PRACHAND NEET 2025

PHYSICS

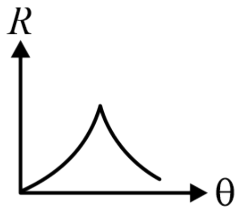
MOTION IN A PLANE

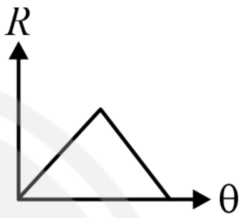
DPP : 01

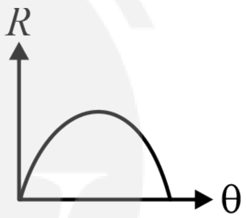
Q1 From a certain height, two bodies are projected horizontally with velocities $10 \mathrm{~m/s}$ and $20 \mathrm{~m/s}$. They hit the ground in t_1 and t_2 seconds. Then
(A) $t_1 = t_2$
(B) $t_1 = 2t_2$
(C) $t_2 = 2t_1$
(D) $t_1 = \sqrt{2} t_2$

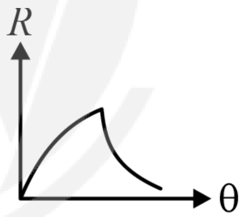
Q2 A river is flowing at the rate of $6 \mathrm{~km/h}$. A swimmer swims across the river with a velocity of $9 \mathrm{~km/h}$ w.r.t. water. The resultant velocity of the man will be (in km/h) :
(A) $\sqrt{117}$
(B) $\sqrt{340}$
(C) $\sqrt{17}$
(D) $3\sqrt{40}$

Q3 If a body is projected at 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 direction of velocity concides with the direction of acceleration when it hits the ground

Q4 A particle is projected at an angle θ with horizontal with speed u. The variation of its horizontal range with θ is best represented by
(A)


(B)


(C)


(D)


Q5 The speed of a projectile at its maximum height is $\frac{\sqrt{3}}{2}$ times of its initial speed 'u' of projection. Its range on the horizontal plane is:
(A) $\frac{\sqrt{3}u^2}{2g}$
(B) $\frac{u^2}{2g}$
(C) $\frac{3u^2}{2g}$
(D) $\frac{3u^2}{g}$

Q6 The coordinates of a particle moving in $x-y$ plane at any instant of time t are $x = 4t^2; y = 3t^2$. The speed of the particle at that instant is
(A) 10t
(B) 5t
(C) 3t
(D) 2t

Q7 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) $\frac{4v^2}{\sqrt{5}g}$

Q8 A person swims in a river aiming to reach exactly on the opposite points on the bank of a river. His speed of swimming is 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water is

(A) 1.0 m/s (B) 0.5 m/s
(C) 0.25 m/s (D) 0.43 m/s

Q9 A ball is thrown from a point with a speed 'v_0' at an elevation angle θ. From the same point and at the same instant, a person starts running with a constant speed $\frac{'v_0'}{2}$ to catch the ball. Will the person be able to catch the ball? If yes, what should be the angle of projection θ?

(A) No (B) Yes, 30°
(C) Yes, 60° (D) Yes, 45°

Q10 Two projectiles A and B are projected with same speed at an angle 30° and 60° to the horizontal, then which of the following is not valid (where *T* is total time of flight, *H* is maximum height and *R* is horizontal range)?

(A) $H_A = 3H_B$ (B) $T_B = \sqrt{3}\,T_A$
(C) $R_A = R_B$ (D) $H_B = 3H_A$

Q11 When an object is shot along the inclined plane from the bottom of a long smooth inclined plane kept at an angle 60° with horizontal, it can travel a distance x_1 along the plane. But when the inclination is decreased to 30° and the same object is shot with the same velocity, it can travel x_2 distance. Then $x_1 : x_2$ will be:

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

Q12 A ball is thrown at an angle of 30° to the horizontal. It falls on the ground at a distance of 90 m. If the ball is thrown with the same initial speed at an angle 30° to the vertical, it will fall on the ground at a distance of:

(A) 120 m (B) 27 m
(C) 90 m (D) 30 m

Q13 The coordinates of a moving particle at any time t are given by $x = \alpha t^3$ and $y = \beta t^3$. The speed of the particle at time 't' is given by

(A) $\sqrt{\alpha^2 + \beta^2}$
(B) $3t\sqrt{\alpha^2 + \beta^2}$
(C) $3t^2\sqrt{\alpha^2 + \beta^2}$
(D) $t^2\sqrt{\alpha^2 + \beta^2}$

Q14 A ball is thrown up at an angle with the horizontal. Then the total change of momentum by the instant it returns to ground is

(A) acceleration due to gravity $\times$ total time of flight
(B) weight of the ball $\times$ half the time of flight
(C) weight of the ball $\times$ total time of flight
(D) weight of the ball $\times$ horizontal range

Q15 **Statement-I:** If circular motion of the object is uniform, the object will possess only centripetal acceleration.

Statement-II: If circular motion of the object is non-uniform, the object will possess both centripetal and tangential acceleration.

(A) Both Statement-I and Statement-II are correct.
(B) Both Statement-I and Statement-II are incorrect.
(C) Statement-I is correct and Statement-II is incorrect.
(D) Statement-I is incorrect and Statement-II is correct.

Q16 When the ratio of the minimum velocity to the maximum velocity is 1/√2, the angle of projection of projectile is

(A) 30° (B) 60°
(C) 15° (D) 45°

Q17 A pebble is thrown horizontally from the top of a 20 m high tower with an initial velocity of 10 m/s. The air drag is negligible. The speed of the pebble when it is at the same distance from top as well as base of the tower ($g = 10$ m/s^2)

(A) $10\sqrt{2}$ m/s (B) $10\sqrt{3}$ m/s

(C) 20 m/s (D) 25 m/s

Q18 A stone is projected from the ground with velocity 50 m/s at an angle of 30°. It crosses a wall after 3 *sec*. How far beyond the wall the stone will strike the ground ($g = 10$ m/sec^2)

(A) 90.2 m (B) 89.6 m

(C) 86.6 m (D) 70.2 m

Q19 The position of a projectile launched from the origin at $t = 0$ is given by $\vec{r} = \left(40\hat{i} + 50\hat{j}\right)$ m at $t = 2$ s. If the projectile was launched at an angle θ with the horizontal, then θ is (take g = 10 ms^{-2})

(A) $\tan^{-1}\frac{2}{3}$ (B) $\tan^{-1}\frac{3}{2}$

(C) $\tan^{-1}\frac{7}{4}$ (D) $\tan^{-1}\frac{4}{3}$

Q20 Four bodies A, B, C and D are projected with equal speeds having angles of projection $15^\circ, 30^\circ, 45^\circ$ and 60° with the horizontal respectively. The body having the shortest range is

(A) A (B) B

(C) C (D) D

Q21 A shell fired from the ground is just able to cross horizontally the top of a wall 90 m away and 45 m high. The direction of projection of the shell will be

(A) 25°

(B) 30°

(C) 60°

(D) 45°

Q22 The equation of a 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

Q23 In projectile motion, the physical quantity that remains invariant throughout is

(A) Vertical component of velocity

(B) Horizontal component of velocity

(C) Kinetic energy of the projectile

(D) Potential energy of the projectile

Q24 **Assertion:** Two particles of different masses are projected with same velocity at same angles. The maximum height attained by both the particles will be same.

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

(A) Assertion is True, Reason is True; Reason is correct explanation for Assertion

(B) Assertion is True, Reason is True; Reason is not correct explanation for Assertion

(C) Assertion is True, Reason is False

(D) Assertion is False, Reason is True

Q25 If angles of projection are $\left(\frac{\pi}{4} + \theta\right)$ and $\left(\frac{\pi}{4} - \theta\right)$ where $\theta < \frac{\pi}{4}$, then the ratio of horizontal ranges described by the projectile is (projection speed is same) ;

(A) $2 : 1$ (B) $1 : 2$

(C) $1 : 1$ (D) $2 : 3$

Q26 **Assertion:** The trajectory of a projectile is quadratic in y and linear in x.

Reason: y co-ordinate of trajectory of a projectile is independent of x- co-ordinate.

(A) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(B) Both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(C) Assertion is correct but Reason is incorrect.

(D) Both the Assertion and Reason are incorrect.

Q27 A ball is projected from the ground with velocity v such that its range is maximum.

	Column-I		Column-II

(a)	Vertical component of velocity at half of the maximum height	(P)	$\frac{v}{2}$
(b)	Velocity at the maximum height	(Q)	$\frac{v}{\sqrt{2}}$
(c)	Change in its velocity when it returns to the ground	(R)	$v\sqrt{2}$
(d)	Average velocity when it reaches the maximum height	(S)	$\frac{v}{2}\sqrt{\frac{5}{2}}$

(A) $a-P,\quad b-Q,\quad c-R,\quad d-S$
(B) $a-Q,\quad b-P,\quad c-R,\quad d-S$
(C) $a-S,\quad b-Q,\quad c-R,\quad d-P$
(D) $a-P,\quad b-R,\quad c-Q,\quad d-S$

Q28 The path of projectile is represented by $y=Px-Qx^2$.

	Column-I		Column-II
(a)	Range	(P)	*P/Q*
(b)	Maximum height	(Q)	*P*
(c)	Time of flight	(R)	$P^2/4Q$
(d)	Tangent of angle of projection is	(S)	$P\sqrt{\frac{2}{Qg}}$

(A) $a-P,\quad b-Q,\quad c-S,\quad d-R$
(B) $a-R,\quad b-P,\quad c-S,\quad d-Q$
(C) $a-S,\quad b-R,\quad c-P,\quad d-Q$
(D) $a-P,\quad b-R,\quad c-S,\quad d-Q$

Q29 **Assertion (A):** The path of one projectile as seen from another projectile is a straight line. Both are projected with same velocity and different angles.
Reason (R): Two projectiles projected with same speed at angles α and $(90^\circ-\alpha)$ have same range.
(A) Assertion (A) is true, Reason (R) is true; Reason (R) is a correct explanation for Assertion (A).
(B) Assertion (A) is true, Reason (R) is true; Reason (R) is not a correct explanation for Assertion (A).
(C) Assertion (A) is true, Reason (R) is false.
(D) Assertion (A) is false, Reason (R) is true.

Q30 **Assertion:** When the velocity of projection of a body is made n times, its time of flight becomes n times.
Reason: Range of projectile depends on the initial velocity of body.
(A) Assertion is True, Reason is True; Reason is correct explanation for Assertion
(B) Assertion is True, Reason is True; Reason is not correct explanation for Assertion
(C) Assertion is True, Reason is False
(D) Assertion is False, Reason is True

Answer Key

Q1	(A)
Q2	(A)
Q3	(C)
Q4	(C)
Q5	(A)
Q6	(A)
Q7	(A)
Q8	(C)
Q9	(C)
Q10	(A)
Q11	(C)
Q12	(C)
Q13	(C)
Q14	(C)
Q15	(A)
Q16	(D)
Q17	(B)
Q18	(C)
Q19	(C)
Q20	(A)
Q21	(D)
Q22	(C)
Q23	(B)
Q24	(A)
Q25	(C)
Q26	(D)
Q27	(A)
Q28	(D)
Q29	(B)
Q30	(B)

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

(A)

Since the vertical component of velocities for both projectiles are same and equal to zero, the time taken to hit the ground will be same.

Video Solution:

Q2 Text Solution:

(A)

v_r = $\sqrt{9^2+6^2}$ km/h

Video Solution:

Q3 Text Solution:

Text Soln

(C)

At maximum height, only horizontal component of velocity is non zero.

Video Solution:

Q4 Text Solution:

(C)

$\text{Hint}: R=\frac{u^2\sin 2\theta}{g}$

$\text{Sol.}: R\propto\sin 2\theta$

Sinusoidal variation is represented by option (3)

Video Solution:

Q5 Text Solution:

(A)

$u\ \cos\theta\ =\frac{\sqrt{3}}{2}u\quad\Rightarrow\ \theta=30^{\circ}$

$R\ =\frac{u^2\ \sin\ 2\theta}{g}\ =\frac{\sqrt{3}\ u^2}{2g}$

Video Solution:

Q6 Text Solution:

(A)

$V_x\ =8t\ and\ V_y\ =\ 6t$

$V\ =\sqrt{(8t)^2+(6t)^2}$

$V=10t$

Video Solution:

Q7 Text Solution:

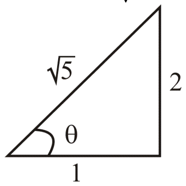
(A)

$R=2H$ given

We know $R=4H\cot\theta\Rightarrow\cot\theta=\frac{1}{2}$

From triangle, we can say that $\sin\theta=\frac{2}{\sqrt{5}}$

$\cos\theta = \frac{1}{\sqrt{5}}$



Range of projectile$(R) = \frac{2v^2 \sin\theta \cos\theta}{g}$

$= \frac{2v^2}{g} \times \frac{2}{\sqrt{5}} \times \frac{1}{\sqrt{5}} = \frac{4v^2}{5g}$

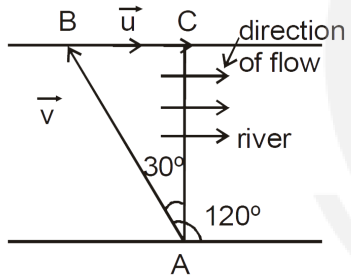
Video Solution:

Q8 Text Solution:

(C)

Here speed of swimer (v) = 0.5 m/s. speed of water (u) = ?

So, $\sin\theta = \frac{u}{v} \Rightarrow \frac{u}{0.5} = \frac{1}{2}$ or $u = 0.25\ \text{ms}^{-1}$



Video Solution:

Q9 Text Solution:

(C)

Yes, Man will catch the ball, if the horizontal component of velocity becomes equal to the constant speed of man.

$\frac{v_0}{2} = v_0 \cos\theta \Rightarrow \cos\theta = \frac{1}{2}$

or $\theta = 60^\circ$

Video Solution:

Q10 Text Solution:

(A)

$T = \frac{2u\sin\theta}{g} \Rightarrow T \alpha \sin\theta$

$\frac{T_1}{T_2} = \frac{\sin 30^\circ}{\sin 60^\circ} = \frac{1}{\sqrt{3}} \Rightarrow T_B = \sqrt{3}T_A$

$\because \theta_1 + \theta_2 = 90^\circ \Rightarrow R_A = R_B$

$H_{max} = \frac{u^2 \sin^2\theta}{2g} \propto \sin^2\theta$

$\frac{H_A}{H_B} = \frac{\sin^2 30^\circ}{\sin^2 60^\circ} = \frac{1}{3}$

$\Rightarrow 3H_A = H_B$

Video Solution:

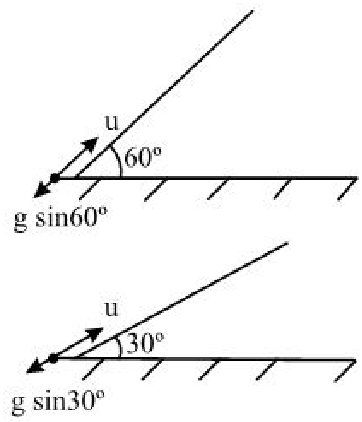
Q11 Text Solution:

(C)

(Stopping distance) $x_1 = \frac{u^2}{2g \sin 60^\circ}$

(Stopping distance) $x_2 = \frac{u^2}{2g \sin 30^\circ}$

$\Rightarrow \frac{x_1}{x_2} = \frac{\sin 30^\circ}{\sin 60^\circ} = \frac{1\times 2}{2\times\sqrt{3}} = 1 : \sqrt{3}$



Video Solution:

Q12 Text Solution:

(C)

If $\theta_1 + \theta_2 = 90°$ $\Rightarrow$Range will be same.

Video Solution:

Q13 Text Solution:

(C)

Velocity in x direction:

$V_x = \frac{dx}{dt} = \frac{d}{dt}\left(\alpha t^3\right) = 3\alpha t^2$

Velocity in y direction:

$V_y = \frac{dy}{dt} = \frac{d}{dt}\left(\beta t^3\right) = 3\beta t^2$

speed will be

$V = \sqrt{V_x^2 + V_y^2} = \sqrt{(3\alpha t^2)^2 + (3\beta t^2)^2}$

$\Rightarrow V = 3t^2\sqrt{\alpha^2 + \beta^2}$

Video Solution:

Q14 Text Solution:

(C)

$\triangle\ p =$ F× time of flight

F= mg

Video Solution:

Q15 Text Solution:

(A)

Uniform circular motion

In uniform circular motion, an object moves in a circle at a constant speed while experiencing centripetal acceleration towards the center of the circle.

Centripetal acceleration

Centripetal acceleration is responsible for changing the direction of an object in circular motion, whether it's uniform or non- uniform.

Tangential acceleration

Tangential acceleration is responsible for changing the magnitude of an object's speed in non-uniform motion.

Non-uniform circular motion

In non-uniform circular motion, an object travels at different speeds and doesn't cover the same distance in equal time intervals.

hence **both statements are true** and statement II is correct explanation of statement I.

Video Solution:

Q16 Text Solution:

(D)

let u=initial velocity

it has min velocity at the top

$\mathrm{V_{min}} = u\cos\theta$

$\frac{u\cos\theta}{u} = \frac{1}{\sqrt{2}}$

$\theta = 45^\circ$

Video Solution:

Q17 Text Solution:

(B)

The pebble is at same distance from top and base of the tower after it falls down by a distance $h = 10$ m.

$$v^2 = u^2 + 2gh = 100 + 2 \times 10 \times 10 = 300$$

$\therefore v = 10\sqrt{3}$ m/s.

Video Solution:

Q18 Text Solution:

(C)

Total time of flight $= \frac{2u \sin\theta}{g} = \frac{2 \times 50 \times 1}{2 \times 10} = 5\, s$

Time to cross the wall = 3 sec (given)

Time in air after crossing the wall = (5 – 3) = 2 sec

Distance travelled beyond the wall $= (u\cos\theta)t$

$= 50 \times \frac{\sqrt{3}}{2} \times 2 = 86.6\, m$

Video Solution:

Q19 Text Solution:

(C)

From equation,

Horizontal velocity (initial),

$u_x = \frac{40}{2} = 20$ m/s

Vertical velocity (initial), $50 = u_y t + \frac{1}{2}gt^2$

$50 = u_y \times 2 + \frac{1}{2}(-10) \times 4$

or, $50 = 2u_y - 20$

or, $u_y = \frac{70}{2} = 35$ m/s

$\therefore \frac{u_y}{u_x} = \frac{35}{20} = \frac{7}{4}$

$\Rightarrow Angle\, \theta = \tan^{-1}\left(\frac{7}{4}\right)$

Video Solution:

Q20 Text Solution:

(A)

Let u be the equal speed of all four bodies.

Let θ be the angle of projection.

Range (R) = $\frac{u^2 \sin 2\theta}{g}$ ....(1)

Range of all the bodies

Substitute the values of θ in equaion (1) for different bodies

Range of A, $R_1 = \frac{u^2 \sin 30^\circ}{g} = \frac{u^2}{2g}$

Range of B, $R_2 = \frac{u^2 \sin 60^\circ}{g} = \frac{\sqrt{3}u^2}{2g}$

Range of C, $R_3 = \frac{u^2 \sin 90^\circ}{g} = \frac{u^2}{g}$

Range of D, $R_4 = \frac{u^2 \sin 120^\circ}{g} = \frac{\sqrt{3}u^2}{2g}$

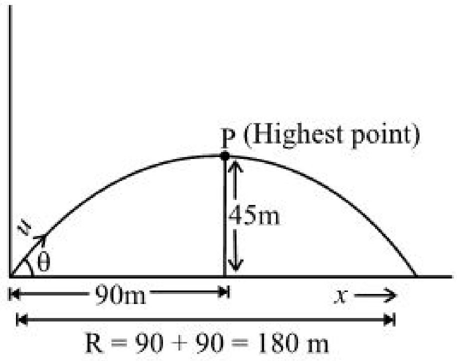
Range of A is the shortest

Hence, option (A) is correct.

Video Solution:

Q21 Text Solution:

(D)



From the figure,

Height in projectile motion,

H = $\frac{u^2 \sin^2 \theta}{2g}$

$$45 = \frac{u^2 \sin^2 \theta}{2g} \ldots\ldots\ldots\ldots (1)$$

Horizonal range,

R = $\frac{u^2 \sin 2\theta}{g}$

$$180 = \frac{u^2 \sin 2\theta}{g} \ldots\ldots\ldots\ldots (2)$$

Divide equation (2) by equation (1), we get

$$\frac{180}{45} = \frac{g}{\frac{u^2 \sin^2 \theta}{2g}}$$

$$4 = \frac{4 \sin \theta \cos \theta}{\sin^2 \theta}$$

$$4 = \frac{4}{\tan \theta}$$

$$\tan \theta = 1$$

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

$$\theta = 45^{\circ}$$

Video Solution:

Q22 Text Solution:

(C)

By using equation of Trajectory

$$y = X \tan \theta - {X^2}/{R} \tan \theta$$

By comparing given equation in question we get-

$$\tan \theta = 16$$

$$\frac{\tan \theta}{R} = \frac{1}{4}$$

$$\frac{16}{R} = \frac{1}{4}$$

$$R = 64\ m$$

Video Solution:

Q23 Text Solution:

Text Soln

(B)

Acceleration in horizontal direction for a projectile is zero in this case.

Video Solution:

Q24 Text Solution:

(A)

Let the particles be thrown with velocity u making an angle θ with the horizontal.

$\rightarrow u_y = u \sin \theta$

At maximum height (H), vertical component of velocity is zero i.e $V_y = 0$

Using $V_y^2 - u_y^2 = 2a_y S$

$\therefore (u \sin \theta)^2 = 2(-g)H \rightarrow H = \frac{u^2 \sin^2 \theta}{2g}$

Thus the maximum height attained by both the particles is same.

Also from the equation used, the maximum height of projectile is independent of particle's mass.

Video Solution:

Q25 Text Solution:

(C)

$\theta_1 = \left(\frac{\pi}{4} + \theta\right)$

$\theta_2 = \left(\frac{\pi}{4} - \theta\right)$

$R_1 = \frac{u^2 \sin 2\theta_1}{g} = \frac{u^2 \sin((\pi/2)+2\theta)}{g} = \frac{u^2 \cos 2\theta}{g}$

$R_2 = \frac{u^2 \sin 2\theta_2}{g} = \frac{u^2 \sin((\pi/2)-2\theta)}{g} = \frac{u^2 \cos 2\theta}{g}$

$= \frac{u^2 \cos 2\theta}{g}$

Ratio will be 1 : 1

Video Solution:

Q26 Text Solution:

(D)

It is known that trajectory equation for projectile motion is:

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

The trajectory of projectile is not quadratic in y and linear in x and y component of trajectory is dependent of x- component.

so, Both Assertion and Reason are incorrect.

Video Solution:

Q27 Text Solution:

(A)

$a. \to p.\ ;\ b. \to Q.\ ;\ C. \to R.\ ;\ d. \to S.$

$a. \to p.$ Range is maximum, when the angle of projection is 45°.

$H = \frac{v^2}{2g}\sin^2 45^\circ = \frac{v^2}{4g} \ldots\ldots (i)$

Velocity, at half of the maximum height is v'.

$v'^2 = v^2 \sin^2 45^\circ - 2g\frac{H}{2} = \frac{v^2}{2} - \frac{v^2}{4} \Rightarrow v'$

$= \frac{\sqrt{3}v}{2}$

$b. \to Q.$

Velocity at the maximum height

$v' = v\cos\ 45^\circ \Rightarrow v' = \frac{v}{\sqrt{2}}$

[Because vertical component of velocity is zero at the highest point]

$C. \to R.$

Projection velocity (At projection point)

$\vec{v_i} = v\ \cos 45^\circ\hat{i}\ +\ v\ \sin 45^\circ\hat{j}$

At the point, when the body strikes the ground

$\vec{v_f} = v\ \cos 45^\circ\hat{i} - v\ \sin 45^\circ\hat{j}$

$\Delta v = \vec{v_f} + \left(-\vec{v_i}\right) = 2v\ \sin 45^\circ\left(-j\right)$

$d. \to S.$

Average velocity $= \frac{Total\ displacement}{Total\ time}$

$Displacement = \sqrt{\left(\frac{R}{2}\right)^2 + H^2}$

$\vec{v_{av}} = \frac{\sqrt{\frac{R^2}{4}+H^2}}{\frac{v\ \sin\theta}{g}} = \frac{\sqrt{R^2+4H^2}}{\frac{2v\ \sin\theta}{g}}$

$v_{av} = \frac{\sqrt{\left(\frac{v^2}{g}\right)^2+4\left(\frac{v^2}{4g}\right)^2}}{\frac{\sqrt{2}v}{g}}$

$v_{ag} = \frac{\frac{v^2}{g}\sqrt{1+\frac{1}{4}}}{\frac{v\sqrt{2}}{g}} = \frac{v^2\sqrt{5}}{2v\sqrt{2}} = \frac{v}{2}\sqrt{\frac{5}{2}}$

Video Solution:

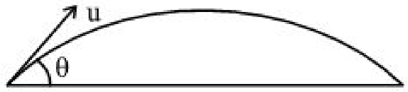
Q28 Text Solution:

(D)

y = px − Qx^2

we know that,

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



So comparing,

P = tanθ

Q = $\frac{g}{2u^2\cos^2\theta}$

$\cos\theta = \frac{1}{\sqrt{P^2+1}}$

$\sin\theta = \frac{P}{\sqrt{P^2+1}}$

$u^2 = \frac{g(P^2+1)}{2Q}$

(i) Range = $\frac{2u^2\sin\theta\cos\theta}{g}$

$= 2\times g\frac{(P^2+1)}{2Q\times g}\times\frac{P}{(P^2+1)}$

$\Rightarrow P/Q$

(ii) Max. height = $\frac{u^2\sin^2\theta}{2g}$

$= \frac{g(P^2+1)}{2Q\times 2g}\times\frac{P^2}{(P^2+1)}$

$= P^2/4Q$

(iii) Time of flight = $\frac{R}{u\cos\theta}$

$= \frac{P/Q}{\sqrt{g\frac{(P^2+1)}{2Q}}}\times\frac{1}{\sqrt{P^2+1}}$

$= \sqrt{\frac{2}{Qg}}P$

(iv) tanθ = P

Video Solution:

Q29 Text Solution:

(B)

If two projectiles were projected from horizontal ground with different intial velocities (u_a and u_b) and different angles (A and B), then at any time t:

Coordinates of A: $\overrightarrow{S_A}$ = ($u_a$cosA)t$\hat{i}$ + $\left[\left(u_B\sin A\right)t - \frac{1}{2}gt^2\right]\hat{j}$

Coordinates of B: $\overrightarrow{S_B}$ = ($u_b$cosB)t$\hat{i}$ + [($u_B\sin B)t\ -\frac{1}{2}gt^2\ ]\ \hat{j}$

Coordinates of A with respect to B:

$\overrightarrow{S_B} - \overrightarrow{S_A}$ = ($u_b$cosB - $u_a$cosA)tî - $(u_B\sin B\ -\ u_A\sin A)t\hat{j}$

Now, $u_b$cosB −$u_a$cosA is constant say k

and $(u_B\sin B\ -\ u_A\sin A)$ is also constant (say n)

So, $S_B - S_A$ = kt$\hat{i}$ - nt$\hat{j}$ which corresponds to a straight line

(x = kt) and the corresponding velocities will not change with time.

So, (A) is true and also Range is same for complementary angles, hence (R) is also true but is not correct explanation of (A).

Video Solution:

Q30 Text Solution:

(B)

time of fight T = $\frac{2u\sin\theta}{g}$

hence (A) is true

Range (R) = $\frac{u^2\sin 2\theta}{g}$

So, (R) is also true, but is not a correct explanation of (A).

Video Solution: