Exercise-1

Marked Questions can be used as Revision Questions.

PART - I : SUBJECTIVE QUESTIONS

Section (A) : Definition, Projectile on a horizontal plane

A-1. Two bodies are projected at angles θ and $(90 - \theta)$ to the horizontal with the same speed. Find the ratio of their times of flight?

A-2. In above question find the ratio of the maximum vertical heights ?

A-3. A body is so projected in the air that the horizontal range covered by the body is equal to the maximum vertical height attained by the body during the motion. Find the angle of projection ?

A-4. A projectile can have the same range R for two angles of projections at a given speed. If T_1 & T_2 be the times of flight in two cases, then find out relation between T_1, T_2 and R ?

A-5. A cricketer can throw a ball to a maximum horizontal distance of 100 m. To what height above the ground can the cricketer throw the same ball with same speed.

A-6. A player kicks a football at an angle of 45º with an initial speed of 20 m/s. A second player on the goal line 60 m away in the direction of kick starts running to receive the ball at that instant. Find the constant speed of the second player with which he should run to catch the ball before it hits the ground [g = 10 m/s^2]

Section (B) : Projectile from a tower

B-1. A projectile is fired horizontally with a velocity of 98 m/s from the top of a hill 490 m high. Find :
(take g = 9.8 m/s^2)
(i) The time taken to reach the ground
(ii) The distance of the target from the foot of hill
(iii) The velocity with which the particle hits the ground

B-2. From the top of a tower of height 50m a ball is projected upwards with a speed of 30 m/s at an angle of 30° to the horizontal. Then calculate -
(i) Maximum height from the ground
(ii) At what distance from the foot of the tower does the projectile hit the ground.
(iii) Time of flight.

Section (C) : Equation of trajectory

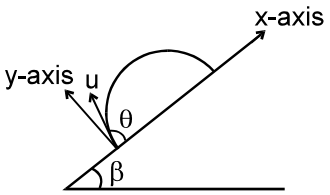
C-1. The equation of a projectile is $y = \sqrt{3}\,x - \frac{gx^2}{2}$, find the angle of projection. Also find the speed of projection. Where at t = 0, x = 0 and y = 0 also $\frac{d^2x}{dt^2} = 0$ & $\frac{d^2y}{dt^2} = -g$.

C-2 A bullet is fired from horizontal ground at some angle passes through the point $\left(\frac{3R}{4}, \frac{R}{4}\right)$, where 'R' is the range of the bullet. Assume point of the fire to be origin and the bullet moves in x-y plane with x-axis horizontal and y-axis vertically upwards. Angle of projection is $\frac{\alpha\pi}{180}$ radian. Find α :

C-3. The radius vector of a point A relative to the origin varies with time t as $\vec{r} = at\hat{i} - bt^2\hat{j}$, where a and b are positive constants and $\hat{i}$ and $\hat{j}$ are the unit vectors of the x and y axes. Find:
(i) The equation of the point's trajectory y(x) ; plot this function
(ii) The time dependence of the velocity **v** and acceleration **a** vectors as well as of the moduli of these quantities.

Section (D) : Projectile on an inclined plane

D-1. A particle is projected at an angle θ with an inclined plane making an angle β with the horizontal as shown in figure, speed of the particle is u, after time t find :



(a) x component of acceleration ?
(b) y component of acceleration ?
(c) x component of velocity ?
(d) y component of velocity ?
(e) x component of displacement ?
(f) y component of displacement ?
(g) y component of velocity when particle is at maximum distance from the incline plane ?

PART - II : ONLY ONE OPTIONS CORRECT TYPE

Section (A) : Definition, Projectile on a horizontal plane

A-1. A ball is thrown upwards. It returns to ground describing a parabolic path. Which of the following remains constant?
(A) Speed of the ball
(B) Kinetic energy of the ball
(C) Vertical component of velocity
(D) Horizontal component of velocity.

A-2. A bullet is fired horizontally from a rifle at a distant target. Ignoring the effect of air resistance, which of the following is correct?

	Horizontal Acceleration	Vertical Acceleration
(A)	10 ms^{-2}	10 ms^{-2}
(B)	10 ms^{-2}	0 ms^{-2}
(C)	0 ms^{-2}	10 ms^{-2}
(D)	0 ms^{-2}	0 ms^{-2}.

A-3. A point mass is projected, making an acute angle with the horizontal. If angle between velocity and acceleration $\vec{g}$ is θ at any time t during the motion, then θ is given by
(A) $0^\circ < \theta < 90^\circ$ (B) $\theta = 90^\circ$ (C) $\theta < 90^\circ$ (D) $0^\circ < \theta < 180^\circ$

A-4. A projectile is thrown with a speed v at an angle θ with the upward vertical. Its average velocity between the instants at which it crosses half the maximum height is
(A) v sin θ, horizontal and in the plane of projection
(B) v cos θ, horizontal and in the plane of projection
(C) 2v sin θ, horizontal and perpendicular to the plane of projection
(D) 2v cos θ, vertical and in the plane of projection.

A-5. A particle moves along the parabolic path $y = ax^2$ in such a way that the x component of the velocity remains constant, say c. The acceleration of the particle is
(A) $ac\,\hat{k}$ (B) $2ac^2\,\hat{j}$ (C) $ac^2\,\hat{j}$ (D) $a^2c\,\hat{j}$

A-6. During projectile motion, acceleration of a particle at the highest point of its trajectory is
(A) g
(B) zero
(C) less than g
(D) dependent upon projection velocity

A-7. The speed at the maximum height of a projectile is half of its initial speed u. Its range on the horizontal plane is:
(A) $\frac{2u^2}{3g}$ (B) $\frac{\sqrt{3}u^2}{2g}$ (C) $\frac{u^2}{3g}$ (D) $\frac{u^2}{2g}$

A-8. The velocity of projection of a projectile is $(6\hat{i} + 8\hat{j})$ ms^{-1}. The horizontal range of the projectile is ($g = 10$ m/sec^2)

(A) 4.9 m (B) 9.6 m (C) 19.6 m (D) 14 m

Section (B) : Projectile from a tower

B-1.* One stone is projected horizontally from a 20 m high cliff with an initial speed of 10 ms^{-1}. A second stone is simultaneously dropped from that cliff. Which of the following is true?

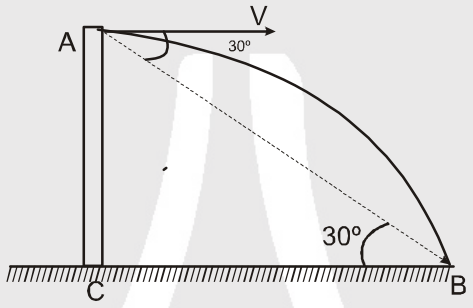
(A) Both strike the ground with the same speed.

(B) The stone with initial speed 10 ms^{-1} reaches the ground first.

(C) Both the stones hit the ground at the same time.

(D) The stone which is dropped from the cliff reaches the ground first.

B-2. An object is thrown horizontally from a point 'A' from a tower and hits the ground 3s later at B. The line from 'A' to 'B' makes an angle of 30º with the horizontal. The initial velocity of the object is : (take $g = 10$ m/s^2)

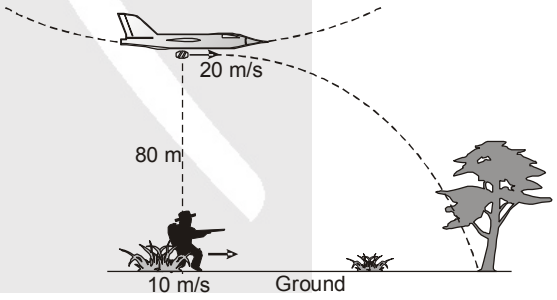


(A) $15\sqrt{3}$ m/s (B) 15 m/s (C) $10\sqrt{3}$ m/s (D) $25/\sqrt{3}$ m/s

B-3. A body is projected horizontally from the top of a tower with initial velocity 18 ms^{-1}. It hits the ground at angle 45º. What is the vertical component of velocity when it strikes the ground?

(A) $18\sqrt{3}$ ms^{-1} (B) 18 ms^{-1} (C) $9\sqrt{2}$ ms^{-1} (D) 9 ms^{-1}

B-4. A bomber plane moving at a horizontal speed of 20 m/s releases a bomb at a height of 80 m 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 10 m/s. After two seconds he realized that he cannot make it, he stops running and immediately holds 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 $g = 10$ m/s^2)



(A) 10 m/s (B) $20\sqrt{10}$ m/s (C) $10\sqrt{10}$ m/s (D) None of these

Section (C) : Equation of trajectory

C-1. A ball is projected from a certain point on the surface of a planet at a certain angle with the horizontal surface. The horizontal and vertical displacement x and y varies with time t in second as:

$x = 10\sqrt{3}t$ and $y = 10t - t^2$

The maximum height attained by the ball is

(A) 100 m (B) 75 m (C) 50 m (D) 25 m.

Section (D) : Projectile on an inclined plane

D-1. A plane surface is inclined making an angle θ with the horizontal. From the bottom of this inclined plane, a bullet is fired with velocity v. The maximum possible range of the bullet on the inclined plane is

(A) $\frac{v^2}{g}$ (B) $\frac{v^2}{g(1+\sin\theta)}$ (C) $\frac{v^2}{g(1-\sin\theta)}$ (D) $\frac{v^2}{g(1+\cos\theta)}$

D-2. A ball is horizontally projected with a speed v from the top of a plane inclined at an angle 45º with the horizontal. How far from the point of projection will the ball strike the plane?

(A) $\frac{v^2}{g}$ (B) $\frac{\sqrt{2}v^2}{g}$ (C) $\frac{2v^2}{g}$ (D) $\left[\frac{2\sqrt{2}v^2}{g}\right]$

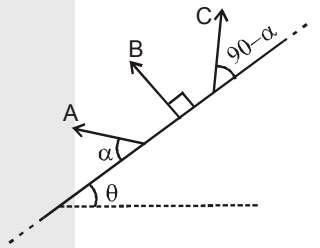
D-3. A particle is projected at angle 37° with the incline plane in upward direction with speed 10 m/s. The angle of incline plane is given 53°. Then the maximum distance from the incline plane attained by the particle will be -

(A) 3m (B) 4 m (C) 5 m (D) zero

D-4. On an inclined plane of inclination 30º, a ball is thrown at an angle of 60º with the horizontal from the foot of the incline with a velocity of $10\sqrt{3}$ ms^{-1}. If g = 10 ms^{-2}, then the time in which ball will hit the inclined plane is -

(A) 1 sec. (B) 6 sec. (C) 2 sec. (D) 4 sec.

D-5. Three stones A, B, C are projected from surface of very long inclined plane with equal speeds and different angles of projection as shown in figure. The incline makes an angle θ with horizontal. If H_A, H_B and H_C are maximum height attained by A, B and C respectively above inclined plane then: (Neglect air friction)

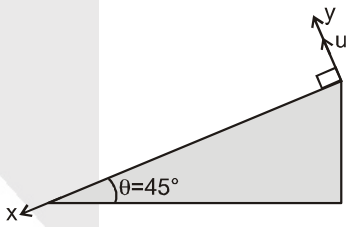


(A) $H_A + H_C = H_B$ (B) $H_A^2 + H_C^2 = H_B^2$

(C) $H_A + H_C = 2H_B$ (D) $H_A^2 + H_C^2 = 2H_B^2$

PART - III : MATCH THE COLUMN

1. An inclined plane makes an angle θ = 45° with horizontal. A stone is projected normally from the inclined plane, with speed u m/s at t = 0 sec. x and y axis are drawn from point of projection along and normal to inclined plane as shown. The length of incline is sufficient for stone to land on it and neglect air friction. Match the statements given in column I with the results in column II. (g in column II is acceleration due to gravity.)



Column I	Column II
(A) The instant of time at which velocity of stone is parallel to x-axis	(p) $\frac{2\sqrt{2}u}{g}$
(B) The instant of time at which velocity of stone makes an angle θ = 45° with positive x-axis. in clockwise direction	(q) $\frac{2u}{g}$
(C) The instant of time till which (starting from t = 0) component of displacement along x-axis become half the range on inclined plane is	(r) $\frac{\sqrt{2}u}{g}$
(D) Time of flight on inclined plane is	(s) $\frac{u}{\sqrt{2}g}$

2. A particle is projected from level ground. Assuming projection point as origin, x-axis along horizontal and y-axis along vertically upwards. If particle moves in x-y plane and its path is given by $y = ax - bx^2$ where a, b are positive constants. Then match the physical quantities given in column-I with the values given in column-II. (g in column II is acceleration due to gravity.)

Column I	**Column II**
(A) Horizontal component of velocity	(p) a/b
(B) Time of flight	(q) $\frac{a^2}{4b}$
(C) Maximum height	(r) $\sqrt{\frac{g}{2b}}$
(D) Horizontal range	(s) $\sqrt{\frac{2a^2}{bg}}$

Exercise-2

Marked Questions may have for Revision Questions.

PART - I : ONLY ONE OPTION CORRECT TYPE

1. A particle moves in the xy plane with only an x-component of acceleration of 2 ms^{-2}. The particle starts from the origin at t = 0 with an initial velocity having an x-component of 8 ms^{-1} and y-component of –15 ms^{-1}. Velocity of particle after time t is :

(A) $[(8 + 2t)\hat{i} - 15\hat{j}]$ m s^{-1} (B) zero

(C) $2t\hat{i} + 15\hat{j}$ (D) directed along z-axis.

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

(A) 90º (B) 60º (C) 30º (D) 45º

3. If R and h represent the horizontal range and maximum height respectively of an oblique projection whose start point (i.e. point of projecteion) & end point are in same horizontal level. Then $\frac{R^2}{8h} + 2h$ represents

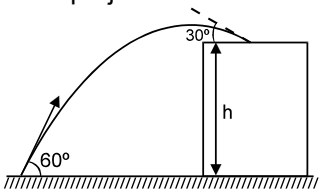
(A) maximum horizontal range (B) maximum vertical range

(C) time of flight (D) velocity of projectile at highest point

4. A projectile is thrown with velocity v making an angle θ with the horizontal. It just crosses the top of two poles, each of height h, after 1 second and 3 second respectively. The time of flight of the projectile is

(A) 1 s (B) 3 s (C) 4 s (D) 7.8 s.

5. A stone projected at an angle of 60º from the ground level strikes at an angle of 30º on the roof of a building of height 'h'. Then the speed of projection of the stone is :

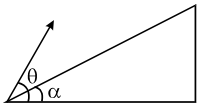


(A) $\sqrt{2gh}$ (B) $\sqrt{6gh}$ (C) $\sqrt{3gh}$ (D) $\sqrt{gh}$

6. A particle at a height 'h' from the ground is projected with an angle 30° from the horizontal, it strikes the ground making angle 45° with horizontal. It is again projected from the same point at height h with the same speed but with an angle of 60° with horizontal. Find the angle it makes with the horizontal when it strikes the ground :

(A) $\tan^{-1}(4)$ (B) $\tan^{-1}(5)$ (C) $\tan^{-1}(\sqrt{5})$ (D) $\tan^{-1}(\sqrt{3})$

7. A projectile is fired at an angle θ with the horizontal. Find the condition under which it lands perpendicular on an inclined plane of inclination α as shown in figure.



(A) $\sin\alpha = \cos(\theta - \alpha)$ (B) $\cos\alpha = \sin(\theta - \alpha)$ (C) $\tan\theta = \cot(\theta - \alpha)$ (D) $\cot(\theta - \alpha) = 2\tan\alpha$

8. A ball is thrown eastward across level ground. A wind blows horizontally to the east, and assume that the effect of wind is to provide a constant force towards the east, equal in magnitude to the weight of the ball. The angle θ (with horizontal east) at which the ball should be projected so that it travels maximum horizontal distance is

(A) 45° (B) 37° (C) 53° (D) 67.5°

PART - II : NUMERICAL VALUE

1. A hunter at the bottom of a slant hill is trying to shoot a deer on a hill. The distance of the deer along his line of sight is $10\sqrt{181}$ meters and the height of the hill is 90 meters. His gun has a muzzle velocity of 100 m/sec. Minimum how many meters above the deer should he aim his rifle in order to hit it? [$g = 10\ m/s^2$]

2. A stone is thrown in such a manner that it would just hit a bird at the top of a tree and afterwards reach a maximum height double that of the tree. If at the moment of throwing the stone the bird flies away horizontally with constant velocity and the stone hits the bird after some time.The ratio of horizontal velocity of stone to that of the bird is $\frac{1}{n}+\frac{1}{\sqrt{n}}$. Find 2n.

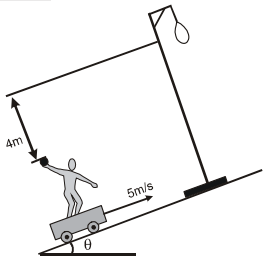
3. If 4 seconds be the time in which a projectile reaches a point P of its path and 5 seconds the time from P till it reaches the horizontal plane passing through the point of projection. The height of P above the horizontal plane (in m) will be - [$g = 9.8\ m/sec^2$]

4. A person standing on the top of a cliff 30 m high has to throw a packet to his friend standing on the ground 40 m horizontally away. If he throws the packet directly aiming at the friend with a speed of $\frac{125}{3}$ m/s. Packet falls at a distance $\frac{20}{\alpha}$ m from the friend. Here α is an integer. Find α. [Use $g = 10\ m/s^2$].

5. A particle is projected from a point (0, 1) on Y-axis (assume + Y direction vertically upwards) aiming towards a point (4, 9). It falls on ground on x axis in 1 sec. If the speed of projection is $\sqrt{\beta}$ m/s, where β is an integer. Find β**.** Taking $g = 10\ m/s^2$ and all coordinate in metres.

6. A Bomber flying upward at an angle of 53º with the vertical releases a bomb at an altitude of 800 m. The bomb strikes the ground 20 sec after its release. Velocity of the bomber at the time of release of the bomb is V m/s. Find V/4. [Given $\sin 53^\circ = 0.8$; $g = 10\ ms^{-2}$]

7. A man is travelling on a flat car which is moving up a plane inclined at $\cos\theta$ = 4/5 to the horizontal with a speed 5 m/s. He throws a ball towards a stationary hoop located perpendicular to the incline in such a way that the ball moves parallel to the slope of the incline while going through the centre of the hoop. The centre of the hoop is 4 m high from the man's hand calculate the time taken by the ball to reach the hoop in second.



8. A stone is projected horizontally with speed v from a height h above ground. A horizontal wind is blowing in direction opposite to velocity of projection and gives the stone a constant horizontal acceleration f (in direction opposite to initial velocity). As a result the stone falls on ground at a point vertically below the point of projection. Then find the value of $\frac{f^2h}{gv^2}$ (g is acceleration due to gravity)

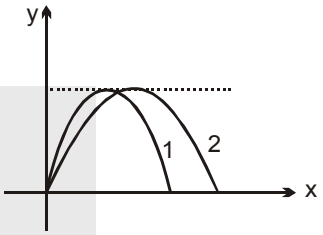
9. If at an instant the velocity of a projectile be 60 m/s and its inclination to the horizontal be 30°, at what time interval (in sec) after that instant will the particle be moving at right angles to its former direction. ($g = 10\ m/s^2$)

PART - III : ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

1. A projectile is projected at an angle α (> 45°) with an initial velocity u. The time t at which its horizontal component will equal the vertical component in magnitude:
(A) $t = u/g (\cos\alpha - \sin\alpha)$ (B) $t = u/g (\cos\alpha + \sin\alpha)$
(C) $t = u/g (\sin\alpha - \cos\alpha)$ (D) $t = u/g (\sin^2\alpha - \cos^2\alpha)$

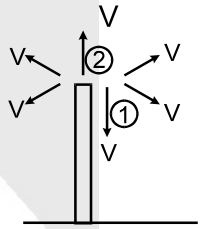
2. At what angle should a body be projected with a velocity 24 ms^{-1} just to pass over the obstacle 14 m high at a distance of 24 m. [Take $g = 10\ ms^{-2}$]
(A) $\tan\theta = 19/5$ (B) $\tan\theta = 1$ (C) $\tan\theta = 3$ (D) $\tan\theta = 2$

3. Two stones are projected from level ground. Trajectories of two stones are shown in figure. Both stones have same maximum heights above level ground as shown. Let T_1 and T_2 be their time of flights and u_1 and u_2 be their speeds of projection respectively (neglect air resistance). Then
(A) $T_2 > T_1$ (B) $T_1 = T_2$
(C) $u_1 > u_2$ (D) $u_1 < u_2$



4. A projectile of mass 1 kg is projected with a velocity of $\sqrt{20}$ m/s such that it strikes on the same level as the point of projection at a distance of $\sqrt{3}$ m. Which of the following options are correct ?
(A) The maximum height reached by the projectile can be 0.25 m.
(B) The minimum velocity during its motion can be $\sqrt{15}$ m/s.
(C) The time taken for the flight can be $\sqrt{\frac{3}{5}}$ s.
(D) Maximum angle of projection can be 60°.

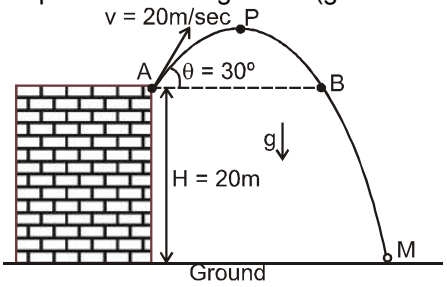
5. Particles are projected from the top of a tower with same speed at different angles as shown. Which of the following are True ?
(A) All the particles would strike the ground with (same) speed.
(B) All the particles would strike the ground with (same) speed simultaneously.
(C) Particle 1 will be the first to strike the ground.
(D) Particle 1 strikes the ground with maximum speed.



PART - IV : COMPREHENSION

Comprehension-1

A ball is projected with initial velocity u = 20 m/sec at an angle $\theta = 30^\circ$ (from horizontal) from point A which is at a height H = 20m above horizontal. P is the highest point for complete motion of particle, whereas M is the point at which particle strikes ground. ($g = 10\ m/s^2$)



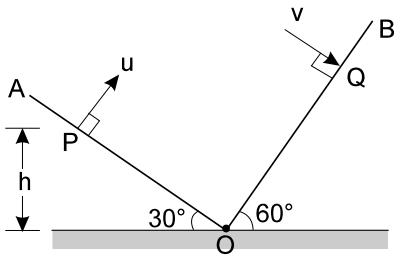
1. Velocity (along vertical direction) of the particle at point P is :
(A) 0 m/sec (B) $10\sqrt{3}$ m/sec (C) $5\sqrt{3}$ m/sec (D) $4\sqrt{3}$ m/sec

2. Total time of flight (from A to M) of the projectile is :

(A) 2 sec (B) $(\sqrt{5}+1)$ sec (C) $(\sqrt{5}-1)$ (D) $(2+\sqrt{5})$ sec

Comprehension-2

Two inclined planes OA and OB having inclinations 30° and 60° with the horizontal respectively intersect each other at O, as shown in figure. A particle is projected from point P with velocity $u = 10\sqrt{3}\ \frac{m}{s}$ along a direction perpendicular to plane OA. If the particle strikes plane OB perpendicular at Q (Take g = 10 m/s^2). Then



3. The time of flight from P to Q is :-

(A) 5 Sec. (B) 2 sec (C) 1 sec (D) None of these

4. The speed with which the particle strikes the plane OB is :

(A) 10 m/s (B) 20 m/s (C) 30 m/s (D) 40 m/s

5. The height h of point P from the ground is :-

(A) $10\sqrt{3}$ m (B) 10 m (C) 5 m (D) 20 m

6. The distance PQ is :

(A) 20 m (B) $10\sqrt{3}$ m (C) 10 m (D) 5 m

Exercise-3

Marked Questions can be used as Revision Questions.

PART - I : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

*** Marked Questions may have more than one correct option.**

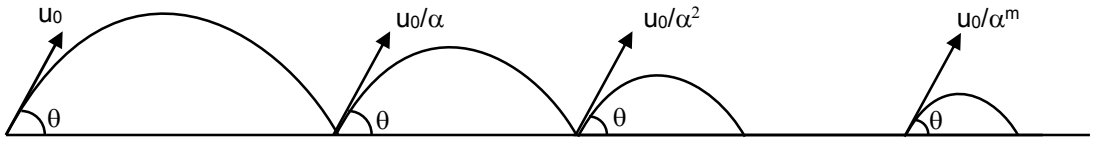
1. Shots fired simultaneously from the top and foot of a vertical cliff at elevations of 30° and 60° respectively, strike an object simultaneously which is at a height of 100 meters from the ground and at a horizontal distance of $200\sqrt{3}$ meters from the cliff. Find the height of the cliff, the velocities of projection of the shots and the time taken by the shots to hit the object. (g = 10 m/sec^2.) **[REE 2000; 5/100]**

2. A ball is projected from the ground at an angle of 45° with the horizontal surface. It reaches a maximum height of 120m and returns to the ground. Upon hitting the ground for the first time, it loses half of its kinetic energy. Immediately after the bounce, the velocity of the ball makes an angle of 30° with the horizontal surface. The maximum height it reaches after the bounce, in metres, is _____.

[JEE (Advanced) 2018; 3/60]

3. A ball is thrown from ground at an angle θ with horizontal and with an initial speed u_0. For the resulting projectile motion, the magnitude of average velocity of the ball up to the point when it hits the ground for the first time is V_1. After hitting the ground, the ball rebounds at the same angle θ but with a reduced speed of u_0/α. Its motion continues for a long time as shown in figure. If the magnitude of average velocity of the ball for entire duration of motion is 0.8 V_1, the value of α is _____

[JEE (Advanced) 2019; 3/62]



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

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

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

2. A particle is moving with velocity $\vec{v}=K(y\hat{i}+x\hat{j})$, where K is a constant. The general equation for its path is: **[AIEEE 2010; 4/144]**

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

3. A water fountain on the ground sprinkles water all around it. If the speed of water coming out of the fountain is v, the total area around the fountain that gets wet is : **[AIEEE 2011; 4/120, –1]**

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

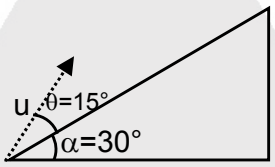
4. A boy can throw a stone up to a maximum height of 10m. The maximum horizontal distance that the boy can throw the same stone up to will be : **[AIEEE 2012 ; 4/120, –1]**

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

5. A projectile is given an initial velocity of $\left(\hat{i}+2\hat{j}\right)$ m/s, where $\hat{i}$ is along the ground and $\hat{j}$ is along the vertical. If g = 10 m/s^2, the equation of its trajectory is : **[JEE (Main) 2013; 4/120]**

(1) $y = x - 5x^2$ (2) $y = 2x - 5x^2$ (3) $4y = 2x - 5x^2$ (4) $4y = 2x - 25x^2$

6. A plane is inclined at an angle $\alpha = 30°$ with respect to the horizontal. A particle is projected with a speed u = 2 ms^{-1} from the base of the plane making an angle $\theta = 15°$ with respect to the plane as shown in the figure. The distance from the base at which the particle hits the plane is close to : (Take g = 10 ms^{-2}) **[JEE (Main) 2019; 4/120, –1]**



(1) 18 cm (2) 14 cm (3) 26 cm (4) 20 cm

Answers

EXERCISE-1

PART - I

Section (A)

A-1. $\tan\theta : 1$ **A-2.** $\tan^2\theta : 1$

A-3. $\tan\theta = 4$ or $\theta = \tan^{-1}(4)$

A-4. $T_1T_2 = 2R/g$ **A-5.** 50 m

A-6. $5\sqrt{2}$ m/s

Section (B)

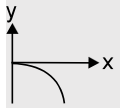
B-1. (i) 10 sec. (ii) 980 m (iii) $98\sqrt{2}$ m/s

B-2. (i) 61.25 m (ii) $75\sqrt{3}$ m $\approx$ 130 m
(iii) 5 sec.

Section (C)

C-1. $\theta = 60°$, 2 m/s **C-2** 53

C-3. (i) $y = -\frac{bx^2}{a^2}$



(ii) $\vec{v} = a\hat{i} - 2bt\hat{j}$

acceleration $= -2b\hat{j}$,

$|\vec{v}| = \sqrt{a^2 + 4b^2t^2}$, |acceleration | = 2 b

Section (D)

D-1. (a) $-g\sin\beta$, (b) $-g\cos\beta$,
(c) $u\cos\theta - g\sin\beta \times t$,
(d) $u\sin\theta - g\cos\beta \times t$,
(e) $u\cos\theta \times t - \frac{1}{2}g\sin\beta \times t^2$,
(f) $u\sin\theta \times t - \frac{1}{2}g\cos\beta \times t^2$, (g) zero.

PART - II

Section (A)

A-1. (D) **A-2.** (C) **A-3.** (D)
A-4. (A) **A-5.** (B) **A-6.** (A)
A-7. (B) **A-8.** (B)

Section (B)

B-1. (C) **B-2.** (A) **B-3.** (B)
B-4. (C)

Section (C)

C-1. (D)

Section (D)

D-1. (B) **D-2.** (D) **D-3.** (A)
D-4. (C) **D-5.** (A)

PART - III

1. (A) r (B) s (C) q (D) p
2. (A) r ; (B) s ; (C) q ; (D) p

EXERCISE-2

PART - I

1. (A) **2.** (B) **3.** (A)
4. (C) **5.** (C) **6.** (C)
7. (D) **8.** (D)

PART - II

1. 10 **2.** 4 **3.** 98
4. 3 **5.** 20 **6.** 25
7. 1 **8.** 2 **9.** 12

PART - III

1. (BC) **2.** (AB) **3.** (BD)
4. (ABCD) **5.** (AC)

PART - IV

1. (A) **2.** (B) **3.** (B)
4. (A) **5.** (C) **6.** (A)

EXERCISE-3

PART - I

1. 400 m, $V_T = 40$ m/s ,
$V_F = 40\sqrt{3}$ m/s, T = 10 s.
2. 30 m **3.** 4

PART - II

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