)m/s$, from the point A, as shown in the figure. At the same time the wedge is made to move with speed $10\left(\sqrt{3}\right)m/s$ towards right as shown in the figure. Then the time after which particle will strike with wedge is



A. $2s$

B. $2\sqrt{3}s$

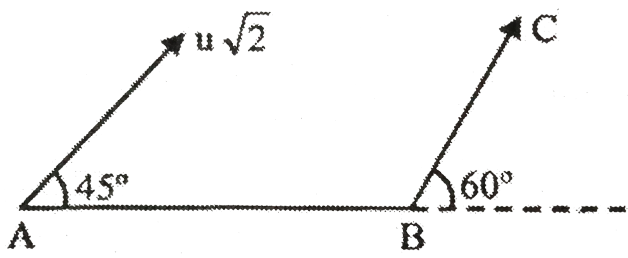
C. $\frac{4}{\sqrt{3}}s$

D. none of these

Answer: A

Watch Video Solution

24. A particle is projected from a point A with velocity $u\sqrt{2}$ at an angle of 45° with horizontal as shown in the figure. It strikes the plane BC at right angles. The velocity of the particle at the time of collision is



A. $\dfrac{\sqrt{3}u}{2}$

B. $\dfrac{u}{2}$

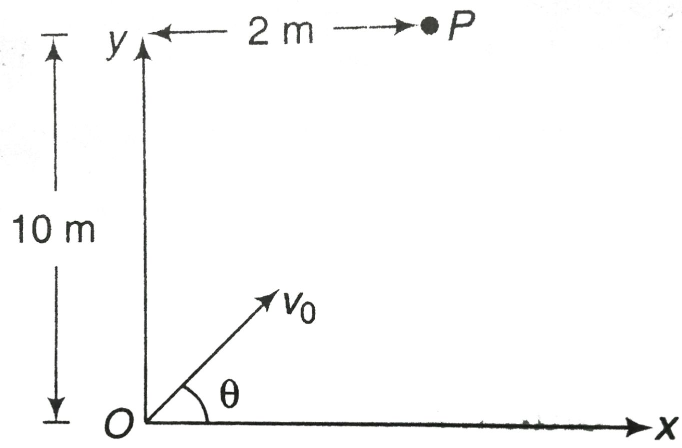
C. $\dfrac{2u}{\sqrt{3}}$

D. u

Answer: C

Watch Video Solution

25. A particle is dropped from point P at time t = 0. At the same time another particle is thrown from point O as shown in the figure and it collides with the particle P. Acceleration due to gravity is along the negative y-axis. If the two particles collide 2 s after they start, find the initial velocity v_0 of the particle which was projected from O. Point O is not necessarily on ground.



A. $\sqrt{6}m/s^{-1}, \theta = \tan^{-1}(1)$ with X-axis

B. $\sqrt{26}m/s^{-1}, \theta = \tan^{-1}(5)$ with X-axis

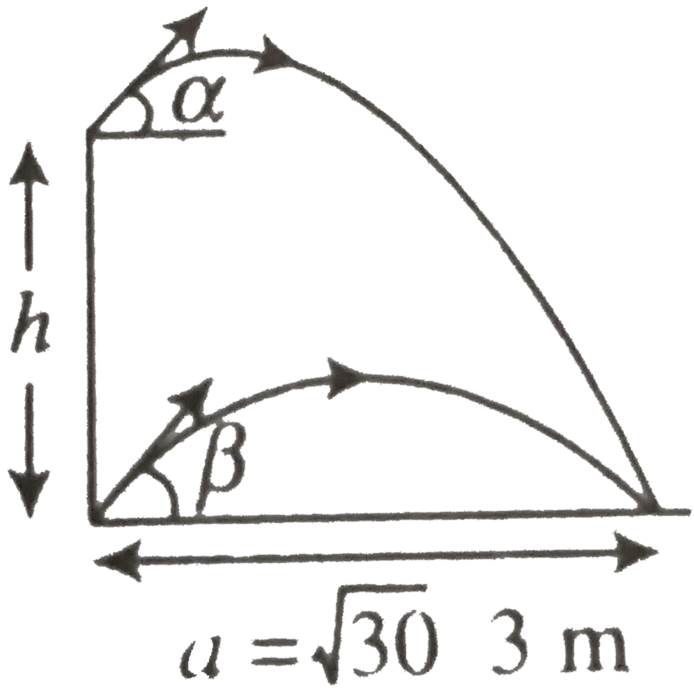
C. $\sqrt{2}m/s^{-1}, \theta = \tan^{-1}(2)$ with X-axis

D. $\sqrt{13}m/s^{-1}, \theta = \tan^{-1}(4)$ with X-axis

Answer: B

Watch Video Solution

26. Shots are fired simultaneously from the top and bottom of a vertical cliff with the elevation $\alpha = 30^{\circ}$, beta $= 60^{\circ}$, respectively. The shots strike an object simultaneously at the same point. If $a = 10\left(\sqrt{3}\right)$ m is the horizontal distance of the object from the cliff, then the height h of the cliff is



A. $\frac{a(\cot\alpha - \cot\beta)}{\cot\alpha\cot\beta}$

B. $a(\sin\beta - \tan\alpha)$

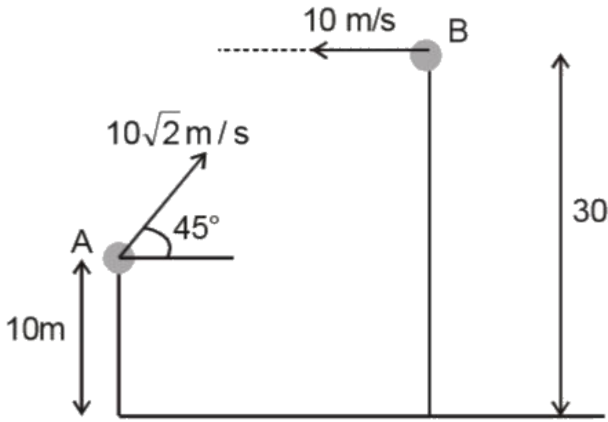
C. $\frac{a\tan\alpha}{\tan\beta}$

D. $a(\cot\alpha - \cot\beta)$

Answer: A

Watch Video Solution

27. Two projectiles are projected simultaneously from two towers as shwon in figure. If the projectiles collide in the air, then find the distance "s" between the towers.



A. $10m$

B. $20m$

C. $30m$

D. $40m$

Answer: B

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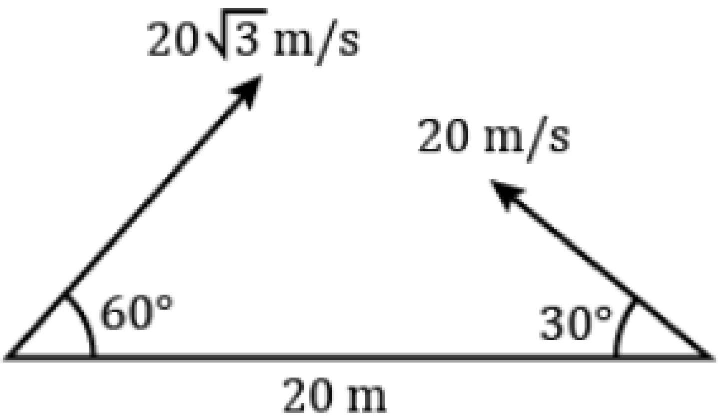
28. In the figure shown, the two projectiles are fired simultaneously. The minimum distance between them during their flight is



A. $20m$

B. $10\sqrt{3}m$

C. $10m$

D. zero

Answer: B

Watch Video Solution

29. Two particles A and B are projected simultaneously in the directins shown in figure with velocities $v_A = 20m/s$ and $v_B = 10m/s$ respectively. They collide in air after $\frac{1}{2}$ s. Find

(a) the angle θ

(b) the distance x.

.

A. $2\sqrt{3}m$

B. $3\sqrt{3}m$

C. $4\sqrt{3}m$

D. $5\sqrt{3}m$

Answer: D

30. A particle starts from the origin of coordinates at time t = 0 and moves in the xy plane with a constant acceleration α in the y-direction. Its equation of motion is $y = \beta x^2$. Its velocity component in the x-direction is

A. Variable

B. $\sqrt{\frac{2\alpha}{\beta}}$

C. $\frac{\alpha}{2\beta}$

D. $\sqrt{\frac{\alpha}{2\beta}}$

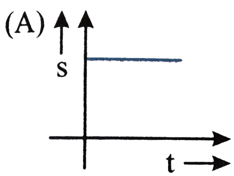
Answer: D

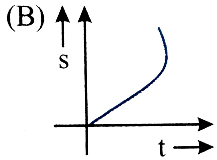
Watch Video Solution

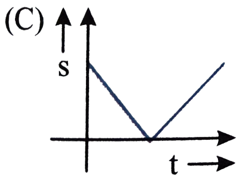
31. Motion of a particle is governed by following relations

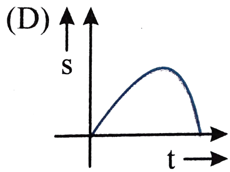
$y = \frac{x}{\alpha}, V_x = b - ct. (a, b, care + veconst)$

The displacement (S) verson from (t) graph os

A. 

B. 

C. 

D. 

Answer: D

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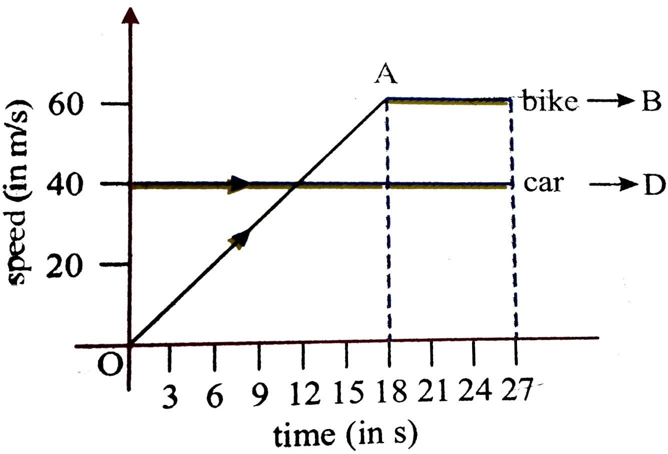
Level -V Multi answer

1. At that instant a motor bike starts from rest in a given direction, a car overtakes the motor bike, both moving in the same direction.The speed time graphs for motor bike and car are represented by OAB and CD respectively.Then



A. at $t = 18s$ the motor bike and car are $180m$ apart.

B. at $t = 18s$ the motor bike and car are $720m$ apart.

C. the relative distance between motor bike and car reduce to zero at $t = 27s$ and both are $1080m$ far from origin

D. the relative distance between motor bike and car always remains same.

Answer: A::C

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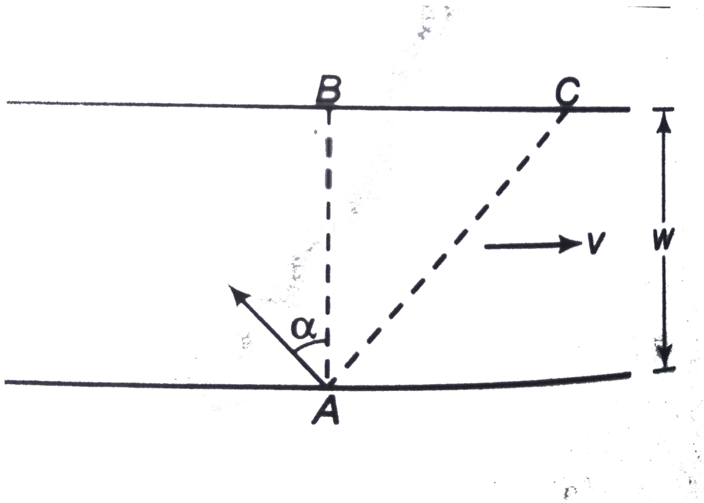
2. A man in a boat crosses a river from point A. If he rows perpendicular to the banks he reaches point C ($BC = 120m$) in 10 min. If the man heads at a certain angle α to the straight line AB (AB is perpendicular to the banks) against the current he reaches point B in 12.5 min. Find the width of the river w, the rowing velocity u, the speed of the river current v and the angle α. Assume the velocity of the boat relative to water to be constant and the same magnitude in both cases.



A. The width of the river is $300 m$

B. The width of the river is $200 m$

C. The rowing velocity is $20 m/\ \text{min}$

D. The rowing velocity is $30 m/\ \text{min}$

Answer: B::C

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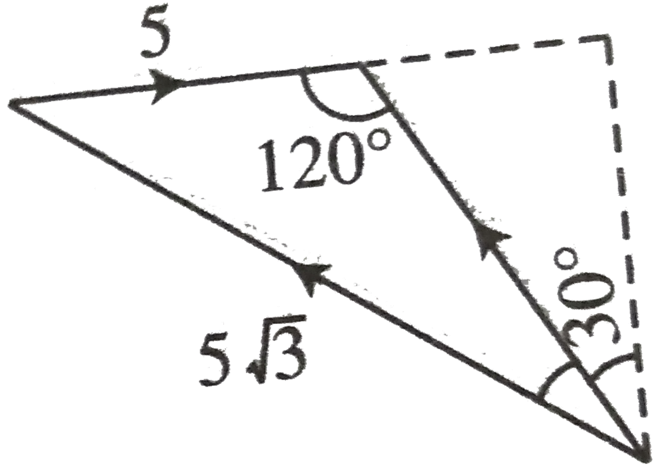
3. A motor boat is to reach at a point 30° upstream on the outer side of a river flowing with velocity $5ms^{-1}$. The velocity of motor boat with respect to water is $5\left(\sqrt{3}\right)ms^{-1}$. The driver should steer the boat at an angle.



A. 30 ° up w.r.t the line of destination from the starting point

B. 60 ° up w.r.t normal to the bank

C. 150 ° w.r.t stream direction

D. none of these

Answer: A::B::C

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4. A car is moving rectilinearly on a horizontal path with acceleration a_0.A person sitting inside the car observes that an insect S is crawling up the screen with an acceleration a.If θ is the inclination of the wind screen with the horizontal, then the acceleration of the insect.

A. perpendicular to screen is $a_0 \tan\theta$

B. perpendicular to screen is $a_0 \sin\theta$

C. along the horizontal is a_0 - $a\cos\theta$

D. parallel to screen is $a + a_0 \cos\theta$

Answer: B::C

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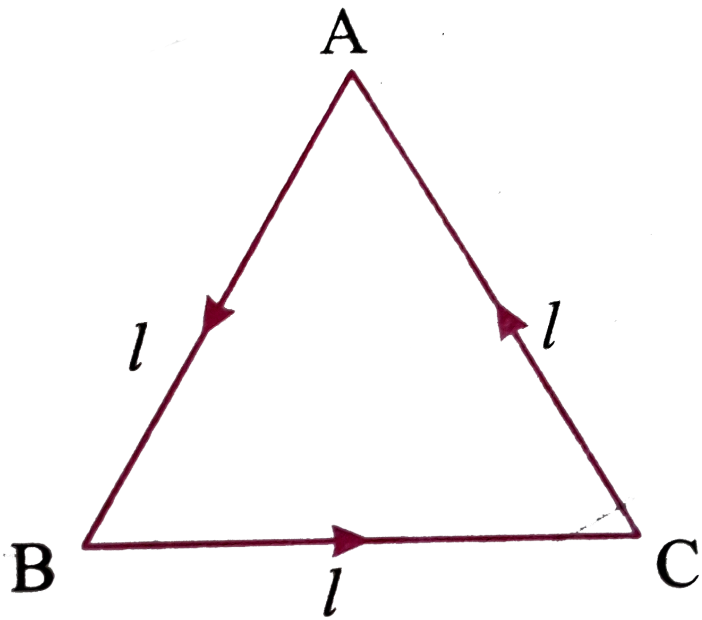
5. Three particles A, B and C and situated at the vertices of an equilateral triangle ABC of side of length l at time $t = 0$,Each of the particles move with constant speed u. A always has its velocity along AB, B along BC and C along CA.



A. The time after which they meet is $\frac{2l}{3u}$

B. Total distance travelled by each particle before they meet is $\frac{2l}{3}$

C. Average velocity during the motion is $\frac{\sqrt{3}u}{2}$

D. Relative velocity of apporach between any two particles is $\frac{3u}{2}$

Answer: A::B::C::D

Watch Video Solution

6. 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. width of the river is $200m$

B. velocity of the boat with respect to water $12m/ \text{ min}$

C. speed of the current $20m/ \text{ min}$

D. velocity of the boat with respect to water $20m/ \text{ min}$

Answer: A::D

Watch Video Solution

7. The coordinate of a particle moving in a plane are given by $x(t) = a\cos(pt)$ and $y(t) = b\sin(pt)$ where $a, b(< a)$ and P are positive constants of appropriate dimensions . Then

A. The path of the particle is an ellipse

B. The velocity and acceleration of the particle are normal to each other at $t = \frac{\pi}{2p}$

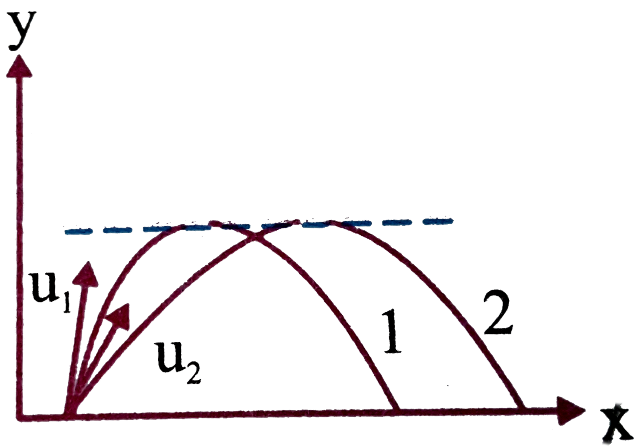
C. The acceleration of the particle is always directed towards a fixed position

D. The distance travelled by the particle in time internal $t = 0$ to $t = \frac{\pi}{2p}$ is a

Answer: A::B::C

Watch Video Solution

8. Trajectories of two projectiles are shown in figure.Let T_1 and T_2 be the time periods and u_1 and u_2 their speeds of projection.Then



A. $T_2 > T_1$

B. $T_1 = T_2$

C. $u_1 > u_2$

D. $u_1 < u_2$

Answer: B::D

Watch Video Solution

9. In a projectile motion let v_x and v_y are the horizontal and vertical components of velocity at any time t and x and y are displacements along horizontal and vertical from the point of projection at any time t.Then

A. $v_y - t$ graph is a straight line with negative slope and positive intercept

B. $x - t$graph is a straight line passing through origin

C. $y - t$ graph is a straight line passing through origin

D. $u_x - t$ graph is a straight line

Answer: A::B::D

Watch Video Solution

10. Two particles are projected from ground with same intial velocities at angles 60° and 30° (with horizontal). Let R_1 and R_2 be their horizontal ranges, H_1 and H_2 their maximum heights and T_1 and T_2 are the time of flights.Then

A. $\frac{H_1}{R_1} > \frac{H_2}{R_2}$

B. $\frac{H_1}{R_1} < \frac{H_2}{R_2}$

C. $\frac{H_1}{T_1} > \frac{H_2}{T_2}$

D. $\frac{H_1}{T_1} < \frac{H_2}{T_2}$

Answer: A::C

Watch Video Solution

11. A particle is projected from the ground with velocity u at angle θ with horizontal.The horizontal range,maximum height and time of flight are R, H and T respectively.Now keeping u as fixed, θ is varied from 30° to 60°.Then

A. R will first increase.H will increase and T will decrease

B. R will first increase.than decrease while H and T both will increase

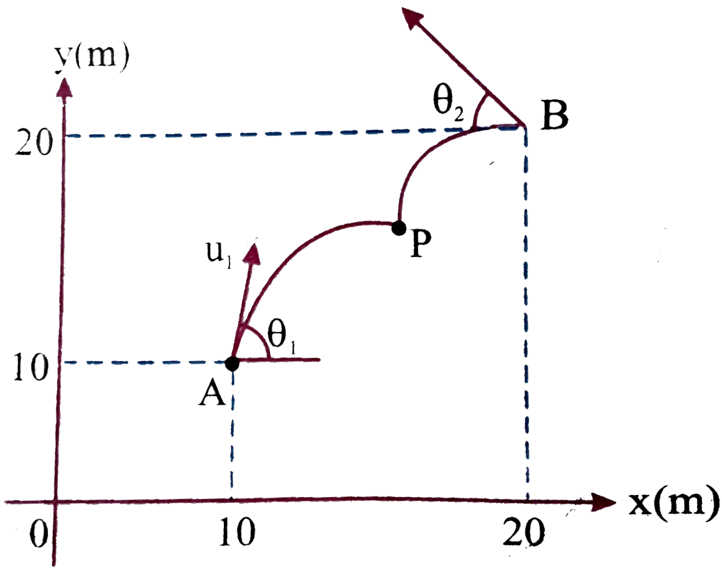
C. R will decrease while H and T will increase

D. R will increase while H and T will decrease

Answer: B

Watch Video Solution

12. Two projectiles A and B are fired simultaneously as shown in figure. They collide in air at point at time t.Then



A. $t\left(u_1\cos\theta_1 - u_2\cos\theta_2\right) = 20$

B. $t\left(u_1\sin\theta_1 - u_2\sin\theta_2\right) = 10$

C. Both (a) and (b) are correct

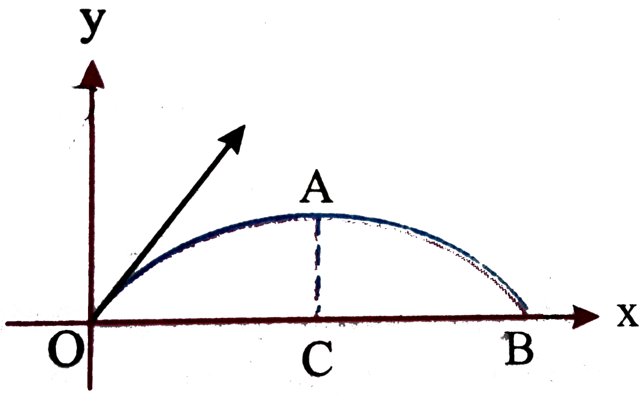
D. Both (a) and (b) are wrong

Answer: B

Watch Video Solution

13. Suppose in the absence of air resistance, $R = OB, H + AC, t_1 = t_{OA}$ and $t_2 = t_{AB}$.If air resistance is taken into consideration and the corresponding values are R', H', T_1' and t_2

then



A. $R' < R, H' < H, t_1' > t_1$ and $t_2' > t_2$

B. $R' < R, H' < H, t_1' > t_1$ and $t_2' < t_2$

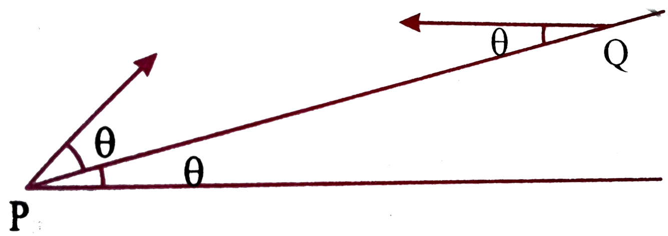
C. $R' < R, H' > H, t_1' > t_1$ and $t_2' < t_2$

D. $R' < R, H' < H, t_1' < t_1$ and $t_2' > t_2$

Answer: D

Watch Video Solution

14. From an inclined palne two particles P, Q are projected with same speed at same angle θ,one up and other down the plane as shown in figure.Which of the following statement(s) is/are correct ?



A. The particles will collide the plane with same speed

B. The times of flight of each particle are same

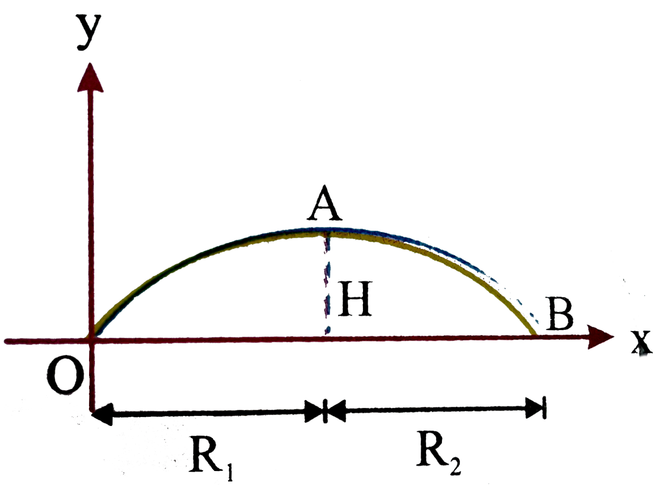
C. Both particles strike the plane perpendicularly

D. The particles will collide in mid air if projected simultaneuosly and time of flight of each particle is less than the time of collision.

Answer: B::D

Watch Video Solution

15. In a projectile motion let $t_{OA} = t_1$ and $t_{AB} = t_2$.The horizontal displacement from O to A is R_1 and from A to B is R_2.Maximum height is H and time of flight is T.If air drag is to be considered, then choose the correct alternative(s).



A. t_1 will decrease while t_2 will increase

B. H will increase

C. R_1 will decrease while R_2 will increase

D. T may increase or decrease

Answer: A::D

Watch Video Solution

16. A projectile is projected from the ground making an angle of 30° with the horizontal.Air exerts a drag which is proportional to the velocity of the projectile

A. at highest point velocity will be horizontal

B. the time of ascent will be equal to the time of descent

C. The time of descent will be greater than the time of ascent

D. the time of ascent will be greater than the time of descent

Answer: A::D

Watch Video Solution

17. A particle is fired from a point on the ground with speed u making an angle θ with the horizontal.Then

A. the radius of curvature of the projectile at the highest point is $\frac{u^2\cos^2\theta}{g}$

B. the radius of curvature of the projectile at the highest point is $\dfrac{u^2\sin^2\theta}{g}$

C. at the point of projection magnitude of tangential acceleration is $g\sin\theta$

D. at the point of projection magnitude of tangential acceleration is $g\cos\theta$

Answer: A::C

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18. A particle is projected from ground with velocity $40\sqrt{2}m$ at $45°$ .At time $t = 2s$

A. displacement of particles is $100m$

B. vertcal component of velocity is $20m/s$

C. velocity makes an angle of $\tan^{-1}(2)$ with vertical

D. particle is at height of $60m$ from ground

Answer: A::B::C::D

Watch Video Solution

Level -V Passage

1. A motor cyclist is riding North in still air at $36 kmh^{-1}$.The wind starts blowing West ward with a velocity $18 kmh^{-1}$

The direction of apparent velocity is

A. $\tan^{-1}(1/2)$ West of North

B. $\tan^{-1}(1/2)$ North of West

C. $\tan^{-1}(1/2)$ East of North

D. $\tan^{-1}(1/2)$ North of East

Answer: A

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2. A motor cyclist is riding North in still air at $36 kmh^{-1}$.The wind starts blowing West ward with a velocity $18 kmh^{-1}$

If the wind velocity becomes $36 kmh^{-1}$ due West, then how much more distance the motor cyclist would cover in 10 min

A. $10 km$

B. $1.8km$

C. $3.6km$

D. $8.5km$

Answer: B

Watch Video Solution

3. A river of width a with straight parallel banks flows due north with speed u. The points O and A are on opposite banks and A is due east of O. Coordinate axes O_x and O_y are taken in the east and north directions respectively. A boat, whose speed is v relative to water, starts from O and crosses the river. If the boat is steered due east and u varies with $xas : u = x(a - x)\frac{v}{a^2}$. Find

(a) equation of trajectory of the boat,

(b) time taken to cross the river,

(c) absolute velocity of boatman when he reaches the opposite bank,

(d) the displacement of boatman when he reaches the opposite bank from the initial position.

A. $y = \frac{x}{a} - \frac{x^2}{2a}$

B. $y = \frac{x^2}{2a} - \frac{x^2}{3a}$

C. $y = \frac{x^2}{a} - \frac{x^3}{a^2}$

D. $y = \frac{x^2}{a} - \frac{x^3}{3a^2}$

Answer: B

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4. A river of width a with straight parallel banks flows due north with speed u. The points O and A are on opposite banks and A is due east of O. Coordinate axes O_x and O_y are taken in the east and north directions respectively. A boat, whose speed is v relative to water, starts from O and crosses the river. If the boat is steered due east and u varies with $xas: u = x(a - x)\frac{v}{a^2}$. Find

(a) equation of trajectory of the boat,

(b) time taken to cross the river,

(c) absolute velocity of boatman when he reaches the opposite bank,

(d) the displacement of boatman when he

reaches the opposite bank from the initial position.

A. $\frac{a}{v}$

B. $\frac{v}{a}$

C. $\frac{2a}{v}$

D. $\frac{2v}{a}$

Answer: A

Watch Video Solution

5. A river of width a with straight parallel banks flows due north with speed u. The points O and A are on opposite banks and A is due east of O. Coordinate axes O_x and O_y are taken in the east and north directions respectively. A boat, whose speed is v relative to water, starts from O and crosses the river. If the boat is steered due east and u varies with $xas: u = x(a - x)\frac{v}{a^2}$. Find

(a) equation of trajectory of the boat,

(b) time taken to cross the river,

(c) absolute velocity of boatman when he reaches the opposite bank,

(d) the displacement of boatman when he reaches the opposite bank from the initial position.

A. west

B. south

C. east

D. north

Answer: C

Watch Video Solution

6. A car is moving towards south with a speed of $20ms^{-1}$. A motorcyclist is moving towards east with a speed of $15s^{-1}$. At a certain instant, the motorcyclist is due south of the car and is at a distance of $50m$from the car.

The shortest distance between the motorcyclist and the car is.

A. $10m$

B. $20m$

C. $30m$

D. $40m$

Answer: C

Watch Video Solution

7. A car is moving towards south with a speed of $20ms^{-1}$. A motorcyclist is moving towards east with a speed of $15ms^{-1}$. At a certain instant, the motorcyclist is due south of the car and is at a distance of $50m$ from the car.

The time after which they are closest to each other.

A. $1/3s$

B. $8/3s$

C. $1/5s$

D. $8/5s$

Answer: D

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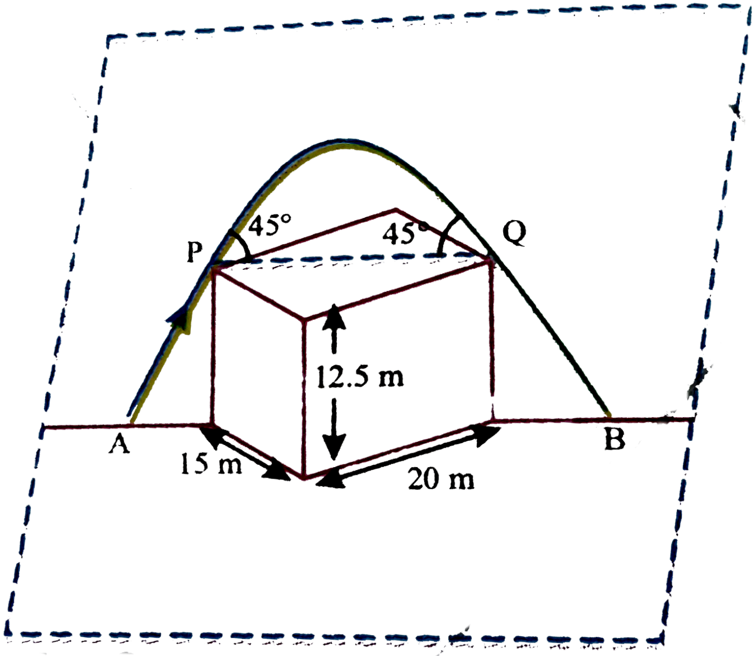
8. A particle is fired from A in the diagonal plane of a building of dimension $20m$(length) $\times$ $15m$ (breadth) $\times$ $12.5m$(height), just clears the roof diagonally & falls on the other side of the building at B.It is observed that the particle is travelling at an angle $45°$ with the horizontal when it clears the edges P and Q of the diagonal. Take $g = 10m/s^2$.

The speed of the particle at point P will be:



A. $5\sqrt{10} m/s$

B. $10\sqrt{5} m/s$

C. $5\sqrt{15} m/s$

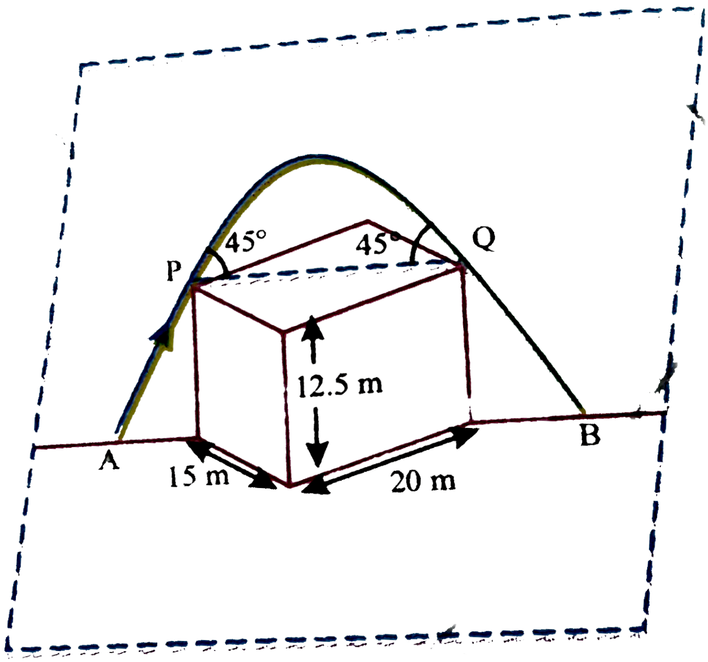
D. $5\sqrt{5}m/s$

Answer: A

Watch Video Solution

9. A particle is fired from A in the diagonal plane of a building of dimension $20m$(length) $\times$ $15m$ (breadth) $\times$ $12.5m$(height), just clears the roof diagonally & falls on the other side of the building at B.It is observed that the particle is travelling at an angle 45° with the horizontal when it clears the edges P and Q of the diagonal. Take $g = 10 m/s^2$.

The speed of projection of the particle at A will be:



A. $5\sqrt{10} m/s$

B. $10\sqrt{5}m/s$

C. $5\sqrt{15}m/s$

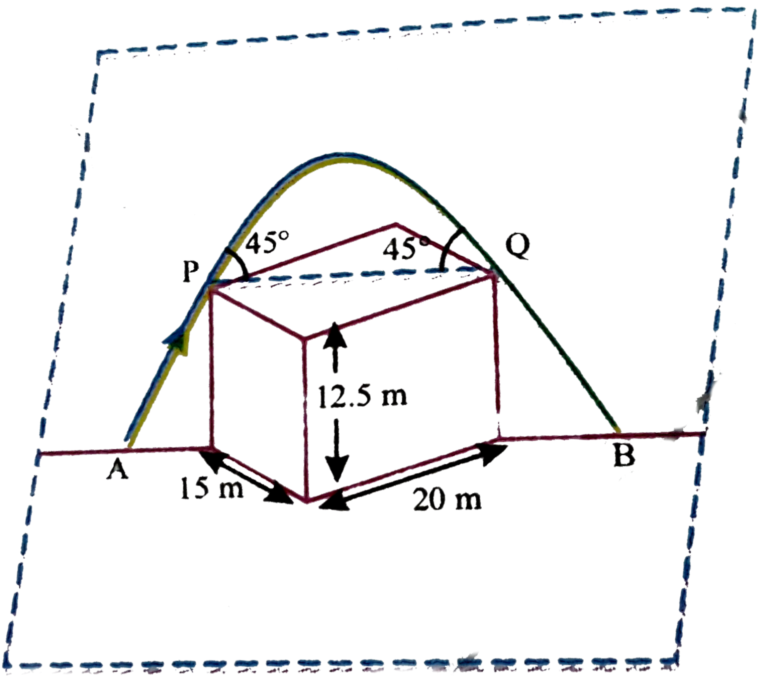
D. $5\sqrt{5}m/s$

Answer: B

Watch Video Solution

10. A particle is fired from A in the diagonal plane of a building of dimension $20m$(length) $\times$ $15m$ (breadth) $\times$ $12.5m$(height), just clears the roof diagonally & falls on the other side of the building at B.It is observed that the particle is travelling at an angle $45°$ with the horizontal when it clears the edges P and Q of the diagonal. Take $g = 10 m/s^2$.

The range that is AB will be:



A. $5\sqrt{10}m$

B. $25\sqrt{3}m$

C. $5\sqrt{15}m$

D. $25\sqrt{5}m$

Answer: B

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11. Two projectiles are projected simultaneously from the top and bottom of a vertical tower of height h at angles 45° and

60° above horizontal respectively.Body strike at the same point on ground at distance $20m$ from the foot of the tower after same time. The speed of projectile projected from the bottom is

A. $40 m/s$

B. $\frac{20}{\sqrt{3}} m/s$

C. $40\sqrt{3} m/s$

D. $\frac{20}{\sqrt{\sqrt{3}}} m/s$

Answer: D

Watch Video Solution

12. Two projectiles are projected simultaneously from the top and bottom of a vertical tower of height h at angles 45° and 60° above horizontal respectively.Body strike at the same point on ground at distance $20m$ from the foot of the tower after same time.

The ratio of the speed of the projectile projected from the top and the speed of the projectile projected from the bottom of tower is

A. $1:\sqrt{2}$

B. $1:\sqrt{3}$

C. $\sqrt{5}:1$

D. $\sqrt{7}:1$

Answer: A

Watch Video Solution

13. Two projectiles are projected simultaneously from the top and bottom of a vertical tower of height h at angles 45° and

60° above horizontal respectively.Body strike at the same point on ground at distance $20m$ from the foot of the tower after same time. The time of flight of projectles is

A. $(3)^{\frac{1}{4}}$

B. $2(3)^{\frac{1}{4}}$

C. $3(3)^{\frac{1}{4}}$

D. $4(3)^{\frac{1}{4}}$

Answer: B

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14. Two guns situated at the top of a hill of height $10m$ fire one shot each with the same speed $5\sqrt{3}m/s$ at some interval of time. One gun fires horizontal and the other fores upwards at an angle of $60\,^\circ$ with the horizontal. Two shots collide in air at a poit P. Find (i) time-interval between the firing and (ii) coordinates of the point P. Take the origin of coordinates system at the foot of the hill right below the muzzle and trajectorise in the x - y plane.

A. $1s$

B. $2s$

C. $3s$

D. $4s$

Answer: A

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15. Two guns situated at the top of a hill of height $10m$ fire one shot each with the same speed $5\sqrt{3}m/s$ at some interval of time. One gun fires horizontal and the other fores upwards at an angle of 60° with the horizontal. Two shots collide in air at a poit P. Find (i) time-interval between the firing and (ii) coordinates of the point P. Take the origin of coordinates system at the foot of the hill right below the muzzle and trajectorise in the x - y plane.

A. $(5m, 5m)$

B. $\left(5\sqrt{3}m, 5\sqrt{3}m\right)$

C. $\left(5\sqrt{3}m, 5m\right)$

D. $\left(5m, 5\sqrt{3}m\right)$

Answer: C

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Integer

1. Three points are located at the vertices of an equilateral triangle each of whose sides measure a. They all start simultaneously with speed v, each aiming at the next in order. How soon will the points converge ?

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2. The slopes of wind screen of two cars are $\alpha_1 = 30^\circ$ and $\alpha_2 = 15^\circ$ respectively. At what ratio $\frac{v_1}{v_2}$ of the velocities of the cars will their drivers see the hail stones bounced back by the wind screen on their cars in vertical direction? Assume hail stones fall vertically downwards and collisions to be elastic.

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3. A heavy particles is projected from a point at the foot of a fixed plane, inclined at an angle 45° to the horizontal, in the vertical plane containging the line of greatest slope through the point. If $\phi\left(>45^{\circ}\right)$ is the inclination to the horizontal of the initial direction of projection,for what value of $\tan\phi$ will the particle strike the plane horizontal.

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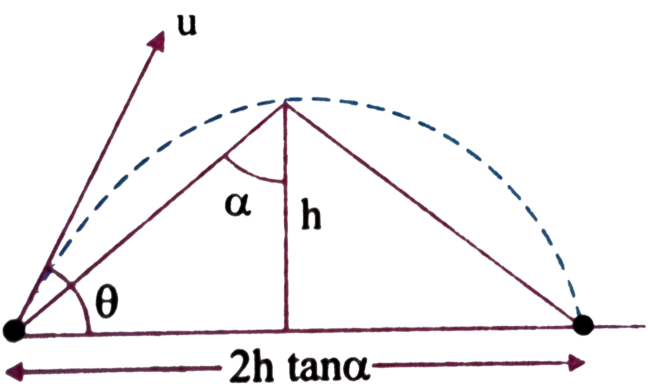
4. A projectile is fired from the base of coneshaped hill. The projectile grazes the vertex and strikes the hill again at the base.If α be the half-angle of the cone, h its height, u the initial velocity of projection and θ angle of projection, then then $\theta\tan\theta$is



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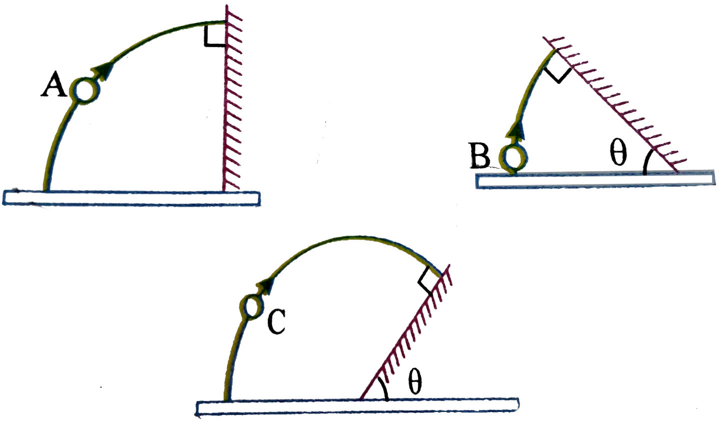
5. Three balls A, B and C are projected from ground with same speed at same angle with the horizontal.The balls A, B and C collide with the wall during a flight in air and all three collide perpendicularly and elastically with the wall as shown in figure.If the time taken by the ball A and fall back on ground is 4 seconds and that by ball B is $2 seconds$Then the time taken by the ball C to reach the ground after projection will be



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6. In figure, the angle of inclination of the inclined plane is 30°. Find the horizontal velocity V_0 so that the particle hits the

inclined plane perpendicularly.

.

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Level-Vi single answer

1. An open merry go round rotates at an angular velocity ω.A person stands in it at a distance r from the rotational axis.It is raining and the rain drops falls vertically at a velocity v_0.How should the person hold an umbrella to prorect himself from the rain in the best way.Angle made by umbrealla with the vertical is

A. $\cot\alpha = \dfrac{v_0}{r\omega}$

B. $\tan\alpha = \dfrac{v_0}{r\omega}$

C. $\cot\alpha = \dfrac{r\omega}{v_0}$

D. $\tan\alpha = \dfrac{v_0}{r\omega}$

Answer: A

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2. A standing man observes rain falling with the velocity of $20ms^{-1}$ at an angle of $30°$ with the vertical.

(a) Find the velocity with which the man should move so that rain appears to fall vertically to him.

Now if he futher increases his speed, rain again appears to fall at $30°$ with the vertical. Find his new velocity.

A. $20m/s$

B. $30m/s$

C. $40m/s$

D. $10m/s$

Answer: A

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3. A person standing on a road has to hold his umbrella at 60^0 with the verticcal to keep the rain away. He throws the umbrella an starts running at $20ms^{-1}$. He finds that rain drops are hitting his head vertically. Find the speed of the rain drops wigh respect to (a) the road

(b) the moving person.

A. $\frac{40}{3}m/s, \frac{20}{3}m/s$

B. $\frac{40}{3}m/s, \frac{22}{3}m/s$

C. $40\frac{\sqrt{3}}{3}m/s, 20\frac{\sqrt{3}}{3}m/s$

D. $40\frac{\sqrt{3}}{3}m/s, \frac{20}{3}m/s$

Answer: C

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4. Two swimmers leave point A on the bank of the river to reach point B lying right across on the other bank. One of them crosses the river along the straight line AB while the other swims at right angles to the stream and then walks the distance that he has been carried away by the stream to get to point B. What was the velocity u of his walking if both swimmers reached the destination simultaneously? The stream velocity $v_0 = 2.0 km/hour$ and the velocity $v^{'}$ of each swimmer with respect to water equals to $2.5 km$ per hour.

A. $3 km / hr$

B. $3.5 km / hr$

C. $4 km / hr$

D. $5 km / hr$

Answer: A

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5. A ball is thrown vertically upward from the 12 m level with an initial velocity of $18m/s$. At the same instant an open platform elevator passes the 5 m level, moving upward with a constant velocity of $2m/s$. Determine ($g = 9.8m/s^2$)

(a) when and where the ball will meet the elevator,

(b) the relative velocity of the ball with respect to the elevator when the ball hits the elevator.

A. $10.2m 9.8m/s$

B. $12.3m19.8m/s$

C. $12m10.2m/s$

D. $12.5m22m/s$

Answer: B

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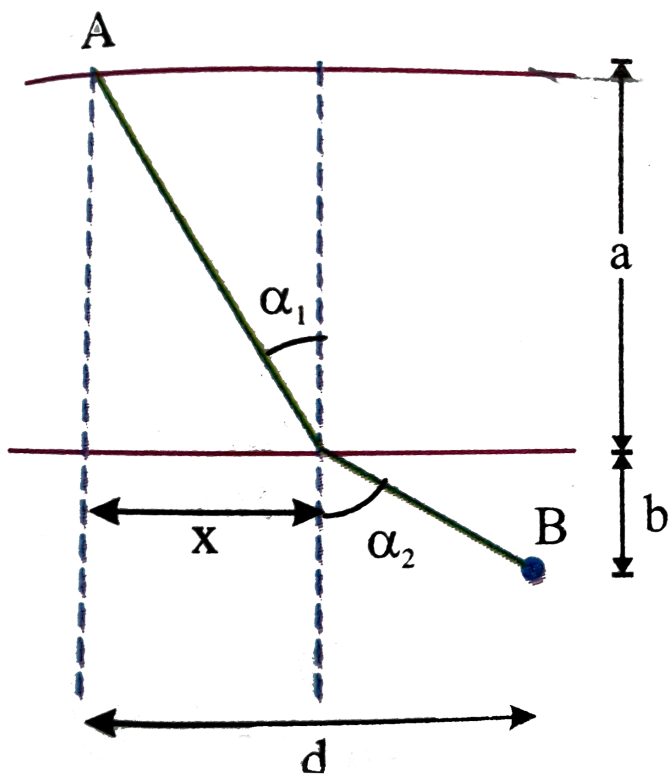
6. From a point A on bank of a channel with still water a person must get to a point B on the opposite bank.All the distances are shown in figure.The person uses a boat to travel across the channel and then walks along the bank of point B.The velocity of the boat is v_1 and the velocity of the walking person is v_2 .Prove that the fastest way for the person to get from A to B is to select the angles α_1 and α_2 in such a manner that



A. $\frac{\sin\alpha_1}{\sin\alpha_2} = \frac{v_2}{v_1}$

B. $\frac{\sin\alpha_1}{\sin\alpha_2} = \frac{v_1}{v_2}$

C. $\frac{\cos\alpha_1}{\cos\alpha_2} = \frac{v_2}{v_1}$

D. $\frac{\cos\alpha_2}{\cos\alpha_1} = \frac{v_1}{v_2}$

Answer: A

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7. On morning Joy was walking on a grass-way in a garden.Wind was also blowing in the direction of his walking with speed u.He suddenly saw his friend Kim walking on the parallel grass-way at a distance x away.Both stopped as they saw each other when they were directly opposite on their ways at a distance x.Joy shouted "Hi Kim".Find the time after which Kim would have heard his greeting.Sound speed in still air is v.

A. $\dfrac{x}{\sqrt{v^2 - u^2}}$

B. $\dfrac{2x}{\sqrt{v^2 - u^2}}$

C. $\dfrac{x}{2\sqrt{v^2 - u^2}}$

D. $\frac{x}{4\sqrt{v^2 - u^2}}$

Answer: A

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8. A projectile is fired with velocity v_0 from a gun adjusted for a maximum range.It passes through two points P and Q whose heights above the horizontal are h each.The separation of the two points is

A. $\frac{v_0}{g}\sqrt{v_0^2 - 4gh}$

B. $\frac{v_0}{g}\sqrt{v_0^2 + 4gh}$

C. $2\frac{v_0}{g}\sqrt{v_0^2 - 4gh}$

D. $\frac{v_0}{g}\sqrt{v_0^2 - gh}$

Answer: A

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9. A shot is fired with a velocity u at a very high vertical wall whose distance from the point of projection is x.The greatest height above the level of the point of projection at which the bullet can hit the wall is.

A. $\frac{u^4 + g^2x^2}{2gu^2}$

B. $\frac{u^4 - g^2x^2}{gu^2}$

C. $\frac{u^4 - g^2x^2}{4gu^2}$

D. $\frac{u^4 - g^2x^2}{2gu^2}$

Answer: D

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10. A stone is projected from the ground in such a direction so as to hit a bird on the top of a telegraph post of height h and attains the maximum height of 2h above the ground. If at the insatant of projection, the bird were to fly away horizontally with a uniform speed, find the ratio between the horizontal velocity of bird and the horizontal component of velocity of stone, if the stone hits the bird while descending.

A. $\dfrac{2}{\sqrt{2}+1}$

B. $\frac{1}{\sqrt{2} + 1}$

C. $\frac{2}{\sqrt{2} - 1}$

D. $\frac{1}{\sqrt{2} - 1}$

Answer: A

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11. The benches of a gallery in a cricket stadium are 1 m wide and 1 m high. A batsman strikes the ball at a levl one metre above the ground and hits a mammoth sixer. The ball starts at 35 m/s at an angle of 53^0 with the horizontal. The benches are perpendicular to the plane of motion and the first bench is 110 m from the batsman.. On which benchk will theball hit?

A. 4 th step

B. 5 th step

C. 6 th step

D. 7 th step

Answer: C

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12. If R is the horizontal range for θ inclination and h is the maximum height reached by the projectile, Then maximum range is

A. $\frac{R^2}{h}+2h$

B. $\frac{R^2}{8h}+2h$

C. $\frac{R^2}{8h}+8h$

D. $\frac{R^2}{h}+h$

Answer: B

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13. The acceleration of gravity can be measured by projecting a body upward and measuring the time it takes to pass two given points in both directions.Show that if the time the body takes to pass a horizontal line a in both directions is t_A anytime to go by a second line B in both direction is t_B, then assuming that the acceleration is constant, its magnitude is $g =$ (where h is the height of the line B above line A.)

A. $\frac{h}{t_A^2 - t_B^2}$

B. $8\frac{h}{t_A^2 - t_B^2}$

C. $8\frac{h}{t_A^2 + t_B^2}$

D. $4\frac{h}{t_A^2 + t_B^2}$

Answer: B

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14. A particle is released from a certain height $H = 400m$. Due to the wind, the particle gathers the horizontal velocity component $v_x = ay$ where a $= (\sqrt{5})s^{-1}$ and y is the vertical displacement of the particle from the point of release, then find

(a) the horizontal drift of the particle when it strikes the ground ,

(b) the speed with which particle strikes the ground.

A. $2.67km$

B. $5.67km$

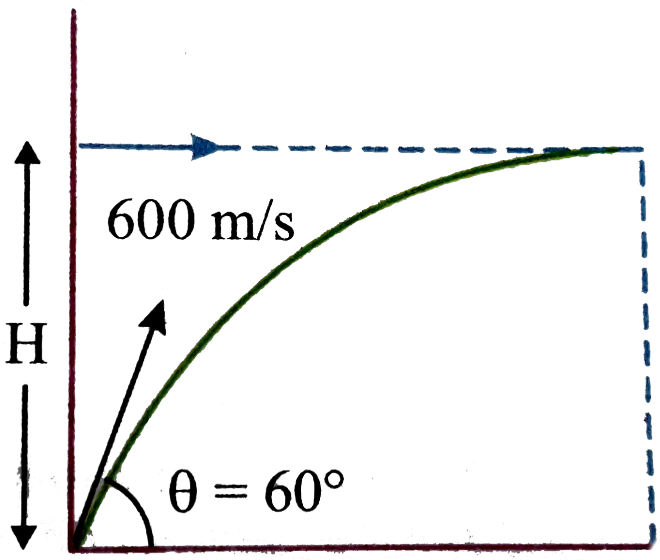
C. $12.67km$

D. $4.97km$

Answer: A

Watch Video Solution

15. A fighter plane enters inside the enemy territory, at time $t = 0$, with velocity $\upsilon_o = 250m/s$ a moves horizontally with constant acceleration $a = 20m/s^2$ (see figure) An enemy tank at the border, spot the plane and fire shots at an angle $\theta = 60^2$ with the horizontal and with velocity $u = 600 m/s$.At what altitude H of the plane it can be hit by the shot?



A. $1500 m$

B. $2473 m$

C. $1650 m$

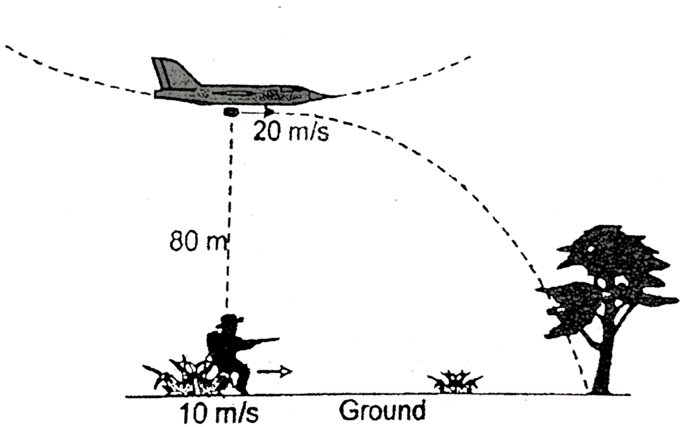
D. $1800m$

Answer: B

Watch Video Solution

16. A bomber plane moving at a horizontal speed of $20m/s$ releases a bomb at a height of $80m$ above ground as shown. At the same instant a Hunter of negligible height starts running from a point below it, to catch the bomb with speed $10m/s$. After two seconds he relized that he cannot make it, he stops running and immediately hold his gun and fires in such direction so that just before bomb hits the ground, bullet will hit it. What should be the firing speed of bullet

(Take $g = 10m/s^2$)



A. $10m/s$

B. $20\sqrt{10}m/s$

C. $10\sqrt{10} m/s$

D. None of these

Answer: C

Watch Video Solution

17. A body has maximum range R_1 when projected up the plane. The same body when projected down the inclined plane, it has maximum range R_2. Find the maximum horizontal range. Assume equal speed of projection in each case and the body is projected onto the inclined plane in the line of the greatest slope.

A. $R = \frac{2R_1R_2}{R_1 - R_2}$

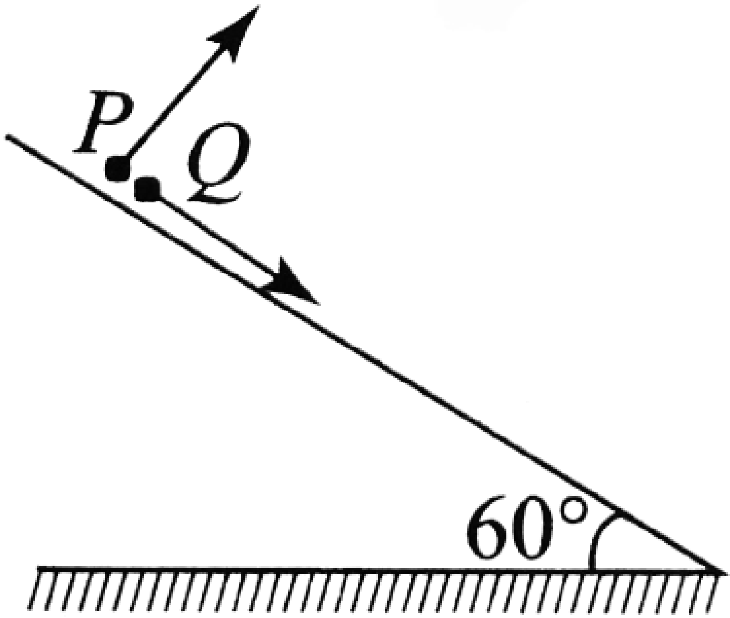
B. $R = \frac{2R_1R_2}{R_1 + R_2}$

C. $R = \frac{R_1R_2}{R_1 - R_2}$

D. $R = \frac{4R_1R_2}{R_1 + R_2}$

Answer: B

Watch Video Solution

18. 

A particle P is projected from a point on the surface of smooth inclined plane (see figure). Simultaneously another particle Q is released on the smooth inclined plane from the same position. P and Q collide after $t = 4$. The speed of projection of P is

A. $5m/s$

B. $10m/s$

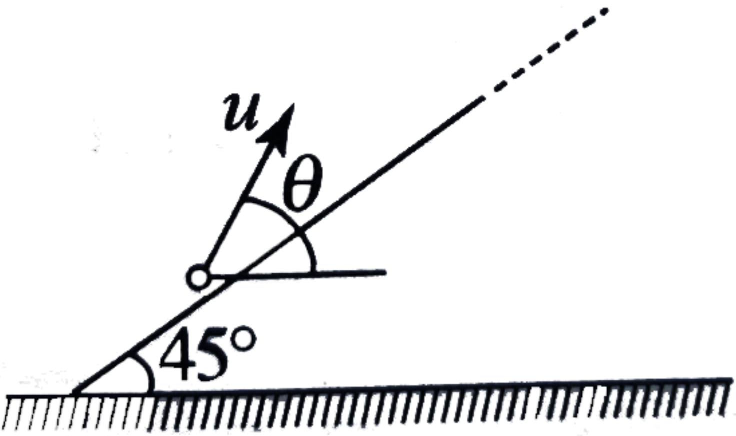
C. $15m/s$

D. $20m/s$

Answer: B

Watch Video Solution

19.



A particle is projected from surface of the inclined plane with speed u and at an angle θ with the horizontal. After some time the particle collides elastically with the smooth fixed inclined plane for the first time and subsequently moves in vertical direction. Starting from projection, find the time taken by the particle to reach maximum height.

(Neglect time of collision).

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

B. $\frac{2u\sin\theta}{g}$

C. $\frac{u(\sin\theta + \cos\theta)}{g}$

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

Answer: C

Watch Video Solution

20. A perfectly elastic particle is projected with a velocity v on a vertical plane through the line of greatest slope of an inclined plane of elevation α.If after striking the plane, the particle rebounds vertically show that it will return to the point of projection at the end of time equal to

A. $\dfrac{6v}{g\sqrt{1 + 8\sin^2\alpha}}$

B. $\dfrac{6v}{g\sqrt{1 + \sin^2\alpha}}$

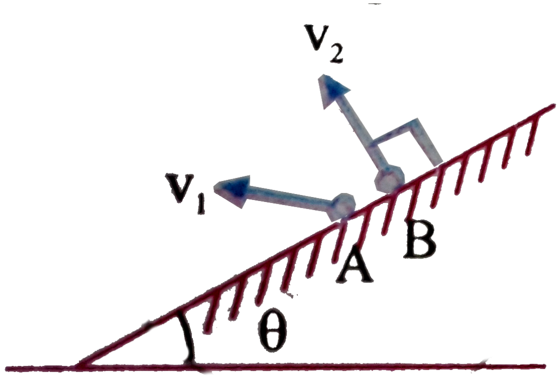
C. $\dfrac{v}{g\sqrt{1 + 8\sin^2\alpha}}$

D. $\dfrac{v}{g\sqrt{1 + \sin^2\alpha}}$

Answer: A

View Text Solution

21. Two bodies A and B are projected from the same place in same vertical plane with velocities v_1 and v_2.Form a long inclined plane as shown Find the ratio of their times of flight.



A. $\dfrac{v_1 \sin\theta}{v_2}$

B. $\dfrac{2v_1 \sin\theta}{v_2}$

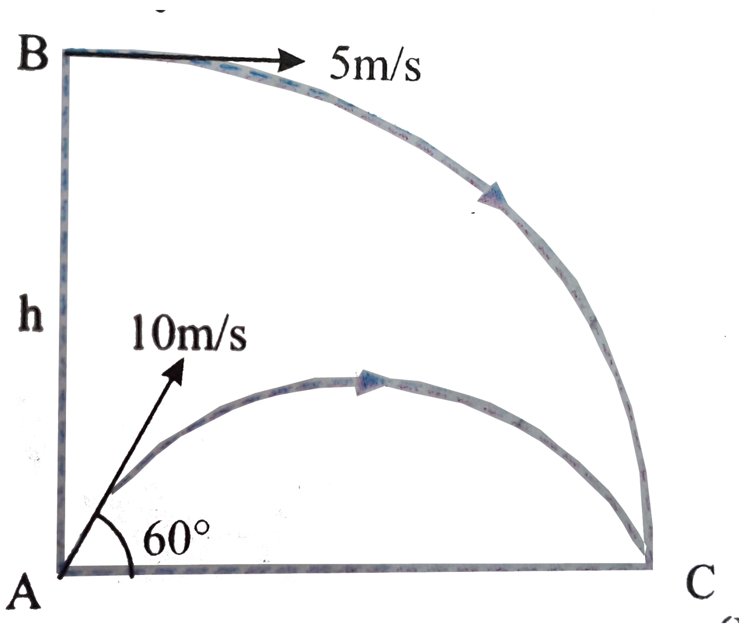
C. $\dfrac{v_1 \sin\theta}{2v_2}$

D. $\dfrac{v_1 \cos\theta}{v_2}$

Answer: A

Watch Video Solution

22. A particle A is projected from the ground with an initial velocity of $10m/s$ at an angle of 60° with horizontal. From what height should an another particle B be projected horizontally with velocity $5m/s$ so that both the particles collide in ground at point C if both are projected simultaneously $g = 10 m/s^2$.



A. $10 m$

B. $15 m$

C. $20 m$

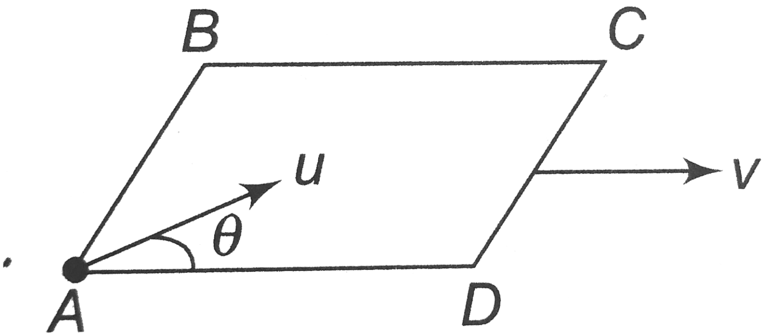
D. $30 m$

Answer: B

Watch Video Solution

23. A smooth square plateform 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

Watch Video Solution

24. Two particles are projected from the same point on ground simultaneously with speeds and $20m/s$ and $20/\sqrt{3}$ at angles 30° and 60° with the horizontal in the same direction.The maximum distance between them till both of them strike the ground is approximately $\left(g = 10m/s^2\right)$

A. $23.1m$

B. $16.4m$

C. $30.2m$

D. $10.4m$

Answer: A

Watch Video Solution

25. 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. $5ms^{-1}, 100ma^{-1}$

B. $100ms^{-1}, 50ma^{-1}$

C. v_A can have any value greater than $25ms^{-1}, 100ms^{-1}$

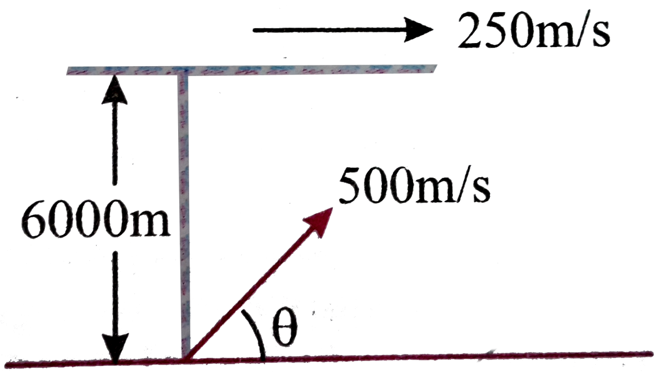
D. $20ms^{-1}, 25ms^{-1}$

Answer: C

Watch Video Solution

26. An aircraft moving with a speed of $250m/s$ is at a height of $6000m$,just overhead of an antiaircraft gun.If the muzzle velocity is

$500 m/s$,the firing angle θ should be:



A. 30°

B. 45°

C. 60°

D. none of these

Answer: C

Watch Video Solution

27. A cannon fires successively two shells from the same point with velocity $V_0 = 250m/s$, the first at the angle $\theta_1 = 60°$ and the second at the angle $\theta_2 = 45°$ to the horizontal, the azimuth being the same. Neglecting the air drag, find the approximate time interval between firings leading to the collision of the shells $\left(g = 9.8m/s^2\right)$

A. 4sec

B. 7sec

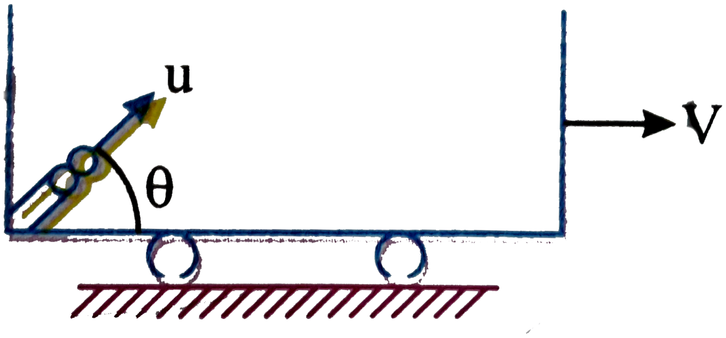
C. 17sec

D. 11sec

Answer: D

Watch Video Solution

28. A shell is projected from a gun with a muzzle velocity v.The gun is fitted with a trolley car at an angle θ as shown in the fig. If the trolley car is made to move with constant velocity v towards right, find the horizontal range of the shell relative to ground.



A. $R = \dfrac{2u\sin\theta(u\cos\theta + v)}{g}$

B. $R = \dfrac{2u\sin\theta(u\cos\theta - v)}{g}$

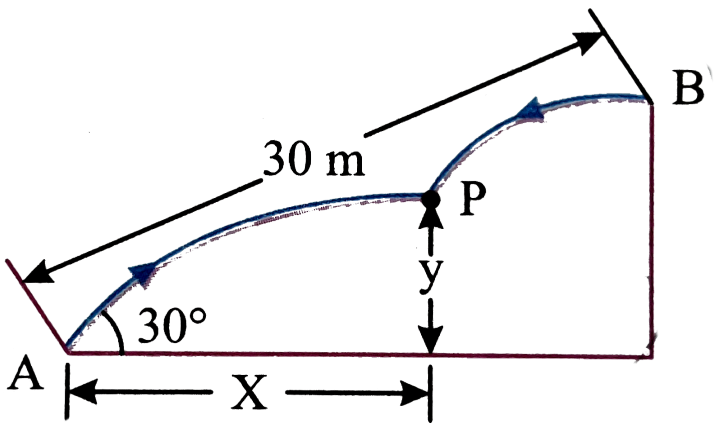
C. $R = \dfrac{u\sin\theta(u\cos\theta + v)}{g}$

D. $R = \dfrac{u\sin\theta(u\cos\theta - v)}{g}$

Answer: A

Watch Video Solution

29. Two guns are projected at each other, one upward at an angle of 30° and the other at the same of depression, the muzzles being $30m$ apart as shown in the figure. If the guns are shots with velocities of $350m/s$ upward and $300m/s$ downward respectively.where the bullets may meet.



A. $x = 14m, y = 8.07m$

B. $x = 4m, y = 4.07m$

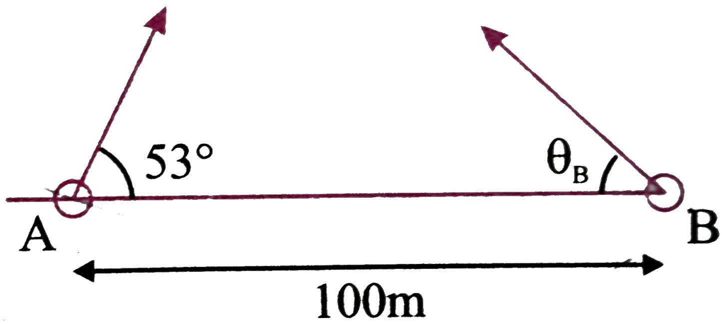
C. $x = 10m, y = 10.07m$

D. $x = 5m, y = 18.07m$

Answer: A

Watch Video Solution

30. Two particles A and B are projected in same vertical plane as shown in figure.Their initial positions $(t = 0)$, initial spped and angle of projections are indicated in the diagram.If initial angle of projection $\theta_B = 37°$, what should be initial speed of projection of particle B, so that it hits particle $A.U_A = 60 m/s$



A. $80 m/s$

B. $75 m/s$

C. $40 m/s$

D. $45 m/s$

Answer: A

Watch Video Solution

Level-Vi multiple answer

1. A child in danger of drowning in a river is being carried downstream by a current that flows uniformly at a speed of $2.5 km/h$. The child is 0.6 km from shore and 0.8 km upstream of a boat landing when a rescue boat sets out. If the boat proceeds at its maximum speed of $20 km/h$ with respect to the water, what angle does the boat velocity v make with the shore? How long will it take boat to reach the child?

A. The angle made by the boat with the shore is $53\,^{\circ}$

B. The angle made by the boat with the shore is $37\,^{\circ}$

C. the time taken by boat to reach the child is $4\ \text{min}$

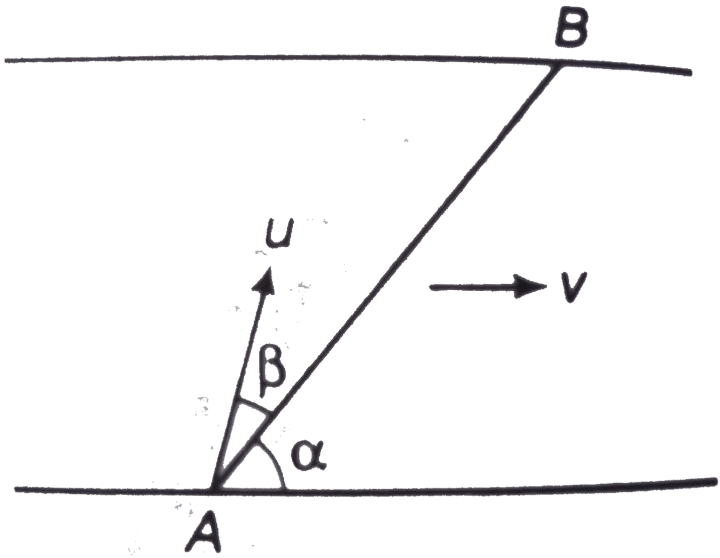
D. the time taken by boat to reach the child is 3 min

Answer: B::D

Watch Video Solution

2. A launch plies between two points A and B on the opposite banks of a river always following the line AB. The distance S between points and B is 1200 m. The velocity of the river current $v = 1.9 m/s$ is constant over the entire width of the river. The line AB makes an angle $\alpha = 60\,^{\circ}$ with the direction of the current. With what velocity u and at what angle beta to the line AB should the launch move to cover the distance AB and back in a time $t = 5 \text{ min}$? The angle beta remains the same during the passage from A to B and from

B to A.



A. The velocity of the boat is $8 m/s$

B. The velocity of the boat is $6 m/s$

C. The angle made by u with the line AB is

12°

D. The angle made by u with the line AB is

10°

Answer: A::C

Watch Video Solution

3. The current velocity of river grows in proportion to the distance from its bank and reaches the maximum value v_0 in the middle. Near the banks the velocity is zero. A boat is moving along the river in such a manner that the boatman rows his boat always perpendicular to the current. The speed of the boat in still water is u. Find the distance through which the boat crossing the river will be carried away by the current, if the width of the river is c. Also determine the trajectory of the boat.

A. The distance carried by the boat is

$$X_{max} = \frac{2cu}{v_0}$$

B. The distance carried by the boat is

$$X_{max} = \frac{v_0}{2cu}$$

C. The trajectary of the boat is $y^2 = \frac{v_0 c}{u} x$

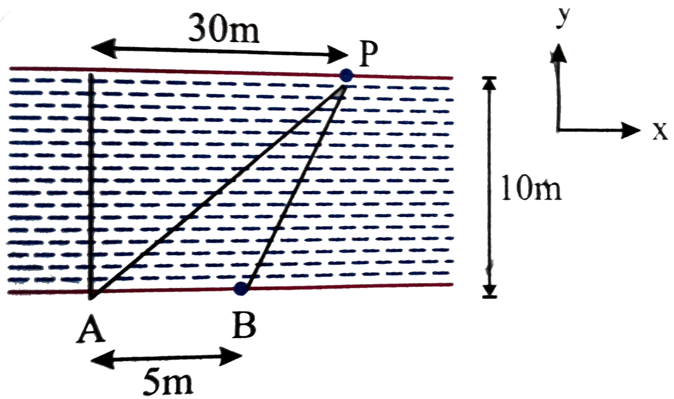
D. The trajectary of the boat is $y^2 = \frac{v_0 c}{u} x$

Answer: B::D

Watch Video Solution

4. Two swimmers A and B start swimming from different positions on the same bank as shown in figure.The swimmer A swims at angle 90° with respect to the river to reach point P.He takes $120 seconds$ to cross the river of width

$10m$.The swimmer B also takes the same time to reach the point P



A. velocity of A with respect to river is $1/6m/s$

B. river flow velocity is $1/4m/s$

C. Velocity of B along y-axis with respect to earth is $1/3m/s$.

D. Velocity of B along x-axis with respect to earth is $5/24 m/s$.

Answer: B::D

Watch Video Solution

5. Two frames of reference P and Q are moving relative to each other at constant velocity. Let $\vec{v}_{OP}$ and $\vec{a}_{OP}$ represent the velocity and the acceleration respectively of a moving particle O as measured by an observer in frame P and

$\vec{V}_{OQ}$ and $\vec{a}_{OQ}$ represent the velocity and the acceleration respectively of the moving particle O as measured by an observer in frame Q, then

A. $\vec{v}_{OP} = \vec{v}_{OQ}$

B. $\vec{v}_{OP} = \vec{v}_{OQ} + \vec{v}_{QP}$

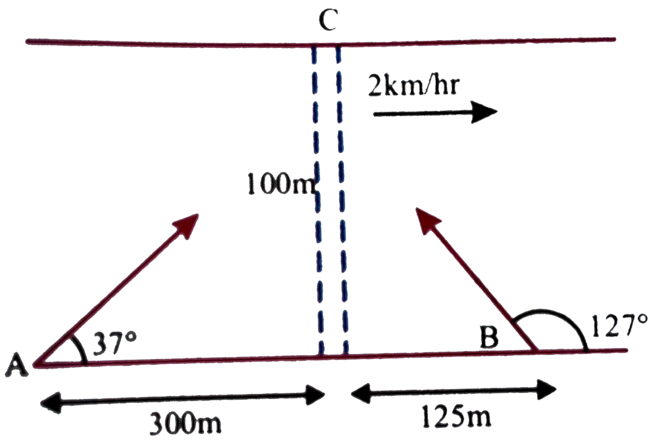
C. $\vec{a}_{OP} = \vec{a}_{OQ}$

D. $\vec{a}_{OP} = \vec{a}_{OQ} + \vec{a}_{QP}$

Answer: B::C::D

Watch Video Solution

6. Two swimmers start a race. One who reaches the point C first on the other bank wins the race.A makes his strokes in a direction of 37^0 to the river flow with velocity $5km/hr$ relative to water. B makes his strokes in a direction 127^0 to the river flow with same relative velocity.River is flowing with speed of $2km/hr$ and is $100m$ wide.speeds of A and B on the ground are $8 km/hr$ and $6 km/hr$ respectively.



A. A will win the race

B. B will win the race

C. the time taken by A to reach the point C

is $165 sec$

D. the time taken by B to reach the point C

is $150 sec$

Answer: A::D

Watch Video Solution

7. Two trains A and B are moving with same speed of $100 km / hr$.Train A moves towards east and train B moves towards west.An an instant when the trains are moving side by side, an aeroplane files above the trains horizontally.For the passengers in the train A, the plane appears to fly from North to South direction.For the passengers in the train B, the plane appears to fly in a direction making an angle $60\,^\circ$ to North-South direction.

A. The speed of the plane with respect to ground is $100\sqrt{\frac{7}{3}}km$

B. The speed of the plane with respect to ground is $100\sqrt{3}km$

C. The plane moves in a direction at an angle of $\tan^{-1}\frac{\sqrt{3}}{2}$ to North-South direction (with respect to ground)

D. The plane moves in a direction at an angle of $\tan^{-1}\frac{\sqrt{5}}{2}$ to North-South direction (with respect to ground)

Answer: A::C

Watch Video Solution

8. Two shells are fired from cannon with speed u each, at angles of α of β respectively with the horizontal.The time interval between the shots is T.They collide in mid air after time t from the first shot.Which of the following conditions must be satisfied?

A. $\alpha > \beta$

B. $t\cos\alpha = (t - T)\cos\beta$

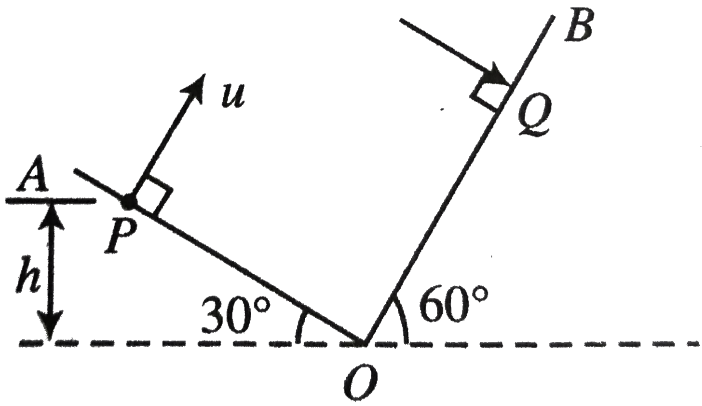
C. $(t - T)\cos\alpha = t\cos\beta$

D. $(u\sin\alpha)t - \frac{1}{2}gt^2 = (u\sin\beta)(t - T) - \frac{1}{2}g(t - T)^2$

Answer: A::B::D

Watch Video Solution

9. Two inclined planes OA and OB having inclination (with horizontal) 30° and 60°, respectively, intersect each other at O as shown in figure. A particle is projected from point P with velocity $u = 10\sqrt{3}ms^{-1}$ along a direction perpendicular to plane OA. If the particle strikes plane OB perpendicularly at Q, calculate



The vertical height h of P from O,

A. The time of flight $2s$

B. The velocity with which the particle strikes the plane $OB = 10m/s$

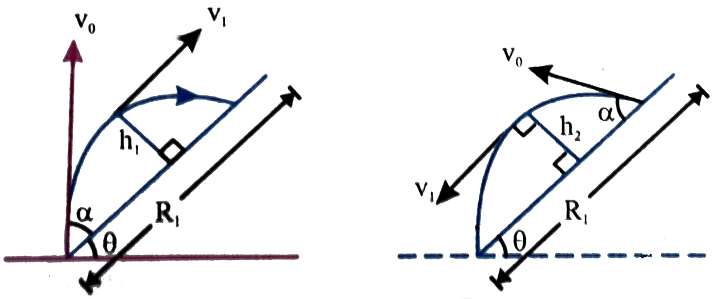
C. The height of the point P from point O is $5m$

D. The distance $PQ = 20m$

Answer: A::B::C::D

Watch Video Solution

10. Two balls are thrown from an inclined plane at angle of projection α with the plane, one up the incline and other down the incline as shown in figure (T stands for total time of flight):



A. $h_1 = h_2 = \dfrac{v_0^2 \sin^2 \alpha}{2g\cos\theta}$

B. $T_1 = T_2 = \dfrac{2v_0 \sin\alpha}{g\cos\theta}$

C. R_2 - $R_1 = g(\sin\theta)T_1^2$

D. $v_1 = v_2$

Answer: A::B::C::D

Watch Video Solution

11. An aeroplane at a constant speed releases a bomb.As the bomb drops away from the aeroplane,

A. It will always be vertically below the aeroplane

B. It will always be vertically below the aeroplane only if the aeroplane was flying horizontally.

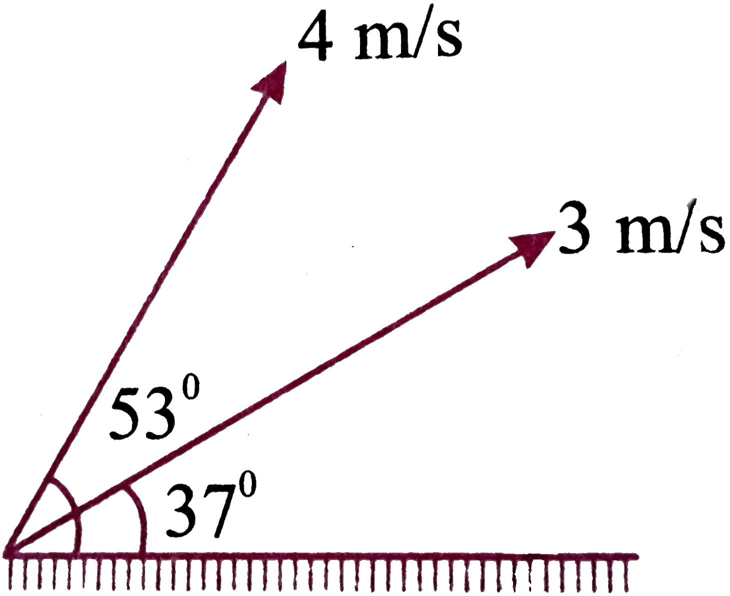
C. It will always be vertically below the aeroplane only if the aeroplane was flying at an angle of 45° to the horizontal

D. It will gradually was fall behind the aeroplane if the aeroplane was flying horizontally.

Answer: A

Watch Video Solution

12. Two particles are projected with speed $4m/s$ and $3m/s$ simultaneously from same point as shown in the figure. Then:



A. Their relative velocity is along vertical direction

B. Their relative acceleration is non-zero and it is along vertical direction

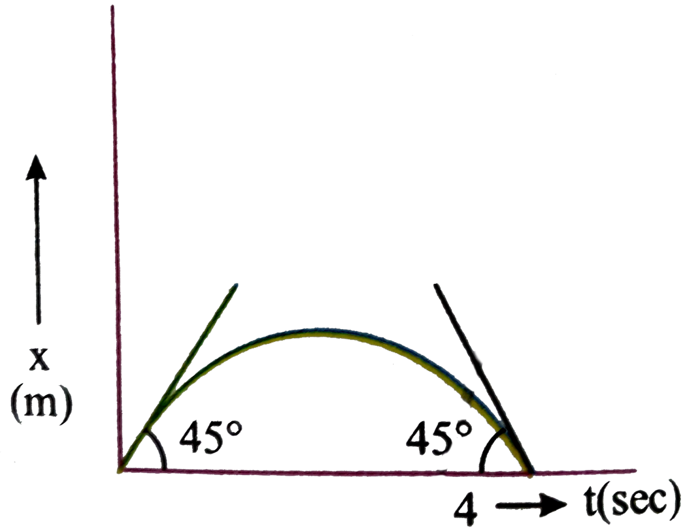
C. They will hit the surface simultaneously

D. Their relative velocity is constant and has magnitude $1.4m/s$

Answer: A::D

Watch Video Solution

13. A particle moves along x-axis with constant acceleration and its x-position depend on time t as shown in the following graph (parabola),then in interval 0 to 4sec.



A. relation between x-coordinate & time is

$x = t - t^2/4$

B. maximum x-coordinate is $1m$.

C. total distance travelled is $2m$

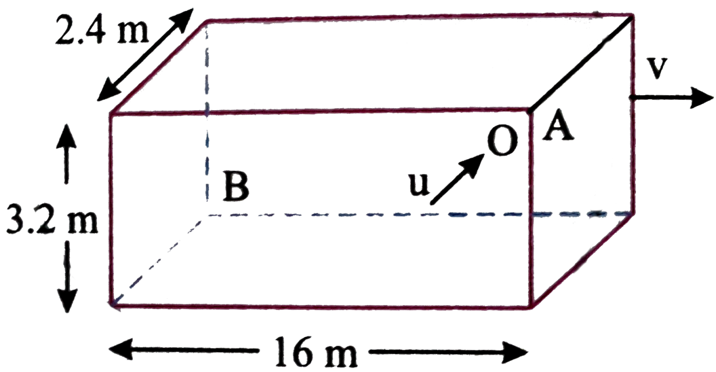
D. average speed is $0.5m/s$

Answer: A::B::C::D

Watch Video Solution

14. A railway compartments is $16m$ long, $2.4m$ wide and $3.2m$ high. It is moving with a velocity v A particle moving horizontally with a speed u perpendicular to the direction of v enters through a hole at an upper corner A and strikes the diagonally opposite corner B

.Assume $g = 10m/s^2$.



A. $v = 20m/s$

B. $u = 3m/s$

C. To an observer inside the compartment, the path of the particle is a parabola

D. To a stationary observer outside the compartment, the path of the particle is parabola

Answer: A::B::C::D

Watch Video Solution

15. Two particles A and B are projected from the same point with the same velocity of projection but at different angles $\alpha$and β of projection, such that the maximum height of A is two-third of the horizontal range of B. then which of the following relations are true?

A. range of A= maximum height of B

B. $3(1 - \cos 2\alpha) = 8\sin 2\beta$

C. maximum value of β is $\sin^{-1}(3/4)$

D. maximum horizontal range of A $=u^2/g$

and this occurs when $\beta = \frac{1}{2}\sin^{-1}\left(\frac{3}{8}\right)$

Answer: B::D

Watch Video Solution

16. Two particles are projected from the same point, with the same speed, in the same vertical plane, at different angles with the horizontal.A frame of references is fixed to one particle.The position vector of the other particle as observed from this frame is $\vec{r}$Which of the following statements are corrects?

A. direction of $\vec{r}$ does not change

B. $\vec{r}$ changes in magnitudes and direction with time

C. The magnitude of $\vec{r}$ increases linearly with time

D. The direction of $\vec{r}$ changes with time, its magnitude may or may not change, depending on the angles of projection

Answer: A::C

Watch Video Solution

Level-VI Passage answer

1. A river of width w is flowing such that the stream velocity varies with y as $v_R = v_0\left[1 + \frac{\sqrt{3} - 1}{w}y\right]$, where y is the perpendicular distance from one bank.A boat starts rowing from the bank with constant velocity $v = 2v_0$ in such a way that it always moves along a straight line perpendicular to the banks.

At what time will he reach the other bank

A. $t = \frac{w\pi}{6v_0}$

B. $\frac{w\pi}{6\left(\sqrt{2} - 1\right)v_0}$

C. $\dfrac{w\pi}{6\left(\sqrt{3}-1\right)v_0}$

D. $\dfrac{w\pi}{\left(\sqrt{3}-1\right)v_0}$

Answer: C

Watch Video Solution

2. A river of width w is flowing such that the stream velocity varies with y as $v_R = v_0\left[1+\dfrac{\sqrt{3}-1}{w}y\right]$, where y is the perpendicular distance from one bank.A boat starts rowing from the bank with constant velocity $v = 2v_0$ in such a way that it always moves along a straight line perpendicular to the banks.

What will be the velocity of the boat along the straight line when he reaches the other bank

A. v_0

B. $\sqrt{2}v_0$

C. $\frac{v_0}{\sqrt{2}}$

D. $2c_0$

Answer: A

Watch Video Solution

3. A man is riding on a flat car travelling with a constant speed of $10m/s$.He wishes to throw a ball through a stationary hoop $15m$ above the height of his hands in such a manner that the ball will move horizontally as it passes through the hoop. He throws the ball with a speed of $12.5m/s$ w.r.t himself.

How many seconds after he release the ball will it pass through the hoop?

A. 1sec

B. 2sec

C. 3sec

D. 4sec

Answer: B

Watch Video Solution

4. A man is riding on a flat car travelling with a constant speed of $10 m/s$.He wishes to throw a ball through a stationary hoop $15 m$ above the height of his hands in such a manner that the ball will move horizontally as it passes through the hoop. He throws the ball with a speed of $12.5 m/s$ w.r.t himself.

At what horizontal distance in front of the hoop must he release the ball?

A. $12.5 m$

B. $15.5 m$

C. $17.5m$

D. $20m$

Answer: C

Watch Video Solution

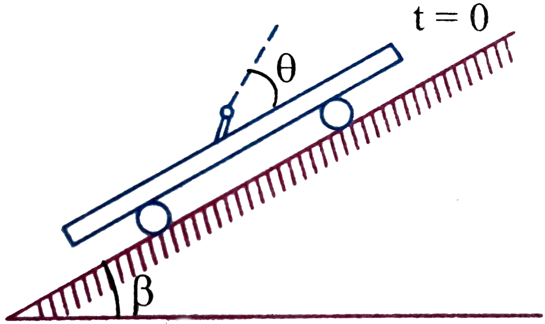
5. A cannon is fixed with a smooth massive trolley car at an angle θ as shown in the figure.The trolley car slides from rest down the inclined plane of angle of inclination β.

The muzzle velocity of the shell fired at $t = y_0$

from the cannon is u,such that the shell moves perpendicular to the inclined just after the firing.

The value of t_0 is:

firing.



A. $\dfrac{u\cos\theta}{g}$

B. $\dfrac{u\cos\theta}{g\cos\theta}$

C. $\dfrac{u\cos\theta}{g\sin\beta}$

D. $\dfrac{u\sin\theta}{g\cos\theta}$

Answer: C

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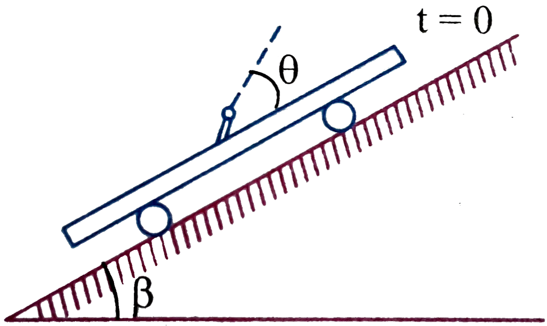
6. A cannon is fixed with a smooth massive trolley car at an angle θ as shown in the figure.The trolley car slides from rest down the inclined plane of angle of inclination β.

The muzzle velocity of the shell fired at $t = y_0$ from the cannon is u,such that the shell moves perpendicular to the inclined just after the firing.

The time of flight of the shell is:

firing.



A. $\dfrac{u\cos\theta}{g\sin\beta}$

B. $\dfrac{2u\sin\theta}{g\cos\beta}$

C. $\dfrac{u}{g}$

D. $\dfrac{u\sin\theta}{g\sin\beta}$

Answer: B

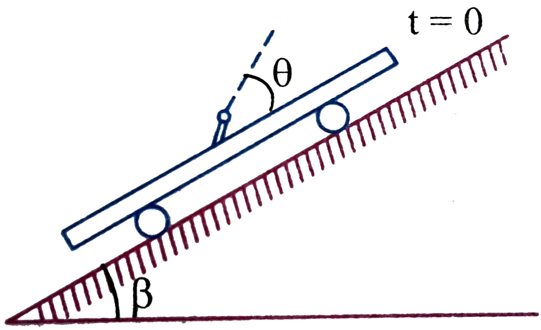
Watch Video Solution

7. A cannon is fixed with a smooth massive trolley car at an angle θ as shown in the figure.The trolley car slides from rest down the inclined plane of angle of inclination β.

The muzzle velocity of the shell fired at $t = y_0$ from the cannon is u,such that the shell moves perpendicular to the inclined just after the firing.

the difference in range of the shell relative to the trolley car and ground is:

firing.



A. $\frac{u^2 \sin 2\theta}{g \cos\beta}$

B. $\frac{u^2 \cos\theta}{2g \sin\beta}$

C. $\frac{u^2 \sin\theta \sin\beta}{2g}$

D. $\frac{2U^2 \sin\theta \cos(\theta - \beta)}{g \cos^2 g}$

Answer: D

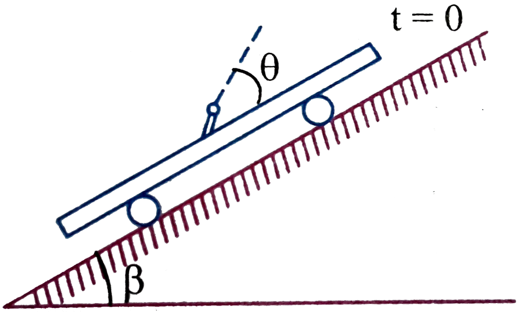
View Text Solution

8. A cannon is fixed with a smooth massive trolley car at an angle θ as shown in the figure.The trolley car slides from rest down the inclined plane of angle of inclination β.

The muzzle velocity of the shell fired at $t = y_0$ from the cannon is u,such that the shell moves perpendicular to the inclined just after the firing.

after what time should the shell be fired such that it will go vertically up?

firing.



A. $\frac{u\cos\theta}{g\sin\beta}$

B. $\frac{u\sin(\theta+\beta)}{g\cos\theta\sin\beta}$

C. $\frac{u\cos(\theta+\beta)}{g\cos\beta}$

D. $\frac{u\cos(\theta+\beta)}{g\sin\beta\cos\beta}$

Answer: D

View Text Solution

9. When we analyse the projectile motion from any accelerated frame O as $\vec{r}_o, \vec{u}_o$ and $\vec{a}_o$ respectively, express the following terms, $\vec{r}_{pO} + \vec{a}_p - \vec{r}_O, \vec{u}_{pO} = \vec{u}_p - \vec{u}_O$ and $\vec{a}_{pO} = \vec{a}_p - \vec{a}_O$

where P stands for projectile. Then using the following kinematical equations of the projectile (For constant acceleration) relative to the accelerating frame ,we have

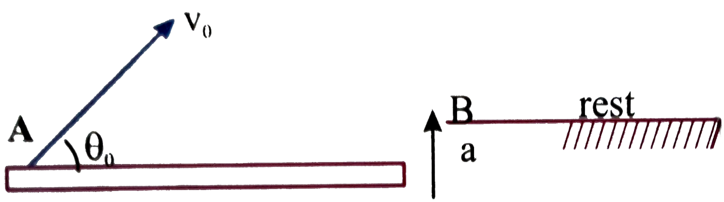
$\vec{S}_{pO} = \vec{u}_{pO}t + \frac{1}{2}\vec{a}_{pO}t^2, \vec{v}_{pO}$

$= \vec{u}_{pO} + \vec{a}_{pO}t$ and $v_{pO}^2 = u_{pO}^2 + 2\vec{a}.\vec{s}_pO$

Using the above expressions, anwer the following

question:A projectile has initial velocity v_0 realtive to the large plate which is moving with a constant upward acceleration a.

Which of the following remains equal for the the observers A and B?



A. Maximum height

B. Range

C. Time of flight

D. Angle of projection

Answer: D

View Text Solution

10. When we analyse the projectile motion from any accelerated frame O as $\vec{r}_o$, $\vec{u}_o$ and $\vec{a}_o$ respectively, express the following terms, $\vec{r}_{pO} + \vec{a}_p - \vec{r}_O$, $\vec{u}_{pO} = \vec{u}_p - \vec{u}_O$ and $\vec{a}_{pO} = \vec{a}_p - \vec{a}_O$

where P stands for projectile. Then using the following kinematical equations of the projectile (For constant acceleration) relative to the accelerating frame ,we have

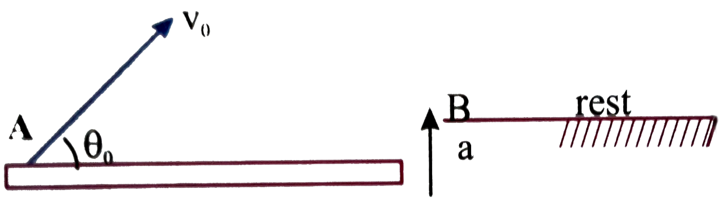
$\vec{S}_{pO} = \vec{u}_{pO}t + \frac{1}{2}\vec{a}_{pO}t^2, \vec{v}_{pO}$

$= \vec{u}_{pO} + \vec{a}_{pO}t$ and $v_{pO}^2 = u_{pO}^2 + 2\vec{a}.\vec{s}_pO$

Using the above expressions, anwer the following

question:A projectile has initial velocity v_0 realtive to the large plate which is moving with a constant upward acceleration a.

Refering to Q.1, velocity of the projectile relative to B ofter some time



A. $< v_0$at an angle$\theta < \theta_0$

B. $> v_0$at an angle$\theta > \theta_0$

C. $> v_0$at an angle$\theta = \theta_0$

D. $v_0$at an angle$\theta = \theta_0$

Answer: D

View Text Solution

11. A point moves in the plane xy according to the law, $x = a\sin\omega t$, $y = a(1 - \cos\omega t)$ Answer the following question taking a and ω as positive constant

The distance travelled by the point during the time T is

A. $2a\omega T$

B. $3a\omega T$

C. $4a\omega T$

D. $a\omega T$

Answer: D

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12. A point moves in the plane xy according to the law, $x = a\sin\omega t, y = a(1 - \cos\omega t)$ Answer the following question taking a and ω as positive constant

The equation of the trajectory of the particle is

A. $y = a - \sqrt{a^2 - x^2}$

B. $y = a + \sqrt{a^2 - x^2}$

C. $y = a - \frac{\sqrt{a^2 - x^2}}{2a}$

D. $y = a - 2\frac{\sqrt{a^2 - x^2}}{a}$

Answer: B

Watch Video Solution

13. A point moves in the plane xy according to the law, $x = a\sin\omega t$, $y = a(1 - \cos\omega t)$ Answer the following question taking a and ω as positive constant

The magnitude of the velocity of the point as a

function of time is

A. $a\sqrt{1 + (1 - \alpha t)^2}$

B. $a\sqrt{1 + (1 - 2\alpha t)^2}$

C. $2a\sqrt{1 + (1 - \alpha t)^2}$

D. $2a\sqrt{1 + (1 - 2\alpha t)^2}$

Answer: B

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14. At time $t = 0$, the position vector of a particle moving in the x - y plane is $5\hat{j}m$.By time $t = 0.62\text{sec}$,its position vector has become $\left(5.1\hat{i} + 0.4\hat{j}\right)m$.with the data answer the following questions.

The magnitude of the average velocity during the above time interval.

A. $.0206m/\sec$

B. $0.206m/\sec$

C. $20.6m/\sec$

D. $2.06m/\sec$

Answer: C

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15. At time $t = 0$, the position vector of a particle moving in the x - y plane is $5\hat{j}m$.By time $t = 0.62$sec,its position vector has become $\left(5.1\hat{i} + 0.4\hat{j}\right)m$.with the data answer the following questions.

The angle θ made by the average velocity with the positive x axis

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

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

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

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

Answer: D

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16. The position vector of a particle at time t is given by $\vec{r} = 2t\hat{i} + 5t\hat{j} + 4\sin\omega t\hat{k}$ where ω is a constant.Answer the following questions

Velocity vector of the particle is

A. Constant in magnitude but variable with direction

B. constant in direction must variable with magnitude

C. constant

D. Varying with magnitude as well as direction

Answer: D

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17. The position vector of a particle at time t is given by $\vec{r} = 2t\hat{i} + 5t\hat{j} + 4\sin\omega t\hat{k}$ where ω is a constant.Answer the following questions

Velocity vector is perpendicular to ....vector

A. $2\hat{i} + 4\hat{j}$

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

C. $5\hat{i}$ - $2\hat{j}$

D. None

Answer: C

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18. The position vector of a particle at time t is given by $\vec{r} = 2t\hat{i} + 5t\hat{j} + 4\sin\omega t\hat{k}$ where ω is a constant.Answer the following questions

Acceleration of the particle is

A. Constant in magnitude but variable with direction

B. constant

C. Constant in direction but variable with magnitude

D. Varying with magnitude as well as direction

Answer: D

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Level-Vi Integer

1. The distance between two moving particles P and Q at any time is a.If v_r be their relative velocity and if u and v be the components of v_r, along and perpendicular to PQ.The closest distance between P and Q and time that elapses before they arrive at their nearest distance is

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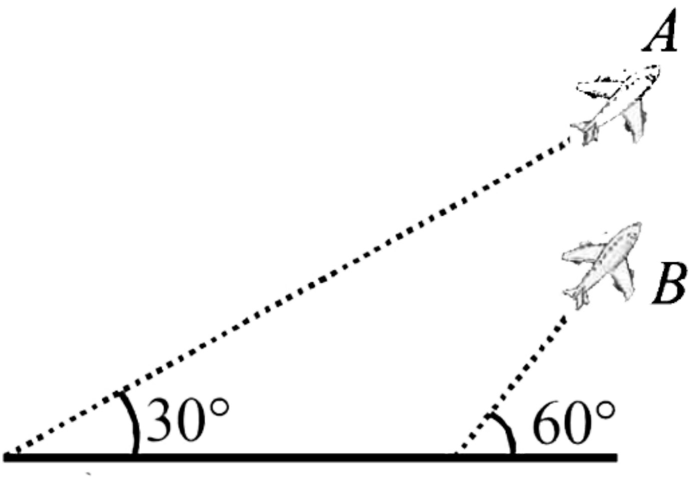
2. Airplanes A and B are flying with constant velocity in the same vertical plane at angles $30\,^{\circ}$ and $60\,^{\circ}$ with respect to the horizontal respectively as shown in figure . The speed of A is $100\sqrt{3}m/s$. At time $t = 0s$, an observer in A finds B at a distance of $500m$. The observer sees B moving with a constant velocity perpendicular to the line of motion of A . If at $t = t_0$, A just escapes being hit by B, t_0 , A just escapes being hit by B, t_0 in seconds is



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3. A rock is launched upward at 45°.A bee moves along the trajectory of the rock at a constant speed equal to the initial speed of the rock.The magnitude of acceleration of the bee at the top point of the trajectory is xg?For the rock, neglect the air resistance.Find the value of x.

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4. A ball is thrown horizontally from a height of $20m$.If hits the ground with a velocity of 3 times the velocity of projection.The velocity of projection is $3.5xm/s$ then x is

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5. A body is projected up from the bottom as inclined plane with velocity $3\sqrt{3}m/\sec$ which makes an angle 60° if the horizontal. The angle of projection is 30° with the plane then the time of flight when it strikes the same plane is $0.1x$. Then the value of x is

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6. A ball is thrown with a velocity whose horizontal component is $12ms^{-1}$ from a point $15m$ above the ground and $6m$ away from a verticlewall $18.75m$ high in such a way so as just to clear the wall. At what time will it reach the ground ? $\left(g = 10ms^{-2}\right)$.

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7. A golfer standing on level ground hits a ball with a velocity of $52ms^{-1}$ at an angle θ above the horizontal. If $\tan\theta = 5/12$, then find the time for which then ball is atleast $15m$ above the ground $\left(takeg = 10ms^{-2}\right)$.

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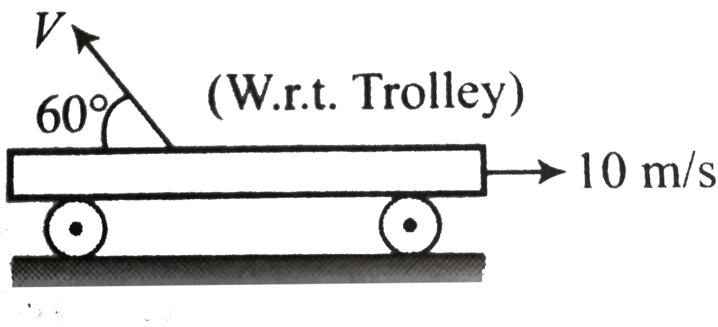
8. A particle is projected from a stationary trolley. After projection, the trolley moves with a velocity $2\left(\sqrt{15}\right)m/s$. For an observer on the trolley, the direction of the particle is as shown in the figure while for the observer on the ground, the ball rises vertically. The maximum height reached by the ball from the trolley is h meter. The value of h will be ....



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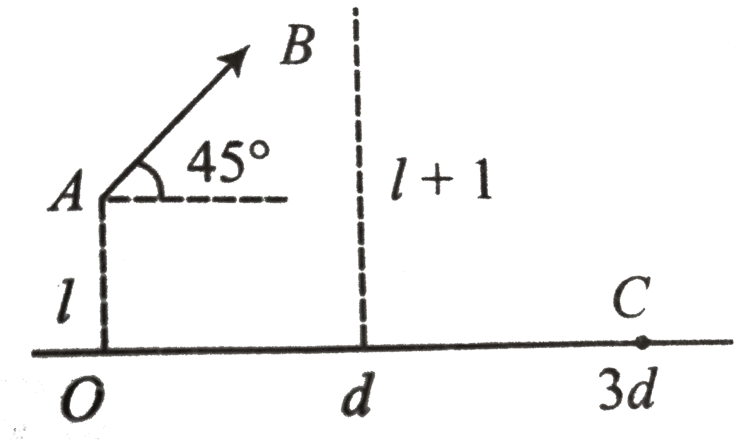
9. A projectile is launched at time t = 0 from point A which is at height 1 m above the floor with speed vms^{-1} and at and angle $\theta = 45°$ with the floor. It passes through a hoop at B which is 1 m above A and B is the highest point of the trajectory. The horizontal distance between A and B is d meters. The projectile then falls into a basket, hitting the floor at C a horizontal distance 3 d meters from A. Find l (in m).



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Level-I (H.W)

1. The forces each of $20N$ act on a body at 120° The magnitude and direction of resultant is

A. $20N, \phi = 60^\circ$

B. $20\sqrt{2}N, \phi = 60^\circ$

C. $10\sqrt{2}N, \phi = 0^\circ$

D. $10\sqrt{2}N, \phi = 120^\circ$

Answer: A

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2. Two forces whose magnitudes are in the ratio $3:5$ give a resultant of $35N$.If the angle between them is 60°, the magnitude of each force is

A. $3N, 5N$

B. $9N, 25N$

C. $15N, 25N$

D. $21N, 35N$

Answer: C

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3. The resultant of two forces $2P$ and $\sqrt{2}P$ is $\sqrt{10}P$.The angle between the forces is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: B

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4. Which one of the following cannot be represented by the three sides of a triangle?

A. 5, 9, 11

B. 3, 7, 11

C. 7, 10, 13

D. 3, 8, 9

Answer: B

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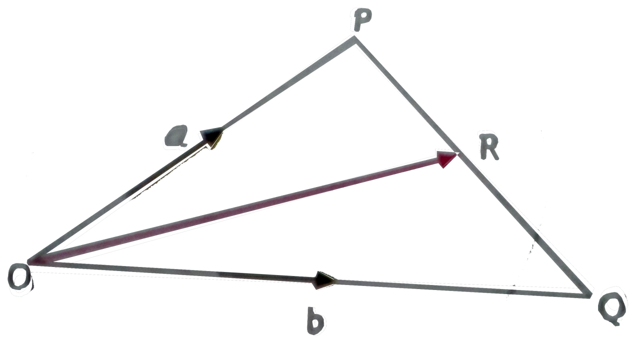
5. Figure shows three vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ where R is the mid point of PQ, then which of the following relations is correct.



A. $\vec{a} + \vec{b} = 2\vec{c}$

B. $\vec{a} + \vec{b} = \vec{c}$

C. $\vec{a} - \vec{b} = 2\vec{c}$

D. $\vec{a}$ - $\vec{b}$ = $\vec{c}$

Answer: A

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6. Eleven forces each equal to $5N$ act on a particle simultaneously.If each force makes an angle 30° with the next one, the resultant of all forces is

A. $15N$

B. $55N$

C. $5N$

D. zero

Answer: C

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7. A body of mass $\sqrt{3}$ kg is suspended by a string to rigid support.The body is pulled horizontally by a force F until the string makes

an angle of 30° with the vertical.The value of F and tension in the string are

A. $9.8N, 9.8N$

B. $9.8N, 19.6N$

C. $19.6N, 19.6N$

D. $19.6N, 9.8N$

Answer: B

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8. Two light strings of length $4cm$ and $3cm$ are tied to a bob of weight $500gm$.The free ends of the strings are tied to pegs in the same horizontal line and separated by $5cm$.The ratio of tension in the longer string to that in the shortest string is

A. $4:3$

B. $3:4$

C. $4:5$

D. $5:4$

Answer: B

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9. A force $2\hat{i} + \hat{j} - \hat{k}$ newton acts on a body which is initially at rest.If the velocity of the body at the end of $20 seconds$ is $4\hat{i} + 2\hat{j} + 2\hat{k} ms^{-1}$, the mass of the body

A. $20kg$

B. $15kg$

C. $10kg$

D. $5kg$

Answer: C

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10. The position vector of a moving particle at seconds in given by $\vec{r} = 3\hat{i} + 4t^2\hat{j} - t^3\hat{k}$.Its displacement during an interval of $1s$ to $3s$ is

A. $\hat{j} - \hat{k}$

B. $3\hat{i} + 4\hat{j} - \hat{k}$

C. $9\hat{i} + 36\hat{j} - 27\hat{k}$

D. $32\hat{j} - 26\hat{k}$

Answer: D

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11. If initial velocity of a body is $\vec{u} = 2\vec{i} - 2\vec{j} + 3\vec{k}$ and the final velocity is $\vec{v} = 2\vec{i} - 4\vec{j} + 5\vec{k}$ and it is changed in time of 10sec.Find the acceleration vector?

A. $\dfrac{3\vec{i} - 2\vec{j} + 2\vec{k}}{10}$

B. $\dfrac{-3\vec{i} + \vec{j} + 2\vec{k}}{10}$

C. $\dfrac{-3\vec{i} - \vec{2}j + 2\vec{k}}{10}$

D. $\dfrac{\vec{-}j + \vec{k}}{5}$

Answer: D

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12. A particle is moving eastwards with a velocity $15ms^{-1}$.Suddenly it moves towards north and moves with the same speed in time 10sec.The average acceleration during this time is

A. $3/\sqrt{2}NE$

B. $3/\sqrt{2}NE$

C. $3/\sqrt{2}NW$

D. $3/\sqrt{2}NW$

Answer: C

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13. A person crossing a road with a certain velocity due north, sees a car moving towards east.The relative velocity of the car w.r.t the person is $\sqrt{2}$ times that of the velocity of the person.The angle made by the relative velocity with the east is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: B

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14. A Person is walking in rain feels the velocity of rain as twice to his velocity.At which angle he should hold the umbrella with vertical if he moves forward, if it is raining vertically downwards

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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15. When it is raining vertically down, to a man walking on road the velocity of rain appears to be $1.5 \times$ his velocity.To protect himself from rain he should hold the umbrealla at an angle θ to vertical. The $\tan\theta =$

A. $\frac{2}{\sqrt{5}}$

B. $\frac{\sqrt{5}}{2}$

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

D. $\frac{3}{2}$

Answer: A

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16. A motor car A is travelling with a velocity of $20 m/s$ in the north-west direction and another motor car B is travelling with a velocity of $15 m/s$ in the north-east directions.The magnitude of relative velocity of B with respect to A is.

A. $25 m/s$

B. $15 m/s$

C. $20 m/s$

D. $35 m/s$

Answer: A

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17. A man can swim in still water at a speed of $6kmph$ and he has to cross the river and reach just opposite point on the other bank.If the river is flowing at a speed of $3kmph$,and the width of the river is $2km$, the time taken to cross the river is (in hours)

A. $\frac{2}{27}$

B. $\frac{2}{\sqrt{27}}$

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

D. $\frac{2}{\sqrt{45}}$

Answer: B

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18. A boat moves perpendicular to the bank with a velocity of $7.2km/h$.The current carries it $150m$ downstreamk.find the velocity of the current (The width of the river is $0.5km$).

A. $0.4ms^{-1}$

B. $1.2ms^{-1}$

C. $0.5ms^{-1}$

D. $0.6ms^{-1}$

Answer: D

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19. A swimmer is capable of swimming $1.65ms^{-1}$ in still water.If she swims directily across a $180m$ wide river whose current is

$0.85 ms^{-1}$,how far downstreams (from a point opposite her starting point) will she reach?

A. $92.7m$

B. $40m$

C. $48m$

D. $20m$

Answer: A

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20. A person swims at 135° to current to river, to meet target on reaching opposite point.The ratio of person's velocity to river water velocity is

A. $\sqrt{3}:1$

B. $\sqrt{2}:1$

C. $1:\sqrt{2}$

D. $1:\sqrt{3}$

Answer: B

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21. The parabolic path of a projectile is represented by $y = \frac{x}{\sqrt{3}} - \frac{x^2}{60}$ in MKS units: Its angle of projection is $\left(g = 10ms^{-2}\right)$

A. $30°$

B. $45°$

C. $60°$

D. $90°$

Answer: A

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22. A body is projected at angle 30° to horizontal with a velocity $50ms^{-1}$.Its time of flight is

A. $4s$

B. $5s$

C. $6s$

D. $7s$

Answer: B

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23. A body is projected with velocity $60m/s$ at 30° to the horizontal.The velocity of the body after $3seconds$ is

A. $20\hat{i} + 20\sqrt{3}\hat{j}$

B. $30\hat{i}$

C. $10\sqrt{3}\hat{j}$

D. $30\sqrt{3}\hat{i}$

Answer: D

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24. A body is projected with velocity u such that in horizontal range and maximum vertical heights are samek.The maximum height is

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

B. $\frac{3u^2}{4g}$

C. $\frac{16u^2}{17g}$

D. $\frac{8u^2}{17g}$

Answer: D

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25. A cricket ball is hit for a six leaving the bat at an angle of 60° to the horizontal with kinetic energy k.At the top, $K.E.$ of the ball is

A. Zero

B. k

C. $\frac{k}{4}$

D. $\frac{k}{\sqrt{2}}$

Answer: C

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26. A bomb at rest is exploded and the pieces are scattered in all directions with a maximum velocity of $20ms^{-1}$.Dangerous distance from that spot is $\left(g = 10m/s^2\right)$

A. $10m$

B. $20m$

C. $30m$

D. $40m$

Answer: D

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27. A boy can throw a stone up to a maximum height of $10m$. The maximum horizontal distance that the boy can throw the same stone up to will be :

A. $20\sqrt{2}m$

B. $10m$

C. $10\sqrt{2}m$

D. $20m$

Answer: D

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28. A grass hopper can jump a maximum horizontal distance of $20.4cm$. If it speeds negligible tiem on the ground, what is its speed of travel along the road, $g = 10m/s^{\circ}$.

A. $3/2m/s$

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

C. $1/2m/s$

D. $\sqrt{\frac{2}{3}}m/s$

Answer: B

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29. A stone is thrown with a velocity v at an angle θ with the horizontal.Its speed when it makes an angle β with the horizontal is

A. $v\cos\theta$

B. $\dfrac{v}{\cos\beta}$

C. $v\cos\theta\cos\beta$

D. $\dfrac{v\cos\theta}{\cos\beta}$

Answer: D

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30. A body is projected with a certain speed at angles of projection of θ and $90 - \theta$.The maximum heights attained in the two cases are $20m$ and $10m$ respectively.The maximum possible range is

A. $60m$

B. $30m$

C. $20m$

D. $80m$

Answer: A

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31. The launching speed of a certain projectile is five times the speed it has at its maximum height.Its angles of projection is

A. $\theta = \cos^{-1}(0.2)$

B. $\theta = \sin^{-1}(0.2)$

C. $\theta = \tan^{-1}(0.2)$

D. $\theta = 0^\circ$

Answer: A

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32. A person throws a bottle into a dustbin at the same height as he is $2m$ away at an angle of 45°.The velocity of thrown is

A. g

B. $\sqrt{g}$

C. $2g$

D. $\sqrt{2g}$

Answer: D

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33. A body projected horizontally from the top of a tower follows $y = 20x^2$ parabola equation where x, y are in $m\left(g = 10m/s^2\right)$.Then the velocity of the projectile is $\left(ms^{-1}\right)$

A. 0.2

B. 0.3

C. 0.4

D. 0.5

Answer: D

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34. A bomb is dropped from an aeroplane flying horizontally with a velocity of $720 kmph$ at an altitude of $980 m$.Time taken by the bomb to hit the ground is

A. $1 s$

B. $7.2 s$

C. $14.14 s$

D. $0.15s$

Answer: C

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35. A body is projected horizontally from a height of $78.4m$ with a velocity $10ms^{-1}$.Its velocity after $3seconds$ is $\left(g = 10m/s^2\right)$ (Take direction of projection as i and vertically upward direction as j)

A. $10\hat{i} - 30\hat{j}$

B. $10\hat{i} + 30\hat{j}$

C. $20\hat{i}$ - $30\hat{j}$

D. $10\hat{i}$ - $10\sqrt{3}\hat{j}$

Answer: A

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36. Two thin wood screens A and B are separated by $200m$ a bullet travelling horizontally at speed of $600m/s$ hits the screen A penetrates through it and finally emerges out from B making holes in A and B the resistance of air and wood are negligible the difference of heights of the holes in A and B is.

A. $5m$

B. $\frac{49}{90}m$

C. $\frac{7}{\sqrt{90}}m$

D. zero

Answer: B

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37. A fly wheel is rotating about its own axis at an angular velocity $11 rads^{-1}$, its angular velocity in revolation per minute is

A. 105

B. 210

C. 315

D. 420

Answer: A

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38. A stationary wheel starts rotating about its own axis at constant angular acceleration. If the wheel completes 50 rotations in first 2 seconds, then the number of rotations mades by it in next two seconds is

A. 75

B. 100

C. 125

D. 150

Answer: D

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39. A point size body is moving along a circle at an angular velocity $2.8 rads^{-1}$.If centripetal acceleration of body is $7ms^{-2}$ then its speed is

A. $1.25ms^{-1}$

B. $2.5ms^{-1}$

C. $3.5ms^{-1}$

D. $7ms^{-1}$

Answer: B

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40. A circular plate is rotating about its own axis at an angular velocity 100 revolutions per minute. The linear velocity of a particle P of plate at a distance $4.2 cm$ from axis of rotation is

A. $0.22 m/s$

B. $0.44 m/s$

C. $2.2m/s$

D. $4.4m/s$

Answer: B

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41. An air craft executes a horizontal loop of radius $1km$ with steady speed of $900kmh^{-1}$. Compare its centripetal acceleration with the acceleration due to gravity.

A. 6.0

B. 6.4

C. 5

D. 7

Answer: B

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Level-II(H.W)

1. The greatest and least resultant of two forces are $7N$ and $3N$ respectively. If each of the force is increased by $3N$ and applied at 60°.The magnitude of the resultant is

A. $7N$

B. $3N$

C. $10N$

D. $\sqrt{129}N$

Answer: D

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2. In an equilateral triangle ABC, AL, BM, and CN are medians. Forces along BC and BA represented by them will have a resultant represented by

A. $2\overrightarrow{AL}$

B. $2\overrightarrow{BM}$

C. $2\overrightarrow{CN}$

D. $\overrightarrow{AC}$

Answer: B

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3. Given that $\vec{A}+\vec{B}+\vec{C}=0$, out of three vectors two are equal in magnitude and the magnitude of third vector is $\sqrt{2}$ times that of either of two having equal magnitude. Then angle between vectors are given by

A. $30^\circ, 60^\circ, 90^\circ$

B. $45^\circ, 135^\circ, 150^\circ$

C. $90^{\circ}, 135^{\circ}, 150^{\circ}$

D. $90^{\circ}, 135^{\circ}, 135^{\circ}$

Answer: D

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4. A and B are two pegs separated by $13cm$.A body of $169kgwt$ is suspended by thread of $17cm$ connecting to $A\&B$, such that the two segments of strings are perpendicular.Then tensions in shorter and longer parts of string are

A. $100 kgwt, 69 kgwt$

B. $65 kgwt, 156 kgwt$

C. $156 kgwt, 65 kgwt$

D. $69 kgwt, 100 kgwt$

Answer: B

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5. Two particles having position vectors $\vec{r}_1 = \left(3\vec{i} + 5\vec{j}\right)m$ and $\vec{r}_2 = \left(-5\vec{i} + 3\vec{j}\right)m$ are moving with velocities $\vec{V}_1 = \left(4\hat{i} - 4\hat{j}\right)ms^{-1}$ and $\vec{V}_2 = \left(1\hat{i} - 3\hat{j}\right)ms^{-1}$. If they collide after 2 seconds, the value of a is

A. 2

B. 4

C. 6

D. 8

Answer: C

Watch Video Solution

6. A body is projected up such that its position vector varies with time as $\vec{r} = \left\{3t\hat{i} + \left(4t - 5t^2\right)\hat{j}\right\}m$. Here t is in second.The time when its y-coordinate is zero is

A. $3s$

B. $1s$

C. $0.8s$

D. $1.25s$

Answer: C

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7. The position of a particle is given by $\vec{r} = 3t\vec{i} - 2t^2\hat{j} + 4\hat{k}m$ where t is in second and the co-efficients have proper units for r to be in m.The magnitude and direction of velocity of the particle at $t = 2s$ is

A. $8.54ms^{-1}, 20^{\circ}$ with x-axis

B. $10.54ms^{-1}, 70^{\circ}$ with x-axis

C. $8.54ms^{-1}, 70^{\circ}$ with x-axis

D. $10.54ms^{-1}, 20^{\circ}$ with x-axis

Answer: C

Watch Video Solution

8. A particle starts from origin at $t = 0$ with a constant velocity $5\hat{i} m/s$ and moves in $x - y$ plane under action of a force which produce a constant acceleration of $\left(3\hat{i} + 2\hat{j}\right)m/s^2$ the y-coordinate of the particle at the instant its x co-ordinate is $84m$ in m is

A. 6

B. 36

C. 18

D. 9

Answer: B

Watch Video Solution

9. When two bodies approach each other with the different speeds, the distance between them decreases by $120m$ for every $1 \min$ .The speeds of the bodies are

A. $2m/s$ and $0.5m/s$

B. $3m/s\&2m/s$

C. $1.75m/s\&0.25m/s$

D. $2.5m/s\&0.5m/s$

Answer: C

Watch Video Solution

10. An aeroplane is flying with the velocity of $V_1 = 800kmph$ relative to the air towards south.A wind with velocity of $V_2 = 15ms^{-1}$ is blowing from west to east.What is the velocity of the aeroplane with respect of the earth.

A. $221.7ms^{-1}$

B. $150ms^{-1}$

C. $82ms^{-1}$

D. $40ms^{-1}$

Answer: A

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11. A boat takes $4hr$ upstream and $2hr$ down the stream for covering the same distance.The ratio of velocity of boat to the water in river is.

A. $1:3$

B. $3:1$

C. $1:\sqrt{3}$

D. $\sqrt{3}:1$

Answer: B

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12. The width of a river is $2\sqrt{3}km$.A boat is rowed in direction perpendicular to the banks of river.If the drift of the boat due to flow is $2km$,the displacement of the boat is.

A. $3km$

B. $6km$

C. $5km$

D. $4km$

Answer: D

Watch Video Solution

13. Person aiming to reach the exactly opposite point on the bank of a stream is swimming with a speed of $0.5ms^{-1}$ at an angle of 120° with the direction of flow of water.The speed of water in the stream is

A. $1ms^{-1}$

B. $0.25ms^{-1}$

C. $0.67ms^{-1}$

D. $3ms^{-1}$

Answer: B

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14. A particle projected from the level ground just clears in its ascent a wall $30m$ high and $120\sqrt{3}$ away measured horizontally.The time since projection to clear the wall is two second.It will strike the ground in the same horizontal plane from the wall on the other side of a distance of (in metres)

A. $150\sqrt{3}$

B. $180\sqrt{3}$

C. $120\sqrt{3}$

D. $210\sqrt{3}$

Answer: B

Watch Video Solution

15. A stone is projected with a velocity $20\sqrt{2}m/s$ at an angle of 45° to the horizontal.The average velocity of stone during its motion from starting point to its maximum height is

A. $10\sqrt{5}m/s$

B. $20\sqrt{5}m/s$

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

D. $20m/s$

Answer: A

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16. A ball is thrown with velocity $8ms^{-1}$ making an angle 60° with the horizontal.Its velocity will be perpendicular to the direction of initial velocity of projection after a time of

A. $\frac{1.6}{\sqrt{3}}s$

B. $\frac{4}{\sqrt{3}}s$

C. $0.6s$

D. $1.6\sqrt{3}s$

Answer: A

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

A. $3km$

B. $4.5km$

C. $1.5km$

D. $2.5km$

Answer: C

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18. A body is projected obliquely from the ground such that its horizontal range is maximum.If the change in its maximum height to maximum height, is P, the change in its linear momentum as it travels from the point of projection to the landing point on the ground will be

A. P

B. $\sqrt{P}$

C. $2P$

D. $2\sqrt{2}P$

Answer: D

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19. A projectile is thrown at angle β with vertical.It reaches a maximum height H.The time taken to reach the hightest point of its path is

A. $\sqrt{\dfrac{H}{g}}$

B. $\sqrt{\dfrac{2H}{g}}$

C. $\sqrt{\dfrac{H}{2g}}$

D. $\sqrt{\dfrac{2H}{g\cos\theta}}$

Answer: B

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20. 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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21. A gardener wants to wet the garden without moving from his place with a water jet whose velocity is $20ms^{-1}$ the maximum area that he can wet $\left(g = 10ms^{-2}\right)$ (in $metre^2$)

A. 1600π

B. 40π

C. 400π

D. 200π

Answer: A

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22. A particle is projected with speed u at angle θ to the horizontal. Find the radius of curvature at highest point of its trajectory

A. $\dfrac{u^2\cos^2\theta}{2g}$

B. $\dfrac{\sqrt{3}u^2\cos^2\theta}{2g}$

C. $\frac{u^2\cos^2\theta}{g}$

D. $\frac{\sqrt{3}u^2\cos^2\theta}{g}$

Answer: C

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23. From the top of a tower of height $78.4m$ two stones are projected horizontally with $10m/s$ and $20m/s$ in opposite directions. On reaching the ground, their separation is

A. $120m$

B. $100m$

C. $200m$

D. $150m$

Answer: A

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24. A body is projected vertically upwards.At its highest point it explodes into two pieces of masses in the ratio of $2:3$ and the lighter piece flies horizontally with a velocity of $6ms^{-1}$

.The time after which the lines joining the point of explosion to the position of particles are perpendicular to each other is

A. $\sqrt{\frac{6}{25}}s$

B. $\sqrt{\frac{12}{15}}s$

C. $\sqrt{\frac{24}{25}}s$

D. $2s$

Answer: C

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25. From the top of a building $80m$high, a ball is thrown horizontally which hits the ground at a distance.The line joining the top of the building to the point where it hits the ground makes an angle of 45° with the ground. Initial velocity of projection of the ball is $\left(g = 10m/s^2\right)$

A. $10m/s$

B. $15m/s$

C. $20m/s$

D. $30m/s$

Answer: C

Watch Video Solution

26. A stone is thrown from the top of a tower of height $50m$ with a velocity of $30ms^{-1}$ at an angle of 30° above the horizontal.Find the time during which the stone will be in air

A. $2\sec$

B. 3sec

C. 4sec

D. 5sec

Answer: D

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27. 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. $3:1$

D. $4:1$

Answer: A

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28. A body is thrown horizontally with a velocity u from the top of a tower.The displacement of the stone when the horizontal and vertical velocities are equal is

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

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

C. $\sqrt{5}\left(\frac{u^2}{2g}\right)$

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

Answer: C

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29. A ball is projected with $20\sqrt{2}m/s$ at angle 45° with horizontal.The angular velocity of the particle at highest point of its journey about point of projection is

A. $0.1rad/s$

B. $1rad/s$

C. $0.3rad/s$

D. $0.4rad/s$

Answer: B

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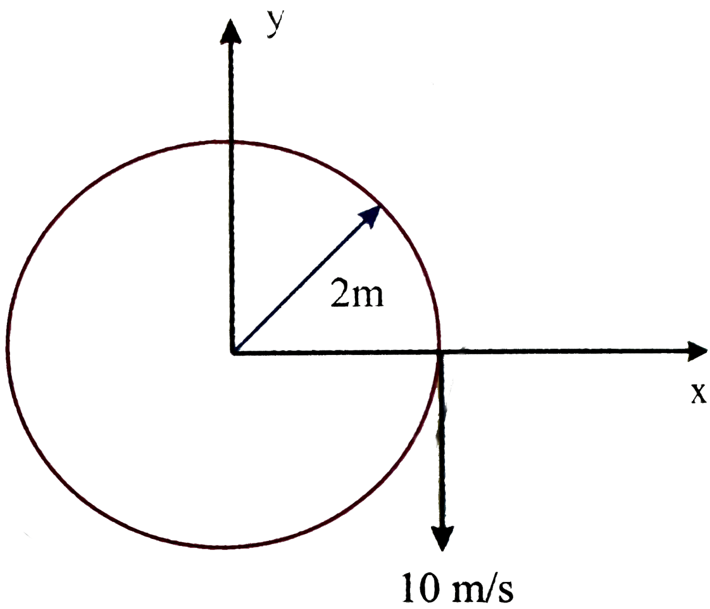
30. A particle is moving along a circular path in xy-plane.When its crosses x-axis,it has an acceleration along the path of $1.5m/s^2$, and is moving with a speed of $10m/s$ in $-ve$ y-

direction.The total acceleration is



A. $50\hat{i}$ - $105\hat{j}m/s^2$

B. $10\hat{i}$ - $1.5\hat{j}m/s^2$

C. -$50\hat{i}$ - $1.5\hat{j}m/s^2$

D. $1.5\hat{i}$ - $50\hat{j}m/s^2$

Answer: C

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31. An insect trapped in a circular groove of radius $12cm$ moves along the groove steadily and complete 7 revolutions in 100 seconds.The linear speed of the motion in cm/s

A. 5.3

B. 4

C. 3

D. 5

Answer: A

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llustration

1. A particle start origin moves towares north with 50m then move towards east with 40m and finaly move towards south with 20m. Find distance and displacement.

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2. A bullet fired at an angle of 30° with the horizontal hits the ground 3.0 km away. By adjusting its angle of projection, can one hope to hit a target 5.0 km away? Assume the muzzle speed to be fixed and neglect air resistance.

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3. A cannon and a target are $5.10km$ apart and located at the same level. How soon will the shell launched with the initial velocity $240m/s$ reach the target in the absence of air drag?

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4. The ceiling of a long hall is $20m$ high. What is the maximum horizontal distance that a ball thrown with a speed of $40m$ can go without hitting the ceiling of hall $\left(g = 10ms^{-2}\right)$?

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5. A ball projected with a velocity of 10 m/s at angle of 30° with horizontal just clears two vertical poles each of height 1m. Find separation between the poles.

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6. A body is projected with velocity u at an angle of projection θ with the horizontal. The direction of velocity of the body makes angle 30° with the horizontal at $t = 2s$ and then after $1s$ it reaches the maximum height. Then

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7. A particle is thrown over a triangle from one end of a horizontal base and after grazing the vertex falls on the other end of the base. If α and β be the base angles and θ the angle of projection, prove that $\tan\theta = \tan\alpha + \tan\beta$.

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8. The velocity of a projectile when it is at the greatest height is $\left(\sqrt{2/5}\right)$ times its velocity when it is at half of its greatest height. Determine its angle of projection.

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9. A foot ball is kicked off with an initial speed of $19.6m/s$ to have maximum range. Goal keeper standing on the goal line $67.4m$ away in the direction of the kick starts running opposite to the direction of kick to meet the ball at that instant. What must his speed be if he is to catch the ball before it hits the ground?

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10. A body projected from a point '0' at an angle θ, just crosses a wall 'y' m high at a distance 'x' m from the point of projection and strikes the ground at Q beyond the wall as shown, then find height of the wall ,

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11. A particle is projected with a velocity of $10\sqrt{2}m/s$ at an angle of 45° with the horizontal. Find the interval between the moments when speed is $\sqrt{125}m/s\left(g = 10m/s^2\right)$

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12. A projectile of $2kg$ has velocities $3m/s$ and $4m/s$ at two points during its flight in the uniform gravitational field of the earth. If these two velocities are $\perp$ to each other then the minimum KE of the particle during its flight is

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13. In the absence of wind the range and maximum height of a projectile were R and H. If wind imparts a horizontal acceleration

$a = g/4$ to the projectile then find the maximum range and maximum height.

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14. 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 :

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15. A ball is thrown from the top of a tower of $61m$ high with a velocity $24.4ms^{-1}$ at an elevation of $30°$ above the horizontal. What is the distance from the foot of the tower to the point where the ball hits the ground?

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16. A particle is projected from a tower as shown in figure, then find the distance from the foot of the tower where it will strike the ground. $\left(g = 10 \text{ m/s}^2\right)$

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17. A golfer standing on the ground hits a ball with a velocity of $52 m/s$ at an angle θ above the horizontal if $\tan\theta = \frac{5}{12}$ find the time for which the ball is at least $15 m$ above the ground?

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

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18. Two paper screens A and B are separated by a distance of $100m$. A bullet pierces A and B. The hole in B is $10cm$ below the hole in A. If the bullet is travelling horizontally at the time of hitting the screen A, calculate the velocity of the bullet when it hits the screen A. Neglect resistance of paper and air.

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19. A boy aims a gun at a bird from a point, at a horizontal distance of $100m$. If the gun can impart a velocity of $500m/\sec$ to the bullet, at what height above the bird must he aim his gun in order to hit it?

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20. An enemy plane is flying horizontally at an altitude of $2km$ with a speed of $300ms^{-1}$.An army man with an anti-aircraft gun on the ground sights enemy plane when it is directly overhead and fires a shell with a muzzle speed of $600ms^{-1}$.At what angle with the vertical should the gun be fired so as to hit the plane?

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21. From the top of a tower, two balls are thrown horizontally with velocities u_1 and u_2 in opposite directions. If their velocities are perpendicular to each other just before they strike the ground, find the height of tower.

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22. From points A and B, at the respective heights of 2m and 6m, two bodies are thrown simultaneouly towards each other, one is thrown horizontally with a velocity of $8\frac{\text{m}}{s}$ and the other, downward at an angle 45° to the horizontal at an initial velocity v_0 such that the bodies collide in flight. The horizontal distance between points A and B equal to 8m.Then find

The initial velocity V_0 of the body thrown at an angle 45°

The time of flight of the bodies before colliding

The coordinate (x,y) of the point of collision (consider the botton of the tower A as origin) is

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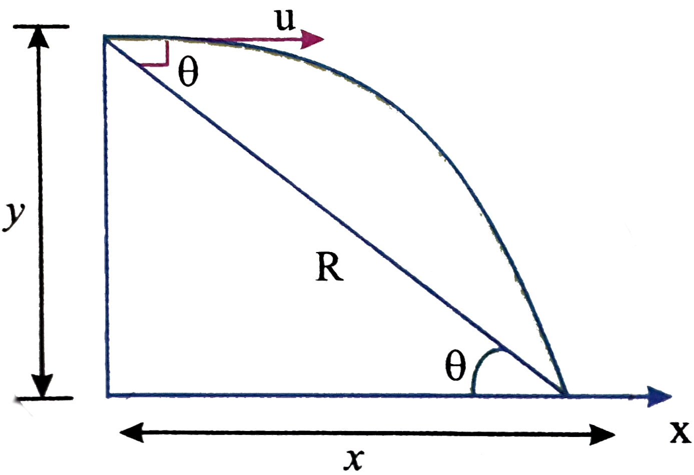
23. A particle is projected horizontally with a speed u from the top of plane inclined at an angle θ with the horizontal. How far from the point of projection will the particle strike the plane ?



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24. A projectile has the maximum range of $500m$. If the projectile is now thrown up on an inclined plane of 30° with the same speed, what is the distance covered by it along the inclined plane?

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25. When a motor cyclist takes a U - $turn$ in $4s$ what is the average angular velocity of the motor cyclist.

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26. What is the linear velocity of a person at equator of the earth due to its spinning motion? (Radius of the earth $= 6400 km$)

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27. (i) What does $\left|\frac{dv}{dt}\right|$ and $\frac{d|V|}{dt}$ represent ?

(ii) Can these be equal ?

(iii) Can $\frac{d \mid V}{dt} = 0$ while $\mid \frac{dV}{dt} \neq 0$?

(iv) Can $\frac{d|V|}{dt} \neq 0$ while $\left|\frac{dv}{dt}\right| = 0$?

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28. A particle revolving in a circular path completes first one third of circumference in 2 sec, while next one third in 1 sec. The average angular velocity of particle will be – ("in "rad//sec)

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29. The angular displacement of a particle is given

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30. The angular velocity of a particle is given by $\omega = 1.5t - 3t^{\circ} + 2$, Find the time when its angular acceleration becomes zero.

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31. A point on the rim of a disc starts circular motion from rest and after time t, it gains an angular acceleration given by $\alpha = 3t - t^2$.

Calculate the angular velocity after 2 s.

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32. In the situation shown the car and the bus are travelling on parallel roads. Initial velocity of car = 0,acceleration $= 1m/s^2$ and velocity of Bus 5 m/s (constant). Find

(i) The instant at which the car overtake the bus.

(ii) The road distance used by the car for overtaking the bus

(iii) Velocity of car w.r.t. the bus at that moment

iv) How will the answer to (i), (i) & (iii) will change if they were moving towards each other (case of crossing)

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33. X is moving with velocity 2m/sec. due east and Y is moving with velocity 4m/sec due west

Find (1) The velocity of Y with respect to X, (2) Velocity of X with respect to Y

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34. A passenger in a Bus moving towards east, observes a man moving towards north. What is the actual direction of man w.r.t ground.

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35. A person moves due east at speed 6m/s and feels the wind is blowing to south at speed 6 m/s.

(a) Find actual velocity of wind blow.

(b) If person doubles his velocity then find the relative velocity of wind blow w.r.t. man.

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36. A man is moving due east with a speed 1 km/hr and rain is falling vertically with a speed

$\sqrt{3}$ km/hr. At what angle from vertical the man has to hold his umbrella to keep the rain away. Also find the speed of rain drops w.r.t. man.

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EVALUATE YOUR SELF-1

1. A particle moves in x-y plane according to equations $x = 4t^2 + 5t$ and 6y=5t The acceleration of the particle must be

A. $8m/\sec^2$

B. $12m/\sec^2$

C. $14m/\sec^2$

D. none of the above

Answer: A

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

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

B. $\frac{\pi u^4}{g^2}$

C. $\frac{\pi u^2}{g^4}$

D. $\frac{\pi u}{g^4}$

Answer: B

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3. From a point on the ground at a distance of 2m from the fot of a verticle wal, a ball is thrown at an angle of 45° which just clears the top of the wall and then strikes the ground at distance of 4m from the foot of the wall on the other side. The height of the wall is

A. $(3/2)$

B. $(2/3)$

C. $(3/4)$

D. $(4/3)$

Answer: D

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

A. $0.5km$

B. $1.0km$

C. $1.5km$

D. $2.0km$

Answer: B

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

A. $\frac{\sqrt{3}u^2}{2g}$

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

C. $\frac{3u^2}{2g}$

D. $\frac{3u^2}{g}$

Answer: A

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6. A student is able to throw a ball vertically to maximum height of 40m. The maximum distance to which the student can throw the ball in the horizonal direction:-

A. $40(2)^{1/2}m$

B. $20(2)^{1/2}m$

C. $20m$

D. $80m$

Answer: D

Watch Video Solution

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

A. 16 m

B. 8 m

C. 64 m

D. 12.8 m

Answer: C

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8. A ball is thrown upwards and returns to the ground describing praraboleic path. Which of the quantities remain constant throufgout the motion.

A. speed of the ball

B. kinetic energy of the ball

C. vertical component of velocity

D. horizontal component of velocity

Answer: D

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9. The velocity of projection of oblique projectile is $\left(6\hat{i} + 8\hat{j}\right)ms^{-1}$ The horizontal range of the projectile is

A. 4.9 m

B. 9.6 m

C. 19.6 m

D. 14 m

Answer: B

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10. If R and h represent the horizontal range and maximum height respectively of an obliquie projectile, the $\frac{R^2}{8h} + 2h$ represents

A. maximum horizontal range

B. maximum vertical range

C. time of flight

D. velocity of projectile at highest point

Answer: A

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EVALUATE YOUR SELF-2

1. 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. 5m/s

B. 10 m/s

C. 15 m/s

D. 20 m/s

Answer: B

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2. A person fires a bullet directly towards a monkey sitting on a tree. Just when the bullet leaves the gun, the monkey starts falling freely. The monkey falls in the range of the bullet. The bullet

A. Will go above the monkey

B. Will hit the monkey

C. Will go below the monkey

D. None of these

Answer: B

View Text Solution

3. a body is thrown horizontally with a velocity $\sqrt{2gh}$ from the top of a tower of height h. It strikes the level gound through the foot of the tower at a distance x from the tower. The value of x is :-

A. h

B. $\frac{h}{2}$

C. 2h

D. $\frac{2h}{3}$

Answer: C

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4. A bomb is dropped from an aeroplane moving horizontally at constant speed. When air resistance is taken into consideration, the bomb

A. ahead of the bag

B. directly above the bag

C. far behind the bag

D. data is not sufficient.

Answer: B

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

B. $\frac{v^2}{g(1 + \sin\theta)}$

C. $\frac{v^2}{g(1 - \sin\theta)}$

D. $\frac{v^2}{g(1 + \cos\theta)}$

Answer: B

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

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

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

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

Answer: D

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7. The time of flight of a projectile on an upwardd inctined plane depends upon

A. angle of inclination of the plane

B. angle of projection

C. the value of acceleration due to gravity

D. all of these.

Answer: D

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EVALUATE YOUR SELF-3

1. If the angle (θ) between velocity vector and the acceleration vector of a moving particle is $90^\circ < \theta < 180^\circ$, then the path of the particle is

A. Straight path with retardation

B. Straight path with acceleration

C. Curvilinear path with acceleration

D. Curvilinear path with retardation

Answer: D

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2. In uniform circular motion

A. Velocity remains constant

B. Speed is constant

C. Acceleration is zero

D. Acceleration is along the direction of tangent

Answer: B

Watch Video Solution

3. A particle moves along a circle if radius (20 //pi) m with constant tangential acceleration. If the velocity of the particle is $80 m/s$ at the end of the second revolution after motion has begun the tangential acceleration is .

A. $40\pi m/s^2$

B. $40m/s^2$

C. $640\pi m/s^2$

D. $160m/s^2$

Answer: B

Watch Video Solution

4. 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

Watch Video Solution

5. In a circular motion of a particle the tangential acceleration of the particle is given by $a_t = 2tm/s^2$. The radius of the circle described is $4m$. The particle is initially at rest. Time after which total acceleration of the particle makes 45° with radial acceleration is :

A. 1s

B. 2s

C. 3s

D. 12s

Answer: B

Watch Video Solution

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

A. $0.5m/s^2$

B. $0.49m/s^2$

C. $0.86m/s^2$

D. None of these

Answer: C

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7. In a non- uniform circular motion

A. Tangential acceleration (a_t) is zero

B. Radial acceleration $\left(a_R\right)$ is zero

C. Both (1) & (2) are correct

D. Both $a_t \& a_R$ are non zero

Answer: D

Watch Video Solution

8. For an electron circulating around the nucleus, the centripetal force is supplied by

A. Magnetic force

B. Electrostatic force

C. Gravitational force

D. Nuclear force

Answer: B

Watch Video Solution

9. A body is revolving with a uniform speed v in a circle of radiusr . The tangential acceleration is

A. $\frac{v}{r}$

B. $\frac{v^2}{r}$

C. Zero

D. $\frac{v}{r^2}$

Answer: C

Watch Video Solution

10. The ratio of angular speeds of minute hand and hour hand of a watch is

A. $1:12$

B. $6:1$

C. $12:1$

D. $1:6$

Answer: C

Watch Video Solution

EVALUATE YOUR SELF -4

1. A lift starts ascending with an acceleration of $4ft/s^2$. At the same time a bolt falls from its cieling 6ft above the floor. Find the time taken by it to reach the floor. $g = 32ft/s^2$

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

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

C. $\frac{1}{\sqrt{5}}s$

D. $\frac{1}{5}s$

Answer: A

Watch Video Solution

Watch Video Solution

2. A bus starts moving with acceleration $2ms^{-2}$. A cyclist $96m$ behind the bus starts simultaneously towards the bus at a constant speed of $20ms^{-1}$

After some time the bus will be left behind. If bus continues moving with the same acceleration, after what time from the beginning, the bus will overtake the cyclist ?

A. 4s

B. 8s

C. 12s

D. 16s

Answer: B

Watch Video Solution

3. Two particles start simultaneously from a point with equal velocities v each along two straight inclined at 60°. Find their relative velocity

A. V

B. 2V

C. $\frac{V}{2}$

D. 3V

Answer: A

Watch Video Solution

4. For a man running with a speed v. Wind appears to have a velocity v and inclination 120° with him. Find original velocity of wind

A. V

B. 2V

C. $\frac{V}{2}$

D. 3V

Answer: A

Watch Video Solution

5. Rain is falling vertically at $10\sqrt{3}$ kph. A man is running at 10 kph. The angle with vertical at which he should hold his umbrella is

A. 60°

B. 45°

C. 30°

D. 15°

Answer: C

Watch Video Solution

6. Rain was falling on a non-windy day, vertically downwards at the rate of 12 m/s. Suddenly wind starts blowing at the rate of 4 m/s due North, with what speed the rain drops hit a man travelling due east at 3 m/s?

A. 10 m/s

B. 11 m/s

C. 12 m/s

D. 13 m/s

Answer: D

View Text Solution

7. A particle is projected from a point A vertically upwards with a speed of $50ms^{-1}$ and another is dropped simultaneously from B which is 200 m vertically above A. They cross each other after [Given: $g = 10ms^{-2}$].

A. 4s

B. 5s

C. 6s

D. 8s

Answer: A

Watch Video Solution

8. A person walks up a stalled escalator in 90 s. When standingon the same escalator, now moving, he is carried in 60 s.The time it would take him to walk up the moving escalator will be:

A. 27s

B. 72s

C. 18s

D. 36s

Answer: D

Watch Video Solution

9. A jet airplance travelling at the speed of $500 km^{-1}$ ejects its products of combustion at the speed of $1500 kmh^{-1}$ relative to the jet plane. What is the speed of the burnt gases with respect to observer on the ground ?

A. 1500 km/h

B. 2000 km/h

C. 1000 km/h

D. 500 km/h

Answer: C

Watch Video Solution

10. Two balls are thrown simultaneously, A vetically upwards with a speed of $20ms^{-1}$ from the ground, and B vetically downwards from height of 40 m with the same speed and along the same line of motion. At what points do the two balls collide? Take $g = 9.8 ms^{-2}$.

A. 15 m above from the ground

B. 15 m below from the top of the tower

C. 20 m above from the ground

D. 20 m below fom the top of the tower

Answer: A

Watch Video Solution

11. A man wishes to swim across a river 0.5km. wide if he can swim at the rate of 2 km/h. in still water and the river flows at the rate of 1km/h. The angle (w.r.t. the flow of the river) along which he should swin so as to reach a point exactly oppposite his starting point, should be:-

A. $60\ °$

B. $120\ °$

C. $145\ °$

D. 90°

Answer: B

Watch Video Solution

12. A boat man can row with a speed of 10 km/hr. in still water. The river flow steadily at 5 km/hr. and the width of the river is 2 km. if the boat man cross the river with reference to minimum distance of approach then time elapsed in rowing the boat will be:-

A. $\frac{2\sqrt{3}}{5}$ hour

B. $\frac{2}{5\sqrt{3}}$ hours

C. $\frac{3\sqrt{2}}{5}$ hours

D. $\frac{5\sqrt{2}}{3}$ hour

Answer: B

Watch Video Solution

13. A boat covers certain distance between two spots on a river taking $'t_1'$ time, going down stream and $'t_2'$ time going upstream, what time will be taken by the boat to cover the same distance in still water:-

A. $\dfrac{t_1 + t_2}{2}$

B. $\dfrac{t_1}{2} + \dfrac{3}{4} t_2$

C. $\dfrac{2t_1 t_2}{t_1 + t_2}$

D. $\dfrac{t_1 + t_2}{2t_1 t_2}$

Answer: C

Watch Video Solution

C.U.Q

1. If $\vec{A} + \vec{B} = \vec{C}$ and the angle between $\vec{A}$ and $\vec{B}$ is 120°, then the magnitude of $\vec{C}$

A. must be equal to $\left|\vec{A} - \vec{B}\right|$

B. must be less than $\left|\vec{A} - \vec{B}\right|$

C. must be greater than $\left|\vec{A} - \vec{B}\right|$

D. must be equal to $\left|\vec{A} - \vec{B}\right|$

Answer: B

Watch Video Solution

2. When two vectors $\vec{A}$ and $\vec{B}$ of magnitudes a and b respectively are added, the magnitude of resultant vector is always

A. Equal to $(a + b)$

B. Less than $(a + b)$

C. Greater than $(a + b)$

D. Not greater than $(a + b)$

Answer: D

Watch Video Solution

3. If $\vec{C} = \vec{A} + \vec{B}$ then

A. $\vec{C}$ is always greater than $\left|\vec{A}\right|$

B. C is always equal to $A + B$

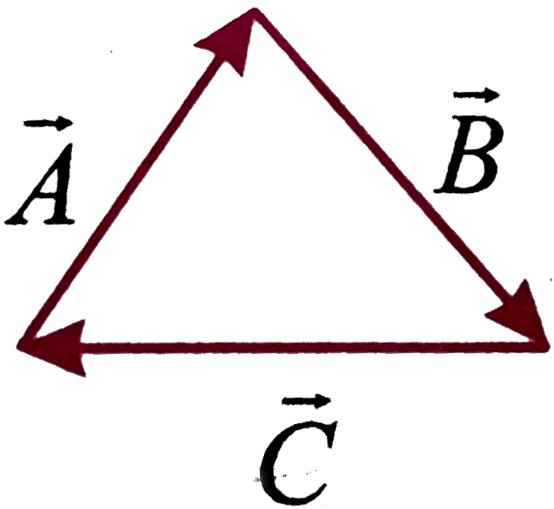
C. C is always equal to $A + B$

D. It is possible to have $\left|\vec{C}\right| < \left|\vec{A}\right|$ and $\left|\vec{C}\right| < \left|\vec{B}\right|$

Answer: D

Watch Video Solution

4. Three forces start acting simultaneously on a particle moving the velocity $\vec{V}$. The forces are represented in magnitude and direction by the three sides of a triangle ABC (as shown). The particle will now move with velocity



A. less than $\vec{V}$

B. greater than $\vec{V}$

C. $\left|\vec{V}\right|$ in the direction of largest force

D. $\vec{V}$ remaining unchanged

Answer: D

Watch Video Solution

5. The minimum number of forces of equal magnitude in a plane that can keep a particle in equilibrium is

A. 4

B. 2

C. 3

D. 5

Answer: B

Watch Video Solution

6. The minimum number of unequal forces in a plane that can keep a particle in equilibrium is

A. 4

B. 2

C. 3

D. 6

Answer: C

Watch Video Solution

7. How many minimum number of coplanar vector having different magnitudes can be added to give zero resultant?

A. 1

B. 2

C. 3

D. 4

Answer: D

Watch Video Solution

8. A train is moving due east and a car is moving due north with equal speeds. A passenger in the train finds that the car is moving towards

A. North-East

B. North-West

C. South-West

D. South-East

Answer: B

Watch Video Solution

9. A bus moves over a straight level road with a constant acceleration a. A boy in the bus drops a ball out side. The acceleration of the ball w.r.t the bus and the earth are respectively

A. $\sqrt{a^2 + g^2}, g$

B. $g, \sqrt{a^2 + g^2}$

C. a, g

D. g, a

Answer: A

Watch Video Solution

Watch Video Solution

10. A particles P moves with speed v along AB and BC, sides of a square $ABCD$. Another particle Q also starts at A and moves with the same speed but along AD and DC of the same square $ABCD$. Then their respective changes in velocities are

A. equal in magnitude but different in directions

B. different in magnitude but same in directions

C. different both in magnitude and direction

D. same both in magnitude and direction

Answer: A

Watch Video Solution

11. A river is flowing from east to west at a speed of $5m/\min$. A man on south bank of river, capable of swimming $10m/\min$ in still water, wants to swim across the river in shortest time. He should swim

A. Due north

B. $30°$ east of west

C. $30°$ west of north

D. $60°$ east of north

Answer: A

Watch Video Solution

12. A hunter aims his fun and fires a bullet directly at a monkey on a tree. At the instant the bullet leaves the gun, the monkey drops. The bullet

A. cannot hit the monkey

B. may hit the monkey it its weight is more than $30kg. wt$

C. may hit the monkey it its weight is less than $30kg.\ wt$

D. hits the monkey irrespective of its weight.

Answer: D

Watch Video Solution

13. Keeping the speed of projection constant, the angle of projection is increased from 0°

to 90°. Then the horizontal range of the projectile

A. goes on increasing up to 90°

B. decreases up to 90°

C. increases up to 45° and decreases afterwards

D. decreases up to 45° and increases afterwards

Answer: C

Watch Video Solution

14. Keeping the speed of projection constant, the angle of projection is increased from 0° to 90°. Then the maximum height of the projectile

A. goes on increasing up to 90°

B. decreases up to 90°

C. increases up to 45° and decreases beyond it

D. decreases up to 45° and increases beyond it

Answer: A

Watch Video Solution

15. The path of one projectile as seen from another projectile is a (if horizontal components of velocities are equal)

A. straight line

B. parabola

C. hyperbola

D. circle

Answer: A

Watch Video Solution

16. Two particles are projected with same speed but at angles of projection $\left(45^{\circ} - \theta\right)$ and $\left(45^{\circ} + \theta\right)$. Then their horizontal ranges are in the ratio of

A. $1:2$

B. $2:1$

C. $1:1$

D. none of the above

Answer: C

Watch Video Solution

17. The acceleration of a projectile relative to another projectile is

A. $-g$

B. g

C. $2g$

D. 0

Answer: D

Watch Video Solution

18. A stone is just dropped from the window of a train moving along a horizontal straight track with uniform speed. The path of the stone is

A. a parabola for an observer standing by the side of the track

B. a horizontal straight line for an ovserver inside the train

C. both (1)&(2) are true

D. (1) is true but (2) is false

Answer: C

Watch Video Solution

19. A bomb is dropped from an aeroplane flying horizontally with uniform speed. The path of the bomb of

A. a verticle straight line for a stationary observer on the ground

B. a parabola for the pilot of the aeroplane

C. a vertical straight line for the pilot and parabola for a stationary observer on the ground

D. a horizontal straight line for the pilot and parabola for a stationary observer on the ground

Answer: C

Watch Video Solution

20. A and B are two trains moving parallel to each other. If a balls is thrown vertically up from the train A, the path of the ball is

A. parabola for an observer standing on the ground

B. vertical straight line for an observer in B when B is moving with same speed but in same direction

C. a parabola for an observer in B when B is moving with same speed but in opposite direction.

D. all the above are true

Answer: D

Watch Video Solution

21. A ball is thrown from rear end to the front end of a compartment of a train which is moving at constant horizontal velocity. An observer sitting in the compartment and another observer standing on the ground draw the trajectory of the ball. They will have

A. equal horizontal and equal vertical ranges

B. equal vertical ranges but different horizontal ranges

C. different vertical ranges but equal horizontal ranges

D. different vertical and different horizontal ranges

Answer: B

Watch Video Solution

22. For body thrown horizontally from the top of a tower,

A. the time of flight depends both on h and v

B. the horizontal Range depends only on v but not on h

C. the time of flight and horizontal Range depend on h but not on v

D. The horizontal Range depends on both v and h

Answer: D

Watch Video Solution

23. A body is projected from a point with different angles of projections $20^\circ, 35^\circ, 45^\circ, 60^\circ$ with the horizontal but with same initial speed. Their respective horizontal but with same initial speed. Their respective horizontal ranges are R_1, R_2, R_3 andR_4. Identify the correct order in increasing order

A. R_1, R_4, R_2, R_3

B. R_2, R_1, R_4, R_3

C. R_1, R_2, R_4, R_3

D. R_4, R_1, R_2, R_3

Answer: A

Watch Video Solution

24. Two particles are projected from the same point with the same speed at different angles θ_1 and θ_2 to the horizontal. If their respective times of flights are T_1 and T_2 and horizontal ranges are same then

a) $\theta_1 + \theta_2 = 90^\circ$,

b)$T_1 = T_2 \tan\theta_1$

c.$T_1 = T_2 \tan\theta_2$,

d) $T_1 \sin\theta_2 = T_2 \sin\theta_1$

A. a, b, $d$are correct

B. a, c, $d$are correct

C. b, c, d are correct

D. a, b, c are correct

Answer: A

Watch Video Solution

25. Two bodies are projected at angles 30° and 60° to the horizontal from the ground such that the maximum heights reached by them are equal then

a) Their times of flight are equal

b) Their horizontal ranges are equal

c) The ratio of their initial speeds of projection is $\sqrt{3}:1$

d) Both take same time to reach the maximum height.

A. a, b, c and d are correct

B. only a, b and c are correct

C. only a and c are correct

D. only a, c and d are correct

Answer: D

Watch Video Solution

26. A body is projected with an initial speed of $100\sqrt{3}ms^{-1}$ at an angle of 60° above the horizontal. If $g = 10ms^{-2}$ then velocity of the projectile

a) is perpendicular to it's acceleration at the instant $t = 15\text{sec}$.

b) Is perpendicular to initial velocity of projection at $t = 20\text{sec}$.

c) Is minimum at the highest point

d) Changes both in magnitude and direction, during its flight.

A. a, b, c and d are correct

B. only a, c and d are correct

C. only b, c and d are correct

D. only a, b and d are correct

Answer: A

Watch Video Solution

27. A paricle 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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Watch Video Solution

28. A car of mass m moves in a horizontal circular path of radius r metre. At an instant its speed is $V m/s$ 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. $\sqrt{a^2 + \left(\frac{V^2}{r}\right)^2}$

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

Answer: C

Watch Video Solution

29. Consider the following two statements A and B and identify the correct choice

A) When a rigid body is rotating about its own axis, at a given instant all particles of body posses same angular velocity.

B) When a rigid body is rotating about its own axis, the linear velocity of a particle is directly proportional to its perpendicular distance from axis

A. A is true but B is false

B. A is false but B is true

C. Both A and B are true

D. Both A and B are false

Answer: C

Watch Video Solution

30. Suppose a disc is rotating counter clockwise in the plane of the paper then

A. It's angular velocity vector will be perpendicular to the page pointing up out of the page

B. It's angular velocity vector will be perpendicular to the page pointing in wards

C. It's angular velocity vector act along the tan-gent to the disc.

D. none of the above is correct

Answer: A

Watch Video Solution

31. $\vec{A}, \vec{B}, \vec{C}, \vec{D}, \vec{E}$ and $\vec{F}$are coplanar vectors having the same magnitude each of $10 units$ and angle between successive vectors is $60\,^{\circ}$ The magnitude of resultant is

A. 0 units

B. 1 units

C. 2 units

D. 3 units

Answer: A

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32. $\vec{A}, \vec{B}, \vec{C}, \vec{D}, \vec{E}$ and $\vec{F}$are coplanar vectors having the same magnitude each of $10 units$

and angle between successive vectors is 60°

If $\vec{A}$ is reversed the magnitude of resultant is

A. 10 units

B. 20 units

C. 30 units

D. 40 units

Answer: B

Watch Video Solution

33. $\vec{A}, \vec{B}, \vec{C}, \vec{D}, \vec{E}$ and $\vec{F}$are coplanar vectors having the same magnitude each of $10 units$ and angle between successive vectors is $60\ ^\circ$ If $\vec{A}, \vec{B} \& \vec{C}$ is reversed the magnitude of resultant is

A. 10 units

B. 20 units

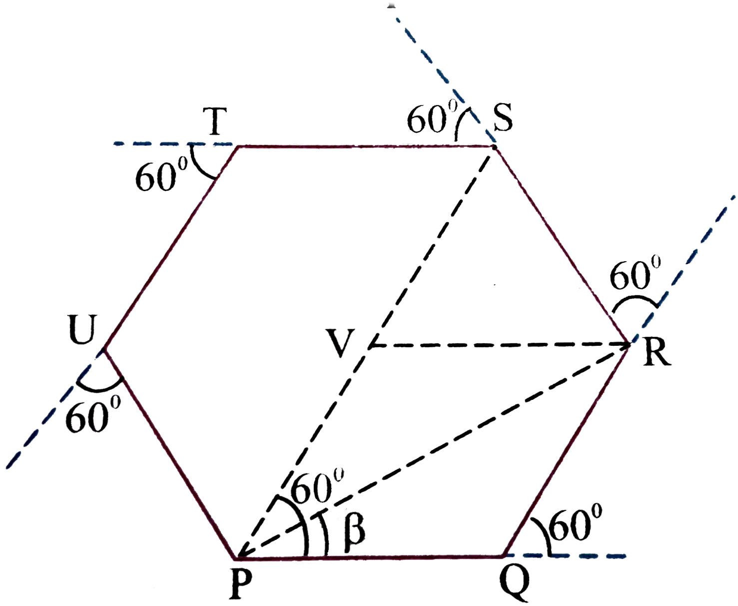
C. 30 units

D. 40 units

Answer: D

Watch Video Solution

34. On an open ground, a motorist follows a track that turns to his left by an angle of 60° after every $500m$. Starting from a given turn, The path followed by the motorist is a regular hexagon with side $500m$, as shown in the given figure specify the displacement of the motorist



at the end of third turn.

A. $500m$

B. $250m$

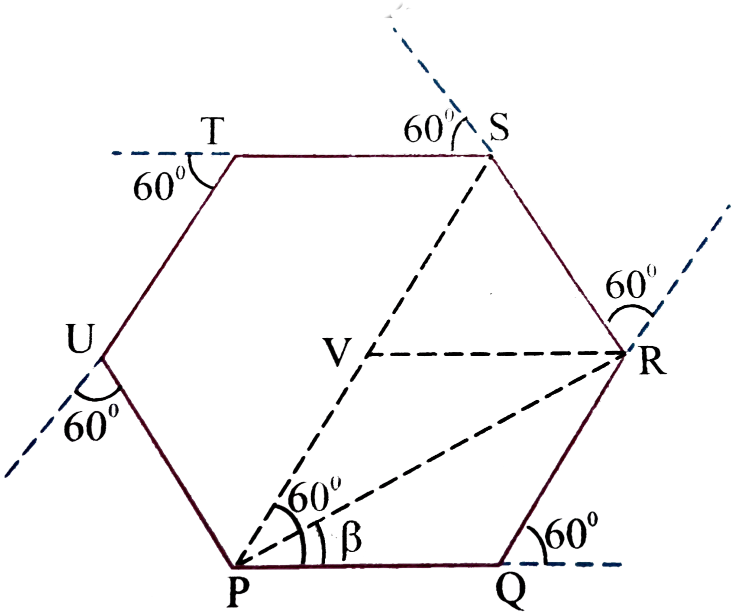
C. $1000m$

D. $1500m$

Answer: C

Watch Video Solution

35. On an open ground, a motorist follows a track that turns to his left by an angle of 60° after every $500m$. Starting from a given turn, The path followed by the motorist is a regular hexagon with side $500m$, as shown in the given figure specify the displacement of the motorist



at the end of sixth turn.

A. $3000m$

B. $1500m$

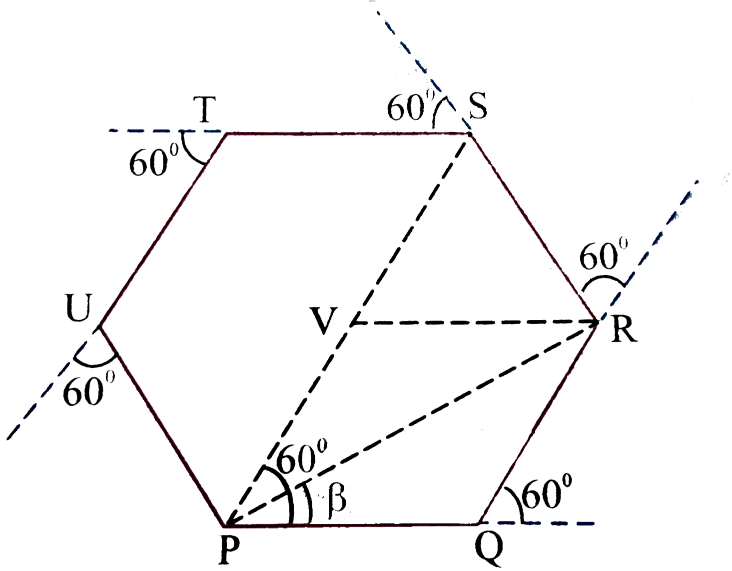
C. $0m$

D. $1000m$

Answer: C

Watch Video Solution

36. On an open ground, a motorist follows a track that turns to his left by an angle of 60° after every $500m$. Starting from a given turn, The path followed by the motorist is a regular hexagon with side $500m$, as shown in the given figure specify the displacement of the motorist



at the end of eighth turn.

A. $3000m$

B. $1500m$

C. $0m$

D. $866m$

Answer: D

Watch Video Solution

37. A train is moving due east and a car is moving due north with equal speeds. A passenger in the train finds that the car is moving towards

A. North- East

B. North- West

C. South- West

D. South- East

Answer: B

Watch Video Solution

38. A bus moves over a straight level road with a constant acceleration a. A boy in the bus drops a ball out side. The acceleration of the ball w.r.t the bus and the earth are respectively

A. $\sqrt{a^2+g^2}, g$

B. $g, \sqrt{a^2 + g^2}$

C. a,g

D. g,a

Answer: A

Watch Video Solution

39. A particles P moves with speed v along AB and BC, sides of a square $ABCD$. Another particle Q also starts at A and moves with the same speed but along AD and DC of the same square $ABCD$. Then their respective changes in velocities are

A. equal in magnitude but different in directions

B. diferent in magnitude but same in directions

C. diferent both in magnitude and direction

D. same both in magnitude and direction

Answer: A

Watch Video Solution

40. Ariver is flowing from west to east at a speed of 5 m/s. Aman on the south bank of the river capable of swimming at 10 m/s in a still water wants to swim, across the river in a shortest time He should swim in a direction

A. Due north

B. 30° east of west

C. 30° west of north

D. 60° east of north

Answer: A

View Text Solution

41. A hunter aims his fun and fires a bullet directly at a monkey on a tree. At the instant the bullet leaves the gun, the monkey drops. The bullet

A. cannot hit the monkey

B. may hit the monkey it its weight is more than 30 kg w

C. may hit the monkey if its weight is less than 30 kg wt

D. hits the monkey irrespective of its weight.

Answer: D

Watch Video Solution

42. Keeping the speed of projection constant, the angle of projection is increased from 0° to 90°. Then the horizontal range of the projectile

A. goes on increasing up to 90°

B. decreases up to 90°

C. increases up to 45° and decreases afterwards

D. decreases up to 45° and increases afterwards

Answer: C

Watch Video Solution

43. Keeping the speed of projection constant, the angle of projection is increased from 0° to 90°. Then the maximum height of the projectile

A. goes on increasing upto 90°

B. decreases upto 90°

C. increases upto 45° and decreases beyond it

D. decreases upto 45° and increases beyond it

Answer: A

Watch Video Solution

44. The path of one projectile as seen from another projectile is a (if horizontal components of velocities are equal)

A. straight line

B. parabola

C. hyperbola

D. circle

Answer: A

Watch Video Solution

45. Two particles are projected with same speed but at angles of projection $\left(45^{\circ} - \theta\right)$

and $\left(45^{\circ} + \theta\right)$. Then their horizontal ranges are in the ratio of

A. $1:2$

B. $2:1$

C. $1:1$

D. none of the above

Answer: C

Watch Video Solution

46. The acceleration of a projectile relative to another projectile is

A. $-g$

B. g

C. 2g

D. 0

Answer: D

Watch Video Solution

47. A stone is just dropped from the window of a train moving along a horizontal straight track with uniform speed. The path of the stone is

A. a parabola for an observer standing by the side of the track

B. a horizontal straight line for an observer inside the train

C. both (1) & (2) are true

D. (1) is true but (2) is false

Answer: C

Watch Video Solution

48. A bomb is dropped from an aeroplane flying horizontally with uniform speed. The path of the bomb of

A. a vertical straight line for a stationary observer on the ground

B. a parabola for the pilot of the aeroplane

C. a vertical straight line for the pilot and parabola for a stationary observer on the ground

D. a horizontal straight line for the pilot and parabola for a stationary observer on the ground

Answer: C

Watch Video Solution

49. A and B are two trains moving parallel to each other. If a balls is thrown vertically up from the train A, the path of the ball is

A. parabola for an observer standing on the ground

B. vertical straight linie for an observer in B when B is moving with the same speed in the same direction of A

C. a parabola for an observer in B when B is moving with same speed but in opposite direction

D. all the above are true

Answer: D

Watch Video Solution

50. A ball is thrown from rear end to the front end of a compartment of a train which is moving at constant horizontal velocity. An observer sitting in the compartment and another observer standing on the ground draw the trajectory of the ball. They will have

A. equal horizontal and equal vertical ranges
B. equal vertical ranges but different horizontal ranges
C. different vertical ranges but equal horizontal ranges
D. different vertical and different horizontal ranges

Answer: B

Watch Video Solution

51. For body thrown horizontally from the top of a tower,

A. the time of flight depends both onh and v

B. the horizontal Range depends only on vbut not on h

C. the time of fight and horizontal Range depend on h but not on v

D. the horizontal Range depends on both v and h

Answer: D

Watch Video Solution

52. A body is projected from a point with different angles of projections $20^{\circ}, 35^{\circ}, 45^{\circ}, 60^{\circ}$ with the horizontal but with same initial speed. Their respective horizontal but with same initial speed. Their respective horizontal ranges are R_1, R_2, R_3 andR_4. Identify the correct order in increasing order

A. R_1, R_4, R_2, R_3

B. R_2, R_1, R_4, R_3

C. R_1, R_2, R_4, R_3

D. R_4, R_1, R_2, R_3

Answer: A

Watch Video Solution

53. Two particles are projected from the same point with the same speed at different angles θ_1 and θ_2 to the horizontal. If their respective times of flights are T_1 and T_2 and horizontal ranges are same then

a) $\theta_1 + \theta_2 = 90^\circ$,

b)$T_1 = T_2 \tan\theta_1$

c.$T_1 = T_2 \tan\theta_2$,

d) $T_1 \sin\theta_2 = T_2 \sin\theta_1$

A. a, b, d are correct

B. a, c, d are correct

C. b, c, d are correct

D. a, b, c are correct

Answer: A

Watch Video Solution

54. Two bodies are projected at angles 30° and 60° to the horizontal from the ground such that the maximum heights reached by them are equal then

a) Their times of flight are equal

b) Their horizontal ranges are equal

c) The ratio of their initial speeds of projection is $\sqrt{3}:1$

d) Both take same time to reach the maximum height.

A. a, b, c and d are corect

B. only a, b and c are correct

C. only a and c are correct

D. only a, c and d are correct

Answer: D

Watch Video Solution

55. A body is projected with an initial speed of $100\sqrt{3}ms^{-1}$ at an angle of 60° above the horizontal. If $g = 10ms^{-2}$ then velocity of the projectile

a) is perpendicular to it's acceleration at the instant $t = 15\text{sec}$.

b) Is perpendicular to initial velocity of projection at $t = 20\text{sec}$.

c) Is minimum at the highest point

d) Changes both in magnitude and direction, during its flight.

A. a, b, c and d are corect

B. only a, c and d are correct

C. only b, c and d are correct

D. only a,b and d are correct

Answer: A

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56. In a projectile motion,the velocity:- (1) is always perpendicular to the acceleration (2) is never perpendicular to the acceleration (3) is perpendicular to the acceleration for one instant only (4) is perpendicular to the acceleration for two instants

A. a and b are correct

B. b and c are correct

C. c and d are correct

D. a and d are correct

Answer: C

Watch Video Solution

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

A. the faster one

B. the slower one

C. both will reach singultaneously

D. depends on the masses

Answer: C

Watch Video Solution

58. A ball is thrown from rear end to the front end of a compartment of a train which is moving at constant horizontal velocity. An observer sitting in the compartment and another observer standing on the ground draw the trajectory of the ball. They will have

A. equal horizontal and equal vertical ranges

B. equal vertical ranges but different horizontal ranges

C. different vertical ranges but equal horiozontal ranges

D. diferent vertical and different horizontal ranges

Answer: B

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59. A projectile has

A. minimum velocity at the point of projection and maximum at the maximum height

B. maximum at the point of projection and minimum at the maximum height

C. same velocity at any point in its path

D. zero velocity at the maximum height irrespective of the velocity of projection

Answer: B

Watch Video Solution

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

A. first

B. the slower one

C. both will reach simutaneously

D. depends on the masses

Answer: C

Watch Video Solution

61. 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

Watch Video Solution

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

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

B. 3

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

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

Answer: C

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63. Consider the following two statements A and B and identify the correct choice

A) When a rigid body is rotating about its own axis, at a given instant all particles of body posses same angular velocity.

B) When a rigid body is rotating about its own axis, the linear velocity of a particle is directly proportional to its perpendicular distance from axis

A. A is true but B is false

B. A is false but B is true

C. Both A and B are true

D. Both A and B are false

Answer: C

Watch Video Solution

64. Suppose a disc is rotating counter clockwise in the plane of the paper then .

A. It's angular velocity vector will be perpendicular to the page pointing up out of the page

B. It's angular velocity vector will be perpendicular to the page pointing in wards

C. It's angular velocity vector acts along the tangent to the disc.

D. none of the above is corect

Answer: A

Watch Video Solution

65. The direction of angular acceleration of a body moving in a circle in the plane of the paper is .

A. along the tangent

B. along the radius inward

C. along the radius outward

D. along the perpendicular to the plane of the first paper

Answer: D

Watch Video Solution

66. Suppose a disc is rotating counter clockwise in the plane of the paper then .

A. it's angular velocity vector will be perpendicular to the page pointing up out of the page

B. It's angular velocity vector will be perpendicular to the page pointing inwards

C. It's angular velocity vector acts along the tangent to the disc

D. none of the above is correct

Answer: A

Watch Video Solution

67. A Particle of mass 'M' moves in a uniform circular path of radius 'r' with a constant speed 'v' then its centripetal acceleration is .

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

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

C. $V^2 r$

D. zero

Answer: A

Watch Video Solution

68. Many great rivers flow towards the equator, what effect does the sediment they carry. To sea have on the rotation of the earth

A. the rotation of the earth slows down

B. the rotation of theearth speeds up

C. no effect on the rotation of the earth

D. none

Answer: A

View Text Solution

69. The average acceleration vector for a particle having a uniform circular motion is

A. A consrant vector of magnitude $\frac{V^2}{r}$

B. a vector of magnitude $\frac{V^2}{r}$ directed normally to the plane of motion

C. null vector

D. equal to instantaneous acceleration vector

Answer: C

Watch Video Solution

70. A ody is in pure rotation. The linear speed v of a particle, the distance r of the particle from the axis and the angular velocity ω of the body are related as $\omega = \frac{v}{r}$. Thus

A. $\omega \alpha \frac{1}{r}$

B. $\omega \alpha r$

C. v

D. ω is independent of r

Answer: D

Watch Video Solution

EXERCISE I-(C.W)

1. A particle is moving eastwards with a velocity $5ms^{-1}$, changes its direction northwards in 10 seconds and moves with same magnitude of velocity. The average acceleration is

A. zero

B. $\frac{1}{\sqrt{2}}ms^{-2}$ towards N-E

C. $\frac{1}{\sqrt{2}ms^{-2}}$ towards S-E

D. $\frac{1}{\sqrt{2}}ms^{-2}$ towards N-W

Answer: D

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2. A man is going due east with a velocity of $5ms^{-1}$.It is vertically rainging downwards with a velocity of $4ms^{-1}$.At what angle should he hold the umbrella to the vertical so as to protect him self from the rain?

A. $\tan^{-1}\left(\frac{5}{4}\right)$ in anti-clockwise direction

B. $\tan^{-1}\left(\frac{5}{4}\right)$ in clock-wise direction

C. $\tan^{-1}\left(\frac{4}{5}\right)$ North of East

D. $\tan^{-1}\left(\frac{4}{5}\right)$ East of North

Answer: B

Watch Video Solution

3. Rain drops are falling downward vertically at 4 kmph. For a person moving forward at 3 kmph feels the rain falling at

A. 7 kmph

B. 1 kmph

C. 5 kmph

D. 25 kmph

Answer: C

Watch Video Solution

4. A man travelling at $10.8 kmph$ in topless car on a rainy day. He holds an umbrella at angle of 37° with the vertical so that he does not wet.If rain drops falls vertically downwards what is rain velocity.

A. 1 m/s

B. 2 m/s

C. 3 m/s

D. 4 m/s

Answer: D

Watch Video Solution

5. A man can row a boat in still water with a velocity of $8kmph$.Water is flowing in a river with a velocity of $4kmph$. At what angle should he row the boat so as to reach the exact opposite point

A. 150° to flow of water.

B. 120° to flow of water.

C. 30° to flow of water.

D. 90° to flow of water.

Answer: B

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6. A person can swim in still water at $5m/s$.He moves in a river of velocity $3m/s$, first down the steam and next same distance up the stream. The ratio of times taken are

A. $1:1$

B. $1:2$

C. $1:4$

D. $4:1$

Answer: C

Watch Video Solution

7. The velocity of water in a river is $2kmph$,while width is $400m$. A boat is rowed from a point rowing always aiming opposite point at $8kmph$

of still water velocity. On reaching the opposite bank the drift obtained is

A. 93 m

B. 100.8 m

C. 112.4 m

D. 100 m

Answer: D

Watch Video Solution

8. A man can swim in still water at a speed of $4kmph$. He desires to cross a river flowing at a speed of $3kmph$ in the shortest time interval. If the width of the river is 3 km , then time taken to cross river (in hours) and the horizontal distance travelled (in km) are respectively

A. $\frac{3}{4}, \frac{9}{4}$

B. $\frac{3}{5}, 3$

C. $\frac{1}{4}, \frac{15}{4}$

D. $\frac{3}{\sqrt{7}}, 7$

Answer: A

Watch Video Solution

9. A particle is projected in xy plane with y-axis along vertical, the point of projection is origin. The equation of the path is $y = \sqrt{3}x - \frac{g}{2}x^2$ .where y and x are in m.Then the speed of projection in ms^{-1} is

A. 2

B. $\sqrt{3}$

C. 4

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

Answer: A

Watch Video Solution

10. If a body is thrown with a speed of $19.6m/s$ making an angle of 30° with the horizontal,then the time of flight is

A. 1s

B. 2s

C. $2\sqrt{3}s$

D. 5s

Answer: B

Watch Video Solution

11. A particle is projected with an initial velocity of $200 m/s$ in a direction making an angle of 30° with the vertical. The horizontal distance covered by the particle in $3s$ is

A. 300 m

B. 150 m

C. 175 m

D. 125 m

Answer: A

Watch Video Solution

12. A body is projected with an initial velocity $20m/s$ at 60° to the horizontal. Its initial velocity vector is ____ $\left(g = 10m/s^2\right)$

A. $10\hat{i}$ - $20\hat{j}$

B. $10\sqrt{3}\hat{i} + 10\hat{j}$

C. $10\hat{i} + 10\sqrt{3}\hat{j}$

D. $5\hat{i} + 5\sqrt{3}\hat{j}$

Answer: C

Watch Video Solution

13. A body is projected at an angle of 30° with the horizontal with momentum P.At its highest point the magnitude of the momentum is:

A. $\frac{\sqrt{3}}{2}P$

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

C. P

D. $\frac{P}{2}$

Answer: A

Watch Video Solution

14. The potential energy of a projectile at its maximum height is equal to its kinetic energy there. If the velocity of projection is $20m/s^{-1}$,its time of flight is $\left(g = 10m/s^2\right)$

A. 2s

B. $2\sqrt{2}s$

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

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

Answer: B

Watch Video Solution

15. From a point on the ground a particle is projected with initial velocity u,such that its horizontal range is maximum. The magnitude of average velocity during its ascent.

A. $\dfrac{\sqrt{5u}}{2\sqrt{2}}$

B. $\dfrac{5u}{4}$

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

D. none

Answer: A

Watch Video Solution

16. The horizontal and vertical displacements of a projectile are given as $x = at$ & $y = bt - ct^2$ .Then velocity of projection is

A. $\sqrt{a^2 + b^2}$

B. $\sqrt{b^2 + c^2}$

C. $\sqrt{a^2 + c^2}$

D. $\sqrt{\left(b^2 - c^2\right)}$

Answer: A

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17. Two bodies are thrown from the same point with the same velocity of $50ms^{-1}$.if their angles of projection are complimentary to each other and the difference of maximum heights is $30m$,the minimum and maximum heights are $\left(g = 10m/s^2\right)$

A. 50 m & 80 m

B. 47.5 m & 77.5 m

C. 30 m & 60 m

D. 25 m & 55 m

Answer: B

Watch Video Solution

18. 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. 50 m

B. 60 m

C. 20 m

D. 40 m

Answer: D

Watch Video Solution

19. If $\vec{u} = a\hat{i} + b\hat{j} + c\hat{k}$ with $\hat{i}, \hat{j}, \hat{k}$are in east, north and vertical directions, horizontal component of velocity of projectile is

A. a

B. b

C. $\sqrt{a^2 + b^2}$

D. $\sqrt{b^2 + c^2}$

Answer: C

Watch Video Solution

20. If the time of flight of a projectile is doubled, what happens to the maximum height at tained?

A. halved

B. remains unchanged

C. doubled

D. become four times

Answer: D

Watch Video Solution

21. If $\vec{u} = a\hat{i} + b\hat{j} + c\hat{k}$ with $\hat{i}, \hat{j}, \hat{k}$are in east, north and vertical directions, the maximum height of the projectileis

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

B. $\frac{b^2}{2g}$

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

D. $\frac{b^2c^2}{2g}$

Answer: C

Watch Video Solution

22. v20

A. 2.5 m

B. 0.8 m

C. 0.9 m

D. 0.45 m

Answer: D

Watch Video Solution

23. A stone is projected from the ground with a velocity of $14ms^{-1}$. One second later it clears a wall 2m high. The angle of projection is $\left(g = 10ms^{-2}\right)$

A. $45°$

B. $30°$

C. $60°$

D. $15°$

Answer: B

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Watch Video Solution

24. The horizontal and vertical distances travelled by a particle in time t are given by x=6t and $y = 8t - 5t^2$. If g=$10m/\sec^2$, then the initial velocity of the particle is

A. $8ms^{-1}$

B. $6ms^{-1}$

C. $14ms^{-1}$

D. $10ms^{-1}$

Answer: D

Watch Video Solution

25. A gun fires a bullet at a speed of $140ms^{-1}$.If the bullet is to hit a-target at the same level as the gun and at 1km distance, the angle of projection may be

A. 60° or 30°

B. 40° or 50°

C. 15° or 75°

D. 20° or 70°

Answer: C

Watch Video Solution

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

A. $1 : 5$

B. $5 : 1$

C. $1 : 40$

D. $40 : 1$

Answer: D

Watch Video Solution

27. For a projectile, the ratio of maximum height reached to the square of flight time is

$\left(g = 10ms^{-2}\right)$

A. $5:4$

B. $5:2$

C. $5:1$

D. $10:1$

Answer: A

Watch Video Solution

28. Two bodies are thrown from the same point with the same velocity of projection angles of projection being complimentary angles. If R_1 and R_2 are the ranges and h_1 and h_2 are maximum heights respectively, then

A. $R_1 = R_2 = \frac{u^2}{g}\sin 2\theta$

B. $h_1 + h_2 = \frac{u^2}{2g}$

C. both

D. none

Answer: C

Watch Video Solution

29. Two bodies are thrown with the same velocity at angles α and $90^{\circ} - \alpha$ to the horizontal.Calculate the ratio of the maximum heights reached by the bodies.

A. $\cot^2\alpha$

B. $\tan^2\alpha$

C. $\sec^2\alpha$

D. $\cos^2\alpha$

Answer: B

Watch Video Solution

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

A. 30°

B. 45°

C. 60°

D. 76°

Answer: C

Watch Video Solution

31. A ball is thrown with a velocity of u making an angle θ with the horizontal. Its velocity vector normal to initial vector (u) after a time interval of

A. $\dfrac{u\sin\theta}{g}$

B. $\dfrac{u}{g\cos\theta}$

C. $\dfrac{u}{g\sin\theta}$

D. $\dfrac{u\cos\theta}{g}$

Answer: C

Watch Video Solution

32. A body projected horizontally with a velocity$v$ from a height h has a range R.With what velocity a body is to be projected horizontally from a height $h/2$ to have the same range ?

A. $\sqrt{2}v$

B. 2v

C. 6v

D. 8v

Answer: A

Watch Video Solution

33. A stone is thrown horizontally with velocity gms^{-1} from the top of a tower of height g metre. The velocity with which it hits the ground is $\left(\text{in} ms^{-1}\right)$

A. g

B. 2g

C. $\sqrt{3}g$

D. 4g

Answer: C

Watch Video Solution

Watch Video Solution

34. A body is thrown horizontally from the top of a tower.It reaches the ground after $4s$ at an angle 45° to the ground.The velocity of projection is

A. 9.8 ms^{-1}

B. 19.6 ms^{-1}

C. 29.4 ms^{-1}

D. 39.2 ms^{-1}

Answer: D

Watch Video Solution

35. Two cliffs of heights $120m$ and $100.4m$ are separated bya horizontal distance of $16m$ if a car has to reach from the first cliff to the second the horizontal velocity of car should be

A. 16 m/s

B. 4 m/s

C. 2 m/s

D. 8 m/s

Answer: D

Watch Video Solution

36. A circular disc is rotating about its own axis at the rate of 200 revolutions per minute. Two particles P, Q of disc are at distances $5cm, 10cm$ from axis of rotation. The ratio of angular velocities of P and Q is

A. $1:2$

B. $1:1$

C. $2:1$

D. $4:1$

Answer: B

Watch Video Solution

37. A stationary wheel starts rotating about its own axis at uniform rate amgular acceleration $8 rad/s^2$.The time taken by its to complete 77 rotation is

A. 5.5 sec

B. 7 sec

C. 11 sec

D. 14 sec

Answer: C

Watch Video Solution

38. A circular disc is rotating about its own axis at uniform rate completes 30 rotations in one minute.The angular velocity of disc in rad s^{-1} is

A. 2π

B. π

C. $\frac{\pi}{2}$

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

Answer: B

Watch Video Solution

39. A particle is moving at uniform speed $2ms^{-1}$ along a circle of radius $0.5m$.The centripetal acceleration of particle is

A. $1ms^{-2}$

B. $2ms^{-2}$

C. $4ms^{-2}$

D. $8ms^{-2}$

Answer: D

Watch Video Solution

40. 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 V are in the ratio :

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:3$

Answer: B

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EXERCISE I-(H.W)

1. A particle is moving eastwards with a velocity $15ms^{-1}$.Suddenly it moves towards north and moves with the same speed in time $10 \sec$.The average acceleration during this time is

A. $3/\sqrt{2}NE$

B. $3\sqrt{2}NE$

C. $3/\sqrt{2}NW$

D. $3\sqrt{2}NW$

Answer: C

Watch Video Solution

2. A person crossing a road with a certain velocity due north, sees a car moving towards east.The relative velocity of the car w.r.t the person is $\sqrt{2}$ times that of the velocity of the person.The angle made by the relative velocity with the east is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: B

Watch Video Solution

3. A Person is walking in rain feels the velocity of rain as twice to his velocity.At which angle he should hold the umbrella with vertical if he moves forward, if it is raining vertically downwards

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

Watch Video Solution

4. When it is raining vertically down, to a man walking on road the velocity of rain appears to be $1.5 \times$ his velocity.To protect himself from rain he should hold the umbrealla at an angle θ to vertical. The $\tan\theta =$

A. $\frac{2}{\sqrt{5}}$

B. $\frac{\sqrt{5}}{2}$

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

D. $\frac{3}{2}$

Answer: A

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5. A motor car A is travelling with a velocity of $20m/s$ in the north-west direction and another motor car B is travelling with a velocity of $15m/s$ in the north-east directions.The magnitude of relative velocity of B with respect to A is.

A. 25 m/s

B. 15 m/s

C. 20 m/s

D. 35 m/s

Answer: B

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6. A man can swim in still water at a speed of $6kmph$ and he has to cross the river and reach just opposite point on the other bank.If the river is flowing at a speed of $3 kmph$,and the width of the river is $2 km$, the time taken to cross the river is (in hours)

A. $\frac{2}{27}$

B. $\frac{2}{\sqrt{27}}$

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

D. $\frac{2}{\sqrt{45}}$

Answer: D

Watch Video Solution

7. A boat moves perpendicular to the bank with a velocity of $7.2km/h$.The current carries it $150m$ downstreamk.find the velocity of the current (The width of the river is $0.5km$).

A. $0.4ms^{-1}$

B. $1.2ms^{-1}$

C. $0.5ms^{-1}$

D. $0.6ms^{-1}$

Answer: A

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8. A swimmer is capable of swimming $1.65ms^{-1}$ in still water.If she swims directily across a $180m$ wide river whose current is $0.85ms^{-1}$,how far downstreams (from a point opposite her starting point) will she reach?

A. 92.7 m

B. 40 m

C. 48 m

D. 20 m

Answer: B

Watch Video Solution

9. A person swims at 135° to current to river, to meet target on reaching opposite point.The ratio of person's velocity to river water velocity is

A. $\sqrt{3}:1$

B. $\sqrt{2}:1$

C. $1:\sqrt{2}$

D. $1:\sqrt{3}$

Answer: A

Watch Video Solution

10. The parabolic path of a projectile is represented by $y = \frac{x}{\sqrt{3}} - \frac{x^2}{60}$ in MKS units: Its angle of projection is $\left(g = 10ms^{-2}\right)$

A. $30°$

B. $45°$

C. 60°

D. 90°

Answer: B

Watch Video Solution

11. A body is projected at angle 30° to horizontal with a velocity $50ms^{-1}$.Its time of flight is

A. 4s

B. 5s

C. 6s

D. 7s

Answer: D

Watch Video Solution

12. A body is projected with velocity $60m/s$ at 30° to the horizontal.The velocity of the body after $3seconds$ is

A. $20\hat{i} + 20\sqrt{3}\hat{j}$

B. $30\hat{i}$

C. $10\sqrt{3}\hat{j}$

D. $30\sqrt{3}\hat{i}$

Answer: D

Watch Video Solution

13. A body is projected with velocity u such that in horizontal range and maximum vertical heights are samek.The maximum height is

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

B. $\dfrac{3u^2}{4g}$

C. $\dfrac{16u^2}{17g}$

D. $\dfrac{8u^2}{17g}$

Answer: C

Watch Video Solution

14. A cricket ball is hit for a six leaving the bat at an angle of 60° to the horizontal with kinetic energy k.At the top, $K.E.$ of the ball is

A. zero

B. k

C. $\frac{k}{4}$

D. $\frac{k}{\sqrt{2}}$

Answer: D

Watch Video Solution

15. A bomb at rest is exploded and the pieces are scattered in all directions with a maximum velocity of $20ms^{-1}$.Dangerous distance from that spot is $\left(g = 10m/s^2\right)$

A. 10 m

B. 20 m

C. 30 m

D. 40 m

Answer: D

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Watch Video Solution

16. A boy can throw a stone up to a maximum height of 10 m. The maximum horizontal distance that the boy can throw the same stone up to will be:

A. $20\sqrt{2}m$

B. 10 m

C. $10\sqrt{2}m$

D. 20 m

Answer: B

Watch Video Solution

17. A grass hopper can jump a maximum horizontal distance of 0.3 m. If it spends negligible time on the ground, its horizontal component of velocity is $\left(g = 10m/s^2\right)$

A. 3/2 m/s

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

C. 1/2 m/s

D. $\sqrt{\frac{2}{3}} m/s$

Answer: A

Watch Video Solution

18. A stone is thrown with a velocity v at an angle θ with the horizontal.Its speed when it makes an angle β with the horizontal is

A. $v\cos\theta$

B. $\frac{v}{\cos\beta}$

C. $v\cos\theta\cos\beta$

D. $\frac{v\cos\theta}{\cos\beta}$

Answer: A

Watch Video Solution

19. A body is projected with a certain speed at angles of projection of θ and $90 - \theta$.The maximum heights attained in the two cases are $20m$ and $10m$ respectively.The maximum possible range is

A. 60 m

B. 30 m

C. 20 m

D. 80 m

Answer: A

Watch Video Solution

20. The launching speed of a certain projectile is five times the speed it has at its maximum height.Its angles of projection is

A. $\theta = \cos^{-1}(0.2)$

B. $\theta = \sin^{-1}(0.2)$

C. $\theta = \tan^{-1}(0.2)$

D. $\theta = 0^\circ$

Answer: D

Watch Video Solution

21. A person throws a bottle into a dustbin at the same height as he is $2m$ away at an angle of 45°.The velocity of thrown is

A. g

B. $\sqrt{g}$

C. 2g

D. $\sqrt{2g}$

Answer: D

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22. A body projected horizontally from the top of a tower follows $y = 20x^2$ parabola equation where x, y are in $m\left(g = 10m/s^2\right)$.Then the velocity of the projectile is $\left(ms^{-1}\right)$

A. 0.2

B. 0.3

C. 0.4

D. 0.5

Answer: D

Watch Video Solution

23. A bomb is dropped from an aeroplane flying horizontally with a velocity of 720 kmph at an altitude of 980m. Time taken by the bomb to hit the ground is

A. 1s

B. 7.2 s

C. 14.14 s

D. 0.15 s

Answer: C

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24. A body is projected horizontally from a height of $78.4m$ with a velocity $10ms^{-1}$.Its velocity after $3seconds$ is $\left(g = 10m/s^2\right)$ (Take direction of projection as i and vertically upward direction as j)

A. $10\hat{i} - 30\hat{j}$

B. $10\hat{i} + 30\hat{j}$

C. $20\hat{i} - 30\hat{j}$

D. $10\hat{i} + 10\sqrt{3}\hat{j}$

Answer: A

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25. Two thin wood screens A and B are separated by $200m$ a bullet travelling horizontally at speed of $600m/s$ hits the screen A penetrates through it and finally emerges out from B making holes in A and B the resistance of air and wood are negligible the difference of heights of the holes in A and B is.

A. 5 m

B. $\frac{49}{90}m$

C. $\frac{7}{\sqrt{90}}m$

D. zero

Answer: B

Watch Video Solution

26. A fly wheel is rotating about its own axis at an angular velocity $11 rad s^{-1}$, its angular velocity in revolation per minute is

A. 105

B. 210

C. 315

D. 420

Answer: A

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27. A stationary wheel starts rotating about its own axis at constant angular acceleration. If the wheel completes 50 rotations in first 2 seconds, then the number of rotations mades by it in next two seconds is

A. 75

B. 100

C. 125

D. 150

Answer: D

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28. A point size body is moving along a circle at an angular velocity $2.8 rads^{-1}$.If centripetal acceleration of body is $7ms^{-2}$ then its speed is

A. $1.25ms^{-1}$

B. $2.5ms^{-1}$

C. $3.5ms^{-1}$

D. $7ms^{-1}$

Answer: B

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29. A circular plate is rotating about its own axis at an angular velocity 100 revolutions per minute. The linear velocity of a particle P of plate at a distance $4.2cm$ from axis of rotation is

A. 0.22 m/s

B. 0.44 m/s

C. 2.2 m/s

D. 4.4 m/s

Answer: B

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30. An aircraft executes a horizontal loop of radius 1 km with a steady speed of 900 kmph . Compare its centripetal acceleration with acceleration due to gravity .

A. 6.0

B. 6.4

C. 5

D. 7

Answer: B

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EXERCISE II-(C.W)

1. A particle is projected from ground with some initial velocity making an angle of 45° with the horizontal.It reaches a height of $7.5m$ above the ground while it travels a horizontal distance of $10m$ from the point of projection.The initial speed of the projection is

A. 5 m/s

B. 10 m/s

C. 20 m/s

D. 40 m/s

Answer: C

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2. A particle is projected from ground at an angle 45° with initial velocity $20\sqrt{2}ms^{-1}$.The magnitude of average velocity in a timer interval from $t = 0$ to $t = 3s$ in ms^{-1} is

A. 20.62

B. 10.31

C. 41.14

D. 5.15

Answer: A

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3. A ball is thrown with a velocity of u making an angle θ with the horizontal. Its velocity vector normal to initial vector (u) after a time interval of

A. $\dfrac{u\sin\theta}{g}$

B. $\dfrac{u}{g\cos\theta}$

C. $\dfrac{u}{g\sin\theta}$

D. $\dfrac{u\cos\theta}{g}$

Answer: C

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4. A stone is projected with a velocity $20\sqrt{2}m/s$ at an angle of 45° to the horizontal.The average velocity of stone during its motion from starting point to its maximum height is

A. $10\sqrt{5}$ m/s

B. $20\sqrt{5}$ m/s

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

D. 20 m/s

Answer: A

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5. A player kicks a football obliquely at a speed of $20m/s$ so that its range is maximum. Another player at a distance of $24m$ away in the direction of kick starts running at that instant to catch it, the speed with which the second player has to run is $\left(g = 10ms^{-2}\right)$

A. 4 m/s

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

C. $8\sqrt{2}$ m/s

D. 8 m/s

Answer: B

Watch Video Solution

6. A particle is fired with velocity u making angle θ with the horizontal.What is the change in velocity when it is at the highest point?

A. $u\cos\theta$

B. u

C. $u\sin\theta$

D. $u\cos\theta$ - u

Answer: C

Watch Video Solution

7. Two projectiles A and B are thrown from the same point with velocities v and $\frac{v}{2}$

respectively. If B is thrown at an angle 45° with horizontal.What is the inclination of A .when their ranges are the same?

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

B. $\frac{1}{2}\sin^{-1}\left(\frac{1}{4}\right)$

C. $2\sin^{-1}\left(\frac{1}{4}\right)$

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

Answer: B

Watch Video Solution

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

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

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

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

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

Answer: A

Watch Video Solution

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

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

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

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

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

Answer: A

Watch Video Solution

10. A ball is projected from the ground with velocity u such that its range is maximum Then

A. Its velocity at half the maximum height is $\frac{\sqrt{3}}{2}u$

B. Its velocity at the maximum height is 'u'.

C. Change in its velocity when it returns to the ground is 'u'.

D. all the above are true.

Answer: A

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11. A projectile is given an initial velocity of $\left(\hat{i} + 2\hat{j}\right)$ The Cartesian equation of its path is $\left(g = 10ms^{-1}\right)$ (Here , $\hat{i}$ is the unit vector along horizontal and $\hat{j}$ is unit vector vertically upwards)

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

B. $9y = 12x - 5x^2$

C. $y = 9x - 5x^2$

D. $5y = x - 9x^2$

Answer: B

Watch Video Solution

12. A projectile has initially the same horizontal velocity as it would acquire if it had moved from rest with uniform acceleration of $3ms^{-2}$ for 0.5 min. If the maximum height reached by it is $80m$, then the angle of projection is $\left(g = 10ms^{-2}\right)$.

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

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

C. $\tan^{-1}\left(\frac{4}{9}\right)$

D. $\sin^{-1}\left(\frac{4}{9}\right)$

Answer: B

Watch Video Solution

13. A ball is thrown from a point with a speed V_0,at an angle of projection θ.From the same point and at the same instance a person starts running with a constant speed $\frac{V_0}{\sqrt{2}}$ to catch the ball will the person be able to catch the ball? If yes, what should be the angle of projection

A. yes, 60°

B. yes, 30°

C. No

D. yes, 45°

Answer: D

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14. If a stone is to hit at a point which is at a distance d away and at a height h (see fig) above the point from where the stone starts, then what is the value of initial speed u if the stone is launched at an angle θ?

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

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

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

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

Answer: B

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15. If a projectile crosses two walls of equal height h symmetrically as shown in the fig. Choose the correct statement (s) $\left(g = 10m/s^2\right)$

A. The time of fight is 8 sec

B. The height of each wall is 60 m

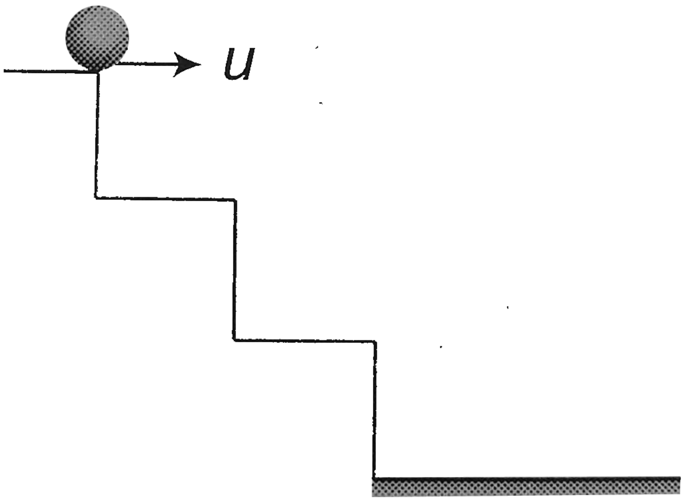
C. The maximum height of projectile is 80m

D. All the above

Answer: D

View Text Solution

16. A staircase contains four steps each $10cm$ high and $20cm$ wide. The minimum horizontal velocity of a ball rolling off the uppermost plane so as to hit directly the lowest plane is



A. 42 ms^{-1}

B. 4.2 ms^{-1}

C. 24 ms^{-1}

D. 2.4 ms^{-1}

Answer: C

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17. From certain height h two bodies are projected horizontally each with velocity v.One body is projected towards North and the other body is projected towards east. Their separation on reaching the ground

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

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

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

D. $\sqrt{\frac{8v^2h}{g}}$

Answer: C

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18. An object is projected horizontally from a top of the tower of height h.The line joining the point of projection and point of striking on the ground makes an angle 45° with ground,Then with what velocity the object strikes the ground

A. $\sqrt{\frac{11gh}{2}}$

B. $\sqrt{\frac{9gh}{2}}$

C. $\sqrt{\frac{7gh}{2}}$

D. $\sqrt{\frac{5gh}{2}}$

Answer: A

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19. A ball is thrown horizontally from a cliff such that it strikes the ground after $5s$.The line of sight makes an angle 37° with the horizontal.The initial velocity of projection in ms^{-1} is

A. 50

B. $\frac{100}{\sqrt{3}}$

C. $\frac{100}{\sqrt{2}}$

D. $\frac{100}{3}$

Answer: C

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20. An object is launched from a cliff $20m$ above the ground at an angle of 30° above the horizontal with an initial speed of $30m/s$ .How far does the object travel before landing on the ground?(in metre)

A. 20

B. $20\sqrt{3}$

C. 60

D. $60\sqrt{3}$

Answer: B

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21. A bomber flying upward at an angle of 53° with the vertical releases a bomb at an altitude of $800m$.The bomb strikes the ground $20s$ after its release.If $g = 10ms^{-2}$, the velocity at the time of release of the bomb in ms^{-1} is

A. 400

B. 800

C. 100

D. 200

Answer: C

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22. Two particles move in a uniform gravitational field with an acceleration g.At the initial moment the particles were located at same point and moved with velocities $u_1 = 9ms^{-1}$ and $u_2 = 4ms^{-1}$ horizontally in opposite directions.The time between the particles at the moment when their velocity vectors are mutually perpendicular in s in

(take $g = 10ms^{-2}$)

A. 0.36

B. 3.6

C. 0.6

D. 6

Answer: C

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23. An aeroplane is flying horizontally at a height of $980m$ with velocity $100ms^{-1}$ drops a food packet.A person on the ground is $414m$ ahead horizontally from the dropping point.At what velocity should he move so that he can catch the food packet.

A. $50\sqrt{2}ms^{-1}$

B. $\frac{50}{\sqrt{2}}ms^{-1}$

C. $100ms^{-1}$

D. $200ms^{-1}$

Answer: D

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

A. 0.5 m/s^2

B. 0.87 m/s^2

C. 0.56 m/s^2

D. 1 m/s^2

Answer: B

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25. The length of minute hand in a pendu lum clock is 10cm, the speed of Tip of the hand is (in m/s):

A. $\frac{\pi}{6000}$

B. $\frac{\pi}{18000}$

C. $\frac{\pi}{3600}$

D. $\frac{\pi}{1200}$

Answer: D

Watch Video Solution

26. A particle moves on a circle of radius r with centripetal accelration as function of time as

$a_c = K^2rt^2$ where k is a positive constant , find the resu ltant acceleration.

A. kt^2

B. kr

C. $kr\sqrt{k^2t^4 + 1}$

D. $kr\sqrt{k^2t^2 - 1}$

Answer: C

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27. A particle moves in a circular path such that its speed v varies with distance s as $v = \alpha\sqrt{s}$ where α is a positive constant. If the acceleration of the particle after traversing a distance s is $\left[\alpha^2\sqrt{x + \frac{s^2}{R^2}}\right]$ find x.

A. $\alpha^2\sqrt{\frac{1}{4} - \frac{s^2}{R^2}}$

B. $\alpha^2\sqrt{\frac{1}{4} + \frac{s^2}{R^2}}$

C. $\alpha\sqrt{\frac{1}{2} + \frac{s^2}{R^2}}$

D. $\alpha^2\sqrt{\frac{1}{2}+\frac{s^2}{R^2}}$

Answer: B

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EXERCISE II-(H.W)

1. A particle projected from the level ground just clears in its ascent a wall $30m$ high and $120\sqrt{3}$ away measured horizontally.The time since projection to clear the wall is two second.It will strike the ground in the same horizontal plane from the wall on the other side of a distance of (in metres)

A. $150\sqrt{3}$

B. $180\sqrt{3}$

C. $120\sqrt{3}$

D. $210\sqrt{3}$

Answer: B

Watch Video Solution

2. A stone is projected with a velocity $20\sqrt{2}m/s$ at an angle of 45° to the horizontal.The average velocity of stone during its motion from starting point to its maximum height is

A. $10\sqrt{5}$ m/s

B. $20\sqrt{5}$ m/s

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

D. 20 m/s

Answer: A

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3. A ball is thrown with velocity $8ms^{-1}$ making an angle $60°$ with the horizontal.Its velocity will be perpendicular to the direction of initial velocity of projection after a time of

A. $\frac{1.6}{\sqrt{3}}s$

B. $\frac{4}{\sqrt{3}}s$

C. $0.6s$

D. $1.6\sqrt{3}s$

Answer: A

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4. The range of a projectile, when launched at an angle of 15° with the horizontal is 1.5 km. what is the range of the projectile, when launched at an angle of 45° to the horizontal with the same speed ?

A. 3 km

B. 4.5 km

C. 1.5 km

D. 2.5 km

Answer: C

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5. A body is projected obliquely from the ground such that its horizontal range is maximum. If the change in its linear momentum, as it moves from half the maximum height to maximum height, is P, the change in its linear momentum as it travels from the point of projection to the landing point on the ground will be:

A. P

B. $\sqrt{2}P$

C. 2P

D. $2\sqrt{2}P$

Answer: D

Watch Video Solution

6. A projectile is thrown at angle β with vertical.It reaches a maximum height H.The time taken to reach the hightest point of its path is

A. $\sqrt{\frac{H}{g}}$

B. $\sqrt{\frac{2H}{g}}$

C. $\sqrt{\frac{H}{2g}}$

D. $\sqrt{\frac{2H}{g\cos\beta}}$

Answer: B

Watch Video Solution

7. 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. 0.05

B. 0.1

C. 0.15

D. 0.2

Answer: A

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8. A gardener wants to wet the garden without moving from his place with a water jet whose velocity is $20ms^{-1}$ the maximum area that he can wet $\left(g = 10ms^{-2}\right)$ (in $metre^2$)

A. 1600π

B. 40π

C. 400π

D. 200π

Answer: A

Watch Video Solution

9. A particle is projected with speed u at angle θ to the horizontal. Find the radius of curvature at highest point of its trajectory

A. $\dfrac{u^2\cos^2\theta}{2g}$

B. $\dfrac{\sqrt{3}u^2\cos^2\theta}{2g}$

C. $\frac{u^2\cos^2\theta}{g}$

D. $\frac{\sqrt{3}u^2\cos^2\theta}{g}$

Answer: C

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10. A cricketer of height $2.5m$ thrown a ball at an angle of 30° with the horizontal such that it is received by another crickerter of same height standing at distance of $50m$ from the first one.Find the maximum height attained by the ball.

A. 10 m

B. 9 m

C. 10.7 m

D. 9.7 m

Answer: D

Watch Video Solution

11. A particle when fired at an angle $\theta = 60\,°$ along the direction of the breadth of a rectangular building of dimension $9m \times 8m \times 4m$ so as to sweep the edges.Find the range of the projectile.

A. $8\sqrt{3}$

B. $4\sqrt{3}$

C. $\frac{8}{\sqrt{3}}$

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

Answer: A

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12. A hiker stands on the edge of a cliff $490m$ above the ground and throwns a stone horiozontally with an initial speed of $15ms^{-1}$ neglecting air resistance.The time taken by the stone to reach the ground in seconds is $\left(g = 9.8ms^2\right)$

A. 5

B. 10

C. 1

D. 15

Answer: B

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13. Two bodies are projected from the same point with same speed in the directions making an angle α_1 and α_2 with the horizontal and strike at same point in the horizontal plane through a point of projection. If t_1 and t_2 are their time of flights.Then $\frac{t_1^2 - t_2^2}{t_1^2 + t_2^2}$

A. $\frac{\tan\left(\alpha_1 - \alpha_2\right)}{\tan\left(\alpha_1 + \alpha_2\right)}$

B. $\frac{\sin\left(\alpha_1 + \alpha_2\right)}{\sin\left(\alpha_1 - \alpha_2\right)}$

C. $\frac{\sin\left(\alpha_1 - \alpha_2\right)}{\sin\left(\alpha_1 + \alpha_2\right)}$

D. $\frac{\sin^2\left(\alpha_1 - \alpha_2\right)}{\sin^2\left(\alpha_1 + \alpha_2\right)}$

Answer: C

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14. From the top of a tower of height $78.4m$ two stones are projected horizontally with $10m/s$ and $20m/s$ in opposite directions. On reaching the ground, their separation is

A. 120 m

B. 100 m

C. 200 m

D. 150 m

Answer: A

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15. A body is projected vertically upwards.At its highest point it explodes into two pieces of masses in the ratio of $2:3$ and the lighter piece flies horizontally with a velocity of $6ms^{-1}$ .The time after which the lines joining the point of explosion to the position of particles are perpendicular to each other is

A. $\sqrt{\frac{6}{25}}s$

B. $\sqrt{\frac{12}{15}}s$

C. $\sqrt{\frac{24}{25}}s$

D. 2s

Answer: C

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16. From the top of a building $80m$high, a ball is thrown horizontally which hits the ground at a distance.The line joining the top of the building to the point where it hits the ground makes an angle of 45° with the ground. Initial velocity of projection of the ball is $\left(g = 10 m/s^{2}\right)$

A. 10 m/s

B. 15 m/s

C. 20 m/s

D. 30 m/s

Answer: C

Watch Video Solution

17. A stone is thrown from the top of a tower of height $50m$ with a velocity of $30ms^{-1}$ at an angle of 30° above the horizontal.Find the time during which the stone will be in air

A. 2 sec

B. 3 sec

C. 4 sec

D. 5 sec

Answer: D

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18. 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

Watch Video Solution

19. A body is thrown horizontally with a velocity u from the top of a tower.The displacement of the stone when the horizontal and vertical velocities are equal is

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

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

C. $\sqrt{5}\left(\frac{u^2}{2g}\right)$

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

Answer: C

Watch Video Solution

20. A hiker stands on the edge of a cliff $490m$ above the ground and throwns a stone horiozontally with an initial speed of $15ms^{-1}$

neglecting air resistance.The speed with which

it hits the ground in ms^{-1} is $\left(g = 9.8ms^2\right)$

A. 9.8

B. 99

C. 4.9

D. 49

Answer: B

Watch Video Solution

21. A ball is projected with $20\sqrt{2}m/s$ at angle 45° with horizontal.The angular velocity of the particle at highest point of its journey about point of projection is

A. 0.1 rad/s

B. 1 rad/s

C. 0.3 rad/s

D. 0.4 rad/s

Answer: B

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22. A particle is moving along a circular path in xy-plane. When it crosses x-axis, it has an acceleration along the path of $1.5 m/s^2$, and is moving with a speed of 10 m/s in -ve y-direction. The total acceleration is

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23. An insect trapped in a circular groove of radius $12 cm$ moves along the groove steadily and complete 7 revolutions in 100 seconds.The linear speed of the motion in cm/s

A. 5.3

B. 4

C. 3

D. 5

Answer: A

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24. A particle moves in a circle of radius 20 cm. Its linear speed is given by v=2t where t is in s and v in m/s. Then

a) the radial acceleration at $t = 2s$ is $80ms^{-2}$

b) tangential acceleration at $t - 2s$ is $2ms^{-2}$

c)net acceleration at t=2s is greater than $80ms^{-2}$

d) tangential acceleration remains constant in magnitude.

A. only a,b,c are correct

B. only a,b,d are correct

C. only a,c,d are correct

D. all a,b,c,d are correct

Answer: D

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EXERCISE - III

1. A fielder in a cricket match throws ball from the boudnary line to the wicket keeper. The ball describes at parabolic path. Which of the following quantities remain constant during the motion in air? (Neglecting air resistance)

A. Kinetic energy

B. Vertical component of velocity

C. Hrizontal component of velocity

D. Speed

Answer: C

View Text Solution

2. A body is projected horizontally with a velocity of $4ms^{-1}$ from the top of a high tower. The velocity of the body after 0.7 is nearly (Take, $g = 10ms^{-2}$)

A. $1ms^{-1}$

B. $10ms^{-1}$

C. $8ms^{-1}$

D. $3m^{-1}$

Answer: C

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Watch Video Solution

3. 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. 0.05

B. 0.1

C. 0.15

D. 0.2

Answer: A

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

A. R^2

B. $\frac{1}{R^2}$

C. $\frac{1}{R}$

D. R

Answer: D

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5. 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. $10ms^{-2}$

C. $10\pi ms^{-2}$

D. $\frac{10}{\pi}ms^{-2}$

Answer: D

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6. Assertion: A body of mass $1kg$ is making $1rps$ in a circle of radius $1m$. Centrifugal force acting on it is $4\pi^2 N$.

Reason: Centrifugal force is given by $F = \frac{mv^2}{r}$.

A. Both assertion and reason are true and reason is the correct explanantion of assertion

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

C. Assertion is true but reason is false

D. Both assertion and reason are false

Answer: A

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7. A roller coaster is designed such that riders experience "weightlessness" as they go round the top of a hill whose radius of curvature is $20m$. The speed of the car at the top of the hill is between

A. $14ms^{-1}$ and $15ms^{-1}$

B. $15ms^{-1}$ and $16ms^{-1}$

C. $16ms^{-1}$ and $17ms^{-1}$

D. $13ms^{-1}$ and $14ms^{-1}$

Answer: A

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8. A partricle of mass m is projected with a velocity v at an angle of 60° with horizontal When the particle is at the maximum height. The magnitude ofits angular momentum about the point ofprojection is

A. zero

B. $\frac{3mv^2}{16g}$

C. $\dfrac{\sqrt{3}mv^3}{16g}$

D. $\dfrac{3mv^3}{16g}$

Answer: B

Watch Video Solution

9. 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. 50 m

B. 60 m

C. 20 m

D. 40 m

Answer: D

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10. One end of string of length l is connected to a particle on mass m and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed v the net force on the particle (directed toward centre) will be (T reprents the tension in the string):

A. $\frac{mv^2}{l}$

B. $T - \frac{mv^2}{l}$

C. $T + \frac{mv^2}{l}$

D. Zero

Answer: A

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11. A car is moving in a circular horizonta track of radius 10m with a constant speed of 10 m/s. A pendulum bob is suspended from the roof of the cat by a light rigid rod of length 1.00m. The angle made by the rod with track is

A. Zero

B. 30°

C. 45°

D. 60°

Answer: C

Watch Video Solution

12. A wheel is rotating at 900 rpm about its axis. When the power is cut off, it comes to rest in 1 min. The angular retardation (in rad s^{-2}) is

A. $\frac{\pi}{2}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{6}$

D. $\frac{\pi}{8}$

Answer: A

Watch Video Solution

13. 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

Watch Video Solution

14. The horizontal range is equal to two times maximum height of a projectile. The angle of projection ofthe projectile is:

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

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

C. $\theta = 45^{\circ}$

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

Answer: B

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15. The position vector of a particle $\vec{R}$ as a funtion of time is given by:

$\vec{R} = 4\sin(2\pi t)\hat{i} + 4\cos(2\pi t)\hat{j}$

Where R is in meters, t is in seconds and $\hat{i}$ and $\hat{j}$ denote until vectors along x-and y-directions, respectively Which one of the following statements is wrong for the motion of particle ?

A. Path of the particle is a circle of radius 4 meter

B. Acceleration vector is along -$\vec{R}$.

C. Magnitude of acceleration vector is $\frac{v^2}{R}$,where v is the velocity of particle.

D. Magnitude of the velocity of aprticle is 8 meter/second

Answer: D

Watch Video Solution

16. Range of a projectile is R, when the angle of projection is 30°. Then, the value of the other angle of projection for the same range is

A. 45°

B. 60°

C. 50°

D. 40°

Answer: B

Watch Video Solution

17. A ball is thrown from a point with a speed V_0,at an angle of projection θ.From the same point and at the same instance a person starts running with a constant speed $\frac{V_0}{\sqrt{2}}$ to catch the ball will the person be able to catch the ball? If yes, what should be the angle of projection

A. yes, 60°

B. yes, $30°$

C. No

D. yes, $45°$

Answer: A

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18. If a_r and a_t represent radial and tangential accelerations, the motion of a particle will be uniformly circular if

A. $a_r = 0$ and $a_t = 0$

B. $a_r = 0$ and $a_t \neq 0$

C. $a_r \neq 0$ and $a_t = 0$

D. $a_r \neq 0$ and $a_t \neq 0$

Answer: C

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19. A Particle is kept at rest at the top of a sphere of diameter $42m$.when disturbed slightly, it slides down. At what height h from the bottom, the particle will leave the sphere

A. 14 m

B. 28 m

C. 35 m

D. 7 m

Answer: C

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20. The maximum range of a gun from horizontal terrain is $16km$. If $g = 10m/s^2$ what must be the muzzle velocity of the shell?

A. 200 m/s

B. 100 m/s

C. 400 m/s

D. 300 m/s

Answer: C

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21. A projectile can have the same range R for two angles of projection. If t_1 and t_2 be the times of flight in the two cases:-

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

A. 0.5 m

B. 1.0 km

C. 1.5 km

D. 2.0 km

Answer: B

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23. A ball is thrown at different angles with the same speed u and from the same points and it has same range in both the cases. If y_1 and y_2 be the heights attained in the two cases, then find the value of $y_1 + y_2$.

A. u^2/g

B. $2u^2/g$

C. $u^2/2g$

D. $u^2/4g$

Answer: C

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24. A projectile is projected with linear momentum p making angle θ with the horizontal. The change in momentum of the projectile on returning to the ground will be-

A. 2p

B. $2p\cos\theta$

C. $2p\sin\theta$

D. $2p\tan\theta$

Answer: C

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25. The driver of a car travelling at $72 kmh^{-1}$ suddenly sees a big rock on the road at a distance of 20m. What can he do to avoid a collision ?

A. Apply brakes

B. Turn sharply

C. Follow a zig - zag path

D. Shut the engine

Answer: A

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26. 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 makes 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: C

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27. A spaceman in training is rotated in a seat at the end of a horizontal arm of length 5 m. If he can with stand acceleration upto 9 g, then what is the maximum number of revolution per second permissible? (Take, g $=10ms^{-2}$)

A. 13.5 rev/s

B. 1.35 rev/s

C. 0.675 rev/s

D. 6.75 rev/s

Answer: C

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28. Two stones are projected with the same speed but making different angles with the horizontal. Their horizontal ranges are equal. The angle of projection of one is $\frac{\pi}{3}$ and the maximum height reached by it is 102 m. Then the maximum height reached by the other in metres is

A. 3.36

B. 224

C. 56

D. 34

Answer: D

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29. 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. $45°$

B. $60°$

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

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

Answer: C

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30. Two particles starting from a point on a circle of radius 4m in horizontal plane move along the respectively in opposite directions. The particle will collide with each other after a time of

A. $3.0s$

B. $2.5s$

C. $2.0s$

D. $1.5s$

Answer: B

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31. For angle of projection of a projectile at angles and $\left(45^{\circ}+\theta\right)$, the horizontal range described by the projectile are in the ratio of

A. $2:1$

B. $1:1$

C. $2:3$

D. $1:2$

Answer: B

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

A. $45°$

B. $60°$

C. $0°$

D. $30°$

Answer: B

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33. A police jeep is chasing with, velocity of $45 km/h$ a thief in another jeep moving with velocity $153 km/h$. Police fires a bullet with muzzle velocity of $180 m/s$. The velocity it will strike the car of the thief is.

A. 2s

B. 4s

C. 1s

D. 6s

Answer: B

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34. A police jeep is chasing with, velocity of $45km/h$ a thief in another jeep moving with velocity $153km/h$. Police fires a bullet with muzzle velocity of $180m/s$. The velocity it will strike the car of the thief is.

A. 150 m/s

B. 27 m/s

C. 450 m/s

D. 250 m/s

Answer: A

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35. Which motion does not require force to maintain it?

A. Uniform circular motion

B. Elliptical motion

C. Uniformstraight line motion

D. Projectile motion

Answer: C

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36. A fielder in a cricket match throws ball from the boundary line to thhe wicket keeper. The ball describes a partabolic path. Which of the following quantities remain constant during the motion in air? (Neglecting air resistance)

A. Kinetic energy

B. Vertical component of velocity

C. Hortizontal component of velocity

D. Speed

Answer: C

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37. A particle is moving in a vertical in a vertical circle . The tensions in the string when passing through two positions at angles 30° and 60° from the lowest positon are T_1 and T_2 respectively , then

A. $T_1 = T_2$

B. $T_2 > T_1$

C. $T_1 > T_2$

D. tension in the string always remains the same

Answer: C

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

A. 45°

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

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

D. none of these

Answer: B

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39. The height y and the distance x along the horizontal plane of a projectile on a certain planet (with no surrounding atmosphere) are given by $y = \left(8t - 5t^2\right)$ meter and $x = 6t$ meter , where t is in second. The velocity with which the projectile is projected is

A. 8 m/s

B. 6 m/s

C. 10 m/s

D. not obtained from the data

Answer: C

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40. The relation between the time of flight of projectile T_f and the time to reach the maximum height t_m is

A. $T_f = 2t_m$

B. $T_f = t_m$

C. $T_f = \frac{t_m}{2}$

D. $T_f = \sqrt{2}(t_m)$

Answer: A

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41. The acceleration of an object moving with speed v in a circle of radius r is

A. $\frac{u^2}{r}$ towards the centre

B. $\frac{u}{r}$ way from the centre

C. $\frac{u}{r^2}$ way from the centre

D. $\frac{r}{u^2}$ towards the centre

Answer: A

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42. A projectile of mass 30 kg is shot vertically upwards with an intial velocity of 10 m/s.After

5 s, it explodes into two fragments, one of which having a mass of 20 kg is travelling vertically with a velocity of 150m/s. What is the velocity of the other fragment at that instant?

A. $-15 m/s$

B. 15 m/s

C. zero

D. None of these

Answer: A

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43. A cartis moving horizontally along a straight line with constant speed 30m/s.At projectile is to be fired from the moving cart in such a way that it will return to the cart after the cart has moved 80m. At what speed (relative to the cart) must the projectile be fired? (Take $g = 10m/s^2$)

A. $10\sqrt{8m}/s$

B. $8\sqrt{10m}/s$

C. $\frac{40}{3}m/s$

D. None of these

Answer: C

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44. A bullet is fired with a speed of 1500 m/s in order to hit a target 100 m away. if $g10m/s^2$, the gun should be aimed:

A. 15 cm above the target

B. 10 cm above the target

C. 3 cm above the target

D. directly towards the target

Answer: C

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45. A fighter plane is moving in a vertical circle of radius 'r'. Its minimum velocity at the highest point of the circle will be

A. $\sqrt{\frac{1}{2}gr}$

B. $\sqrt{2gr}$

C. $\sqrt{gr}$

D. $\sqrt{3gr}$

Answer: C

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46. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is

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

B. $\theta = 45^\circ$

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

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

Answer: D

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47. A car of mass $1000kg$ negotiates a banked curve of radius $90m$ on a fictionless road. If the banking angle is 45° the speed of the car is:

A. $5ms^{-1}$

B. $10ms^{-1}$

C. $20ms^{-1}$

D. $30ms^{-1}$

Answer: D

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

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: B

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49. a projectile is fired from the surface of the earth with a velocity of $5ms^{-1}$ and angle θ with the horizontal. Another projectile fired from another planet with a velocity of $3ms^{-1}$ at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth.The value of the acceleration due to gravity on the planet is in ms^{-2} is given $\left(g = 9.8ms^{-2}\right)$

A. 3.5

B. 5.9

C. 16.3

D. 110.8

Answer: A

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50. If the angle of projection of a projector with same initial velocity exceed or fall short of 45° by equal amount α, then the ratio of horizontal rages is

A. $1:2$

B. $1:3$

C. $1:4$

D. $1:1$

Answer: D

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EXERCISE-IV

1. A ball is thrown from a roof top at angle of 40° above the horizontal. It hits the ground a few seconds later. At what point during its motion. Does the ball have

(a) greatest speed (b) smallest speed (c) greatest acceleration ? Explain.

A. At the highest point

B. At the starting point

C. At the point where it toughes the ground

D. None of the above

Answer: C

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2. Two particles A and B are placed as shown in the figure . The particle A one the top of tower , is projected horizontally with a velocity μ and the particle B is projected along the suface towards the tower simultaneously. If particle meet each other , then the speed of projected of particle B is : [igoner friction].

A. $d\sqrt{\frac{g}{2H}} - u$

B. $d\sqrt{\frac{g}{2H}}$

C. $d\sqrt{\frac{g}{2H}} + u$

D. u

Answer: A

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

A. A, B and C have unequal ranges

B. Ranges of A and C are 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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4. An artillary piece which consistently shoots its shells with the same muzzle speed has a maximum range R. To hit a target which is $R/2$ from the gun and on the same level, the elevation angle of the gun should be

A. 15°

B. 45°

C. 30°

D. 60°

Answer: A

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5. A bullet fired at an angle of 30° with the horizontal hits the ground 3 km away. By adjusting the angle of projection, can one hope to hit a target 5 km away ? Assume the muzzle speed to be fixed and neglect air resistance.

A. Not possible

B. Possible

C. information insufficient

D. None of these

Answer: A

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6. The range of a projectile fired at an angle of 15° is 50 m. If it is fired with the same speed at an angle of 45° its range will be

A. 60m

B. 71m

C. 100m

D. 141m

Answer: C

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

A. The average velocity is not zero at any time

B. Average acceleration must always vanish

C. displacements in equal time intervals are equal

D. Equal path lengths are traversed in equal intervals

Answer: D

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8. 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 circubar motion

Answer: C

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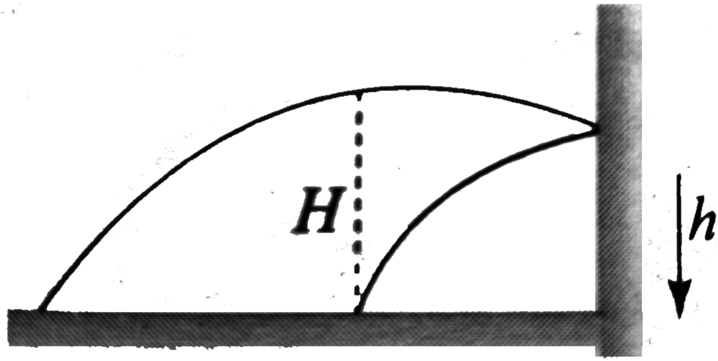

9.

A stone is projected from a horizontal plane. It attains maximum height H & strikes a stationary smooth wall & falls on the ground vertically below the maximum height. Assuming the collision to be elastic the height of the point on the wall where ball will strike is

A. (H/2)

B. (H/4)

C. (3H/4)

D. none of these

Answer: C

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10. 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 $\left(take g = 10ms^{-2}\right)$

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

A. Maggnitude of particle velocity (speed) remains constant

B. paricle velocity remains directed perpendicular to radius vector

C. Direction of acceleration keeps changing as the particle moves

D. Magnetude of acceleration does not remain constant

Answer: D

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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 80 m, he applies brakes and reduces his speed at the constant rate $0.5 ms^{-2}$. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn

?

A. $0.68ms^{-2}$

B. $0.86ms^{-2}$

C. $0.56ms^{-2}$

D. $0.76ms^{-2}$

Answer: B

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13. 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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14. 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 revolution in 22s, then the acceleration of the ston is

A. $16ms^{-2}$

B. $4ms^{-2}$

C. $12ms^{-2}$

D. $8ms^{-2}$

Answer: A

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15. When a body is projected from a level ground the ratio of its speed in the vertical and horizontal direction is 4:3. If the velocity of projection is u, the time after which, the ratio of the velocities in the vertical and horizontal directions are reversed is (A)7u/20g (B)35u/10g (C)9u/g (D)10u/g

A. $\frac{7u}{20g}$

B. $\frac{3u}{10g}$

C. $\frac{9u}{20g}$

D. $\frac{10u}{7g}$

Answer: A

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16. A particle is projected horizonatally with a speed 'u' from the top of plane in clined at an angle θ with the vertical. How far from the point of projection will the particle strike the plane?

A. $\frac{2u^2}{g}\cot\theta ec\theta$

B. $\frac{2u^2}{g}\cot\theta\sec\theta$

C. $\frac{2u^2}{g}\tan\theta\sec\theta$

D. $\frac{2u^2}{g}\cot\theta\cos\theta$

Answer: A

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17. The speed of a projectile when it is at its greatest height is $\sqrt{2/5}$ times its speed at half the maximum height. The angle of projection is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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18. A particle of mass m is projected with an initial velocity U at an angle θ to the horizontal. The torque of gravity on projectile at maximum height about the point of projection is

A. $\dfrac{mU^2\sin 2\theta}{2}$

B. $mU^2\sin 2\theta$

C. $\dfrac{mU^2\sin\theta}{2}$

D. $\dfrac{1}{2}mU^2(\sin 2\theta)^2$

Answer: A

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19. 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. $(R + H), H/2$

B. $(R + H/2), 2H$

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

D. $(R + H), H$

Answer: D

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20. A projectile is fired with a velocity u at right angles to the slope, which is inclined at an angle θ with the horizontal. Derive an expression for the distance R to the point of impact.

.

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

B. $\frac{2u^2}{g}\sec\theta$

C. $\frac{u^2}{g}\tan^2\theta$

D. $\frac{2u^2}{g}\tan\theta\sec\theta$

Answer: A

21. 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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22. Time taken by the projectile to reach from A to B is t. Then the distance AB is equal to :

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

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

C. $\sqrt{3}ut$

D. 2ut

Answer: A

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23. Two persons P and Q crosses the river starting the point A on one side to exactly opposite point B on the other bank of the river. The person P crosses the river in the shortest path. The person Q crosses the river in shortest time and walks back to point B

.Velocity of river is $3kmph$ and speed of each person is $5kmph$ w.r.t river. If the two persons reach the point B in the same time, then the speed of walk of Q is .

A. 8kmph

B. 12kmph

C. 4kmph

D. 6kmph

Answer: B

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24. To a man walking at 7 kmph due west, the wind appears to blow from the north-west but when he walks at 3 kmph due west, the wind appears to blow from north. The magnitude and actual direction of wind are

A. $5kmph, \tan^{-1}\left(\frac{3}{4}\right)$ east of north

B. 5kmph, $\tan\frac{3}{4}$ north of east

C. 4kmph, $\tan^{-1}\left(\frac{3}{4}\right)$ east of north

D. 3kmph,$\tan^{-1}\left(\frac{3}{4}\right)$ north of east

Answer: A

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25. The distance between two moving particles P and Q at any time is a.If v_r be their relative velocity and if u and v be the components of v_r, along and perpendicular to PQ.The closest distance between P and Q and time that elapses before they arrive at their nearest distance is

A. $\dfrac{a\left(v+v_r\right)}{v}, a\left(1+\dfrac{v_r}{u}\right)^2$

B. $\dfrac{av}{\left(v+v_r\right)}, a\left(1+\dfrac{u}{v_r}\right)^2$

C. $\dfrac{av_r}{v}, \dfrac{av_r}{u}$

D. $\dfrac{av}{v_R}, \dfrac{au}{v_r^2}$

Answer: D

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26. In a harbour, wind is blowing at the speed of $72km/h$ and the flag on the mast of a boat anchored in the harbour flutters along the N-E $direction$. If the boat starts moving at a speed of $51km/h$ to the North, what is the direction of flag on the mast of the bat ?

A. Nearly west

B. Nearly east

C. Nearly south

D. Nearly north

Answer: B

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27. A horizontal wid is blowing with a velocity v towards north-east. A man starts running towards north with acceleration a. The after which man will feel the wind blowing towards east is

A. $\frac{v}{a}$

B. $\frac{\sqrt{2}v}{a}$

C. $\frac{v}{\sqrt{2}a}$

D. $\frac{2v}{a}$

Answer: C

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28. Assuming the gravity to be in negative z-direction, a force $F = v \times A$ is exerted on a particle in addition to the force of gravity where v is the velocity of the particle and A is a constant vector in positive x-direction. With what minimum speed a particle of mass m be projected so that it continues to move undeflected with constant velocity ?

A. $-\frac{A}{mg}\hat{j}$

B. $\frac{A}{mg}\hat{j}$

C. $\frac{mg}{A}\hat{j}$

D. $-\frac{mg}{A}\hat{j}$

Answer: D

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29. Rain is falling vertically with a speed of $20ms^{-1}$., A person is running in the rain with a velocity of $5ms^{-1}$ and a wind is also blowing with a speed of $15ms^{-1}$ (both from the west) The angle with the vertical at which the person should hold his umbrella so that he may not get drenched is:

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

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

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

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

Answer: B

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