

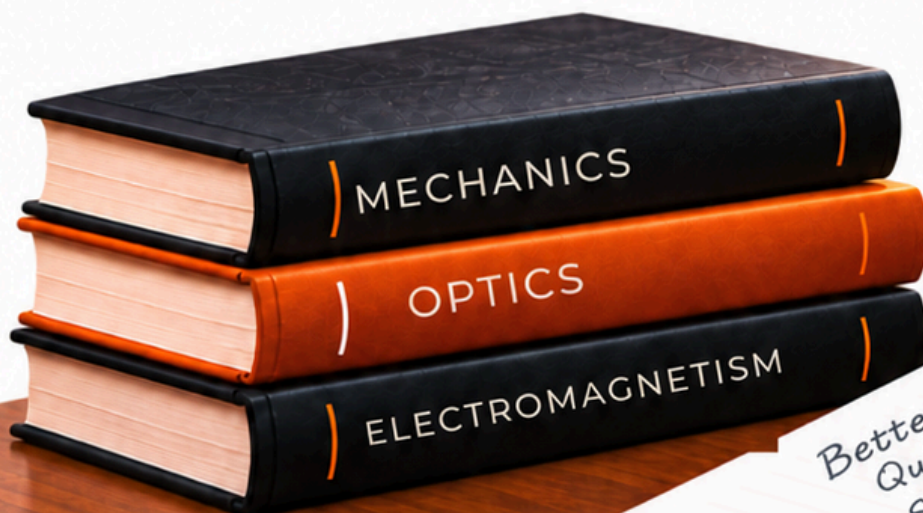
JEE Main Physics

Projectile motion PYQ

$$F = ma$$



$$v = u + at$$



PRACTICE
TODAY
A BRIGHTER
TOMORROW

Subject: Physics

Years: 2026-2003

Total Questions: 70

About this PYQ collection

What is inside

A complete topic-wise set of **70 previous year questions** on **Projectile motion** from **JEE Main (2026-2013)** and its predecessor **AIEEE (2012-2003)**, across **13 exam years**. **60 questions** are from 2019 onwards, so most of the set reflects the recent NTA pattern.

Questions are arranged to reduce unused page space, with newest-first priority and continuous numbering from 1. Each carries an exam date and shift tag to trace the original paper.

Topic-wise questions

TOPIC	QS	%
Projectile motion	70	100%

Question types

TYPE	QS	%
Single-correct MCQ	57	81%
Numerical value	13	19%

Numerical-value questions have no options; all 13 are from 2021 onwards.

How these questions help you

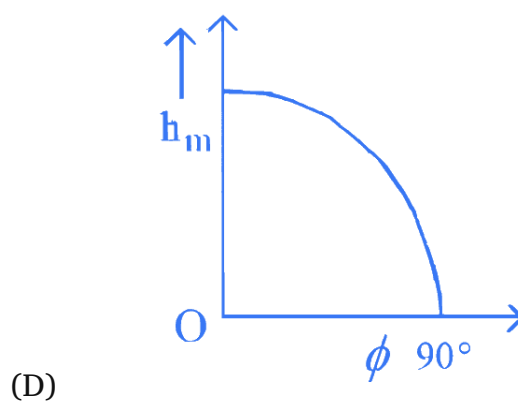
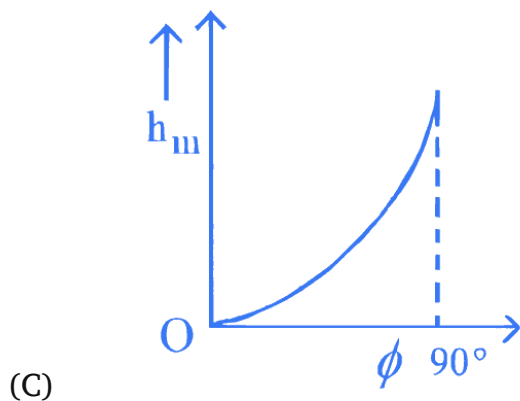
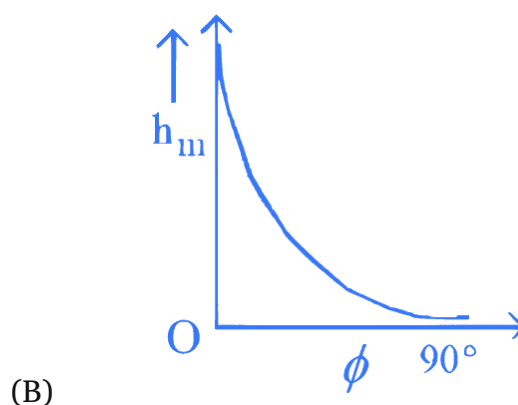
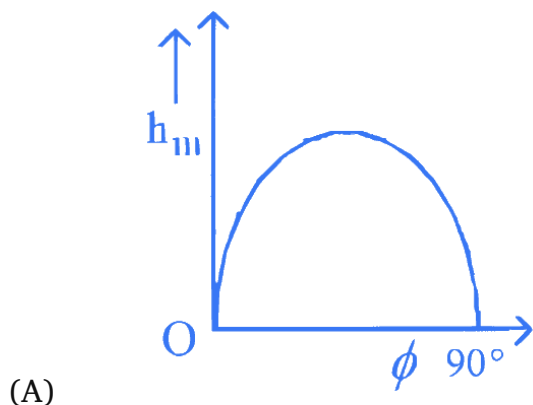
- **Know where the marks are:** projectile motion make up **70 of 70 questions (about 100%)**.
- **Build speed and accuracy:** practice the concepts and question styles used in previous papers.
- **Learn the patterns:** the same question styles return year after year.
- **Strengthen other chapters:** these concepts support further study in Physics.

Questions – Projectile motion

1. Two identical bodies, projected with the same speed at two different angles cover the same horizontal range R . If the time of flight of these bodies are 5 s and 10 s, respectively, then the value of R is _____ m. (Take $g = 10 \text{ m/s}^2$) (8 Apr 2026 | Shift 2)
- (A) 250 (B) 25
(C) 500 (D) 125
-
2. The two projectiles are projected with the same initial velocities at the 15° and 30° with respect to the horizontal. The ratio of their ranges is $1 : x$. The value of x is (4 Apr 2026 | Shift 1)
- (A) $\sqrt{2}$ (B) $\sqrt{3}$
(C) $2\sqrt{3}$ (D) $\frac{1}{\sqrt{2}}$
-
3. If x and y coordinates of a projectile as a function of time (t) are given as $24t$ and $43.6t - 4.9t^2$, respectively, then the angle (in degrees) made by the projectile with horizontal when $t = 2 \text{ s}$ is _____. (4 Apr 2026 | Shift 2)
- (A) 60 (B) 45
(C) 30 (D) 75
-
4. A gun mounted on the ground fires bullets in all directions with same speed. The farthest distance the bullets could reach is 6.4 m. The speed of the bullets from the gun is _____ m/s. (take $g = 10 \text{ m/s}^2$) (4 Apr 2026 | Shift 2)
-
5. A boy throws a ball into air at 45° from the horizontal to land it on a roof of a building of height H . If the ball attains maximum height in 2 s and lands on the building in 3 s after launch, then value of H is _____ m. ($g = 10 \text{ m/s}^2$) (24 Jan 2026 | Shift 1)
- (A) 20 (B) 25
(C) 10 (D) 15

6. A projectile is thrown upward at an angle 60° with the horizontal. The speed of the projectile is 20 m/s when its direction of motion is 45° with the horizontal. The initial speed of the projectile is ____ m/s. (22 Jan 2026 | Shift 1)
- (A) $20\sqrt{3}$ (B) $20\sqrt{2}$
(C) 40 (D) $40\sqrt{2}$
-
7. Two balls with same mass and initial velocity, are projected at different angles in such a way that maximum height reached by first ball is 8 times higher than that of the second ball. T_1 and T_2 are the total flying times of first and second ball, respectively, then the ratio of T_1 and T_2 is (8 Apr 2025 | Shift 2)
- (A) 2 : 1 (B) $\sqrt{2}$: 1
(C) $2\sqrt{2}$: 1 (D) 4 : 1
-
8. Two projectiles are fired from ground with same initial speeds from same point at angles $(45^\circ + \alpha)$ and $(45^\circ - \alpha)$ with horizontal direction. The ratio of their times of flights is (7 Apr 2025 | Shift 1)
- (A) $\frac{1+\tan \alpha}{1-\tan \alpha}$ (B) $\frac{1+\sin 2\alpha}{1-\sin 2\alpha}$
(C) $\frac{1-\tan \alpha}{1+\tan \alpha}$ (D) 1
-
9. A helicopter flying horizontally with a speed of 360 km/h at an altitude of 2 km, drops an object at an instant. The object hits the ground at a point O, 20 s after it is dropped. Displacement of 'O' from the position of helicopter where the object was released is : (use acceleration due to gravity $g = 10 \text{ m/s}^2$ and neglect air resistance) (7 Apr 2025 | Shift 2)
- (A) 7.2 km (B) $2\sqrt{5}$ km
(C) $2\sqrt{2}$ km (D) 4 km
-
10. A particle is projected with velocity u so that its horizontal range is three times the maximum height attained by it. The horizontal range of the projectile is given as $\frac{nu^2}{25g}$, where value of n is: (Given, ' g ' is the acceleration due to gravity.) (3 Apr 2025 | Shift 2)
- (A) 6 (B) 12
(C) 18 (D) 24
-
11. The maximum height reached by a projectile is 64 m. If the initial velocity is halved, the new maximum height of the projectile is ____ m. (5 Apr 2024 | Shift 2)

12. The angle of projection of a particle is measured from the vertical axis as ϕ and the maximum height reached by the particle is h_m . Here h_m as function of ϕ can be presented as (3 Apr 2025 | Shift 1)



13. Two projectiles are fired with same initial speed from same point on ground at angles of $(45^\circ - \alpha)$ and $(45^\circ + \alpha)$, respectively, with the horizontal direction. The ratio of their maximum heights attained is : (29 Jan 2025 | Shift 1)

- (A) $\frac{1+\sin \alpha}{1-\sin \alpha}$ (B) $\frac{1+\sin 2\alpha}{1-\sin 2\alpha}$
 (C) $\frac{1-\tan \alpha}{1+\tan \alpha}$ (D) $\frac{1-\sin 2\alpha}{1+\sin 2\alpha}$

14. A particle is projected at an angle of 30° from horizontal at a speed of 60 m/s. The height traversed by the particle in the first second is h_0 and height traversed in the last second, before it reaches the maximum height, is h_1 . The ratio $h_0 : h_1$ is _____.
 [Take, $g = 10 \text{ m/s}^2$] (22 Jan 2025 | Shift 1)

15. A ball rolls off the top of a stairway with horizontal velocity u . The steps are 0.1 m high and 0.1 m wide. The minimum velocity u with which that ball just hits the step 5 of the stairway will be $\sqrt{x} \text{ ms}^{-1}$ where $x = \underline{\hspace{2cm}}$ [use $g = 10 \text{ m/s}^2$]. (29 Jan 2024 | Shift 1)

16. A ball of mass 100 g is projected with velocity 20 m/s at 60° with horizontal. The decrease in kinetic energy of the ball during the motion from point of projection to highest point is (22 Jan 2025 | Shift 2)
- (A) 20 J (B) 5 J
(C) 15 J (D) zero
-
17. The angle of projection for a projectile to have same horizontal range and maximum height is : (8 Apr 2024 | Shift 2)
- (A) $\tan^{-1}\left(\frac{1}{2}\right)$ (B) $\tan^{-1}(2)$
(C) $\tan^{-1}\left(\frac{1}{4}\right)$ (D) $\tan^{-1}(4)$
-
18. A body of mass M thrown horizontally with velocity v from the top of the tower of height H touches the ground at a distance of 100 m from the foot of the tower. A body of mass 2 M thrown at a velocity $\frac{v}{2}$ from the top of the tower of height 4H will touch the ground at a distance of ____ m. (8 Apr 2024 | Shift 2)
-
19. A particle moving in a circle of radius R with uniform speed takes time T to complete one revolution. If this particle is projected with the same speed at an angle θ to the horizontal, the maximum height attained by it is equal to $4R$. The angle of projection θ is then given by : (1 Feb 2024 | Shift 1)
- (A) $\sin^{-1}\left[\frac{2gT^2}{\pi^2R}\right]^{\frac{1}{2}}$ (B) $\sin^{-1}\left[\frac{\pi^2R}{2gT^2}\right]^{\frac{1}{2}}$
(C) $\cos^{-1}\left[\frac{\pi R}{2gT^2}\right]^{\frac{1}{2}}$ (D) $\cos^{-1}\left[\frac{2gT^2}{\pi^2R}\right]^{\frac{1}{2}}$
-
20. Projectiles A and B are thrown at angles of 45° and 60° with vertical respectively from top of a 400 m high tower. If their ranges and times of flight are same, the ratio of their speeds of projection $v_A : v_B$ is : (30 Jan 2024 | Shift 2)
[Take $g = 10 \text{ ms}^{-2}$]
- (A) 1 : 2 (B) $\sqrt{2} : 1$
(C) $1 : \sqrt{2}$ (D) $1 : \sqrt{3}$
-
21. If the initial velocity in horizontal direction of a projectile is unit vector $\hat{i}$ and the equation of trajectory is $y = 5x(1 - x)$. The y component vector of the initial velocity is _____ $\hat{j}$. (Take $g = 10 \text{ m/s}^2$) (26 Jul 2022 | Shift 1)

22. A projectile fired at 30° to the ground is observed to be at same height at time 3 s and 5 s after projection, during its flight. The speed of projection of the projectile is _____ m s^{-1} .
(Given $g = 10 \text{ ms}^{-2}$) (11 Apr 2023 | Shift 1)
-
23. A projectile is projected at 30° from horizontal with initial velocity 40 ms^{-1} . The velocity of the projectile at $t = 2 \text{ s}$ from the start will be : (Given $g = 10 \text{ m/s}^2$) (11 Apr 2023 | Shift 2)
- (A) $20\sqrt{3} \text{ ms}^{-1}$ (B) Zero
(C) 20 ms^{-1} (D) $40\sqrt{3} \text{ ms}^{-1}$
-
24. The range of the projectile projected at an angle of 15° with horizontal is 50 m. If the projectile is projected with same velocity at an angle of 45° with horizontal, then its range will be (10 Apr 2023 | Shift 1)
- (A) $50\sqrt{2} \text{ m}$ (B) 100 m
(C) $100\sqrt{2} \text{ m}$ (D) 50 m
-
25. Two projectiles are projected at 30° and 60° with the horizontal with the same speed. The ratio of the maximum height attained by the two projectiles respectively is: (10 Apr 2023 | Shift 2)
- (A) $1 : \sqrt{3}$ (B) $\sqrt{3} : 1$
(C) $1 : 3$ (D) $2 : \sqrt{3}$
-
26. Two projectiles A and B are thrown with initial velocities of 40 m/s and 60 m/s at angles 30° and 60° with the horizontal respectively. The ratio of their ranges respectively is ($g = 10 \text{ m/s}^2$) (8 Apr 2023 | Shift 1)
- (A) 4 : 9 (B) $2 : \sqrt{3}$
(C) $\sqrt{3} : 2$ (D) 1 : 1
-
27. The trajectory of projectile, projected from the ground is given by $y = x - \frac{x^2}{20}$. Where x and y are measured in meter. The maximum height attained by the projectile will be. (8 Apr 2023 | Shift 2)
- (A) 10 m (B) 5 m
(C) 200 m (D) $10\sqrt{2} \text{ m}$

28. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R

Assertion A : When a body is projected at an angle 45° , its range is maximum.

Reason R : For maximum range, the value of $\sin 2\theta$ should be equal to one.

In the light of the above statements, choose the correct answer from the options given below:

(6 Apr 2023 | Shift 1)

- (A) Both **A** and **R** are correct and **R** is the correct explanation of **A**
(B) **A** is true but **R** is false
(C) **A** is false but **R** is true
(D) Both **A** and **R** are correct but **R** is NOT the correct explanation of **A**

29. A child stands on the edge of the cliff 10 m above the ground and throws a stone horizontally with an initial speed of 5 ms^{-1} . Neglecting the air resistance, the speed with which the stone hits the ground will be ms^{-1} (given, $g = 10 \text{ ms}^{-2}$).

(1 Feb 2023 | Shift 1)

- (A) 20
(B) 25
(C) 30
(D) 15

30. For a body projected at an angle with the horizontal from the ground, choose the correct statement.

(1 Feb 2023 | Shift 2)

- (A) Gravitational potential energy is maximum at the highest point.
(B) The vertical component of momentum is maximum at the highest point.
(C) The horizontal component of velocity is zero at the highest point.
(D) The Kinetic Energy (K.E.) is zero at the highest point of projectile motion.

31. The initial speed of a projectile fired from ground is u . At the highest point during its motion, the speed of projectile is $\frac{\sqrt{3}}{2}u$. The time of flight of the projectile is :

(31 Jan 2023 | Shift 1)

- (A) $\frac{u}{g}$
(B) $\frac{2u}{g}$
(C) $\frac{u}{2g}$
(D) $\frac{\sqrt{3}u}{g}$

32. Two bodies are projected from ground with same speeds 40 ms^{-1} at two different angles with respect to horizontal. The bodies were found to have same range. If one of the body was projected at an angle of 60° , with horizontal then sum of the maximum heights, attained by the two projectiles, is m. (Given $g = 10 \text{ ms}^{-2}$)

(31 Jan 2023 | Shift 2)

33. Two objects are projected with same velocity 'u' however at different angles α and β with the horizontal. If $\alpha + \beta = 90^\circ$, the ratio of horizontal range of the first object to the 2nd object will be : (25 Jan 2023 | Shift 2)
- (A) 1 : 1 (B) 2 : 1
(C) 1 : 2 (D) 4 : 1
-
34. The maximum vertical height to which a man can throw a ball is 136 m. The maximum horizontal distance upto which he can throw the same ball is : (24 Jan 2023 | Shift 1)
- (A) 136 m (B) 272 m
(C) 68 m (D) 192 m
-
35. An object is projected in the air with initial velocity u at an angle θ . The projectile motion is such that the horizontal range R, is maximum. Another object is projected in the air with a horizontal range half of the range of first object. The initial velocity remains same in both the case. The value of the angle of projection, at which the second object is projected, will be _____ degree. (29 Jul 2022 | Shift 1)
-
36. A ball of mass m is thrown vertically upward. Another ball of mass 2 m is thrown at an angle θ with the vertical. Both the balls stay in air for the same period of time. The ratio of the heights attained by the two balls respectively is $\frac{1}{x}$. The value of x is _____. (27 Jul 2022 | Shift 1)
-
37. A body of mass 10 kg is projected at an angle of 45° with the horizontal. The trajectory of the body is observed to pass through a point (20, 10). If T is the time of flight, then its momentum vector, at time $t = \frac{T}{\sqrt{2}}$, is _____.
[Take $g = 10 \text{ m/s}^2$] (27 Jul 2022 | Shift 2)
- (A) $100\hat{i} + (100\sqrt{2} - 200)\hat{j}$ (B) $100\sqrt{2}\hat{i} + (100 - 200\sqrt{2})\hat{j}$
(C) $100\hat{i} + (100 - 200\sqrt{2})\hat{j}$ (D) $100\sqrt{2}\hat{i} + (100\sqrt{2} - 200)\hat{j}$
-
38. Two projectiles thrown at 30° and 45° with the horizontal respectively, reach the maximum height in same time. The ratio of their initial velocities is : (26 Jul 2022 | Shift 1)
- (A) $1 : \sqrt{2}$ (B) 2 : 1
(C) $\sqrt{2} : 1$ (D) 1 : 2

39. Two projectiles are thrown with same initial velocity making an angle of 45° and 30° with the horizontal respectively. The ratio of their respective ranges will be :
(26 Jul 2022 | Shift 2)
- (A) $1 : \sqrt{2}$ (B) $\sqrt{2} : 1$
(C) $2 : \sqrt{3}$ (D) $\sqrt{3} : 2$
-
40. A ball is projected from the ground with a speed 15 ms^{-1} at an angle θ with horizontal so that its range and maximum height are equal, then ' $\tan \theta$ ' will be equal to :
(25 Jul 2022 | Shift 2)
- (A) $\frac{1}{4}$ (B) $\frac{1}{2}$
(C) 2 (D) 4
-
41. At $t = 0$, truck, starting from rest, moves in the positive x-direction at uniform acceleration of 5 ms^{-2} . At $t = 20 \text{ s}$, a ball is released from the top of the truck. The ball strikes the ground in 1 s after the release. The velocity of the ball, when it strikes the ground, will be :
(Given $g = 10 \text{ ms}^{-2}$) (30 Jun 2022 | Shift 1)
- (A) $100\hat{i} - 10\hat{j}$ (B) $10\hat{i} - 100\hat{j}$
(C) $100\hat{i}$ (D) $-10\hat{j}$
-
42. Two projectiles P_1 and P_2 thrown with speed in the ratio $\sqrt{3} : \sqrt{2}$, attain the same height during their motion. If P_2 is thrown at an angle of 60° with the horizontal, the angle of projection of P_1 with horizontal will be :
(30 Jun 2022 | Shift 1)
- (A) 15° (B) 30°
(C) 45° (D) 60°
-
43. A person can throw a ball upto a maximum range of 100 m. How high above the ground he can throw the same ball?
(29 Jun 2022 | Shift 2)
- (A) 25 m (B) 50 m
(C) 100 m (D) 200 m
-
44. A body is projected from the ground at an angle of 45° with the horizontal. Its velocity after 2s is 20 ms^{-1} . The maximum height reached by the body during its motion is _____ m. (use $g = 10 \text{ ms}^{-2}$)
(24 Jun 2022 | Shift 2)

45. A projectile is launched at an angle ' α ' with the horizontal with a velocity 20 ms^{-1} . After 10 s, its inclination with horizontal is ' β '. The value of $\tan\beta$ will be : ($g = 10 \text{ ms}^{-2}$). (27 Jun 2022 | Shift 1)

(A) $\tan\alpha + 5\sec\alpha$ (B) $\tan\alpha - 5\sec\alpha$
(C) $2\tan\alpha - 5\sec\alpha$ (D) $2\tan\alpha + 5\sec\alpha$

46. A fighter jet is flying horizontally at a certain altitude with a speed of 200 ms^{-1} . When it passes directly overhead an anti-aircraft gun, a bullet is fired from the gun, at an angle θ with the horizontal, to hit the jet. If the bullet speed is 400 m/s , the value of θ will be _____°. (26 Jun 2022 | Shift 1)

47. Given below are two statements. One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Two identical balls A and B thrown with same velocity ' u ' at two different angles with horizontal attained the same range R . If A and B reached the maximum height h_1 and h_2 respectively, then $R = 4\sqrt{h_1 h_2}$

Reason R : Product of said heights.

$$h_1 h_2 = \left(\frac{u^2 \sin^2 \theta}{2g} \right) \cdot \left(\frac{u^2 \cos^2 \theta}{2g} \right)$$

Choose the correct answer :

(25 Jun 2022 | Shift 2)

- (A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is NOT the correct explanation of A.
(C) A is true but R is false. (D) A is false but R is true.

48. A projectile is projected with velocity of 25 m/s at an angle θ with the horizontal. After t seconds its inclination with horizontal becomes zero. If R represents horizontal range of the projectile, the value of θ will be :

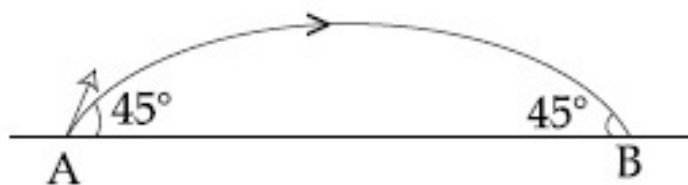
[use $g = 10 \text{ m/s}^2$]

(24 Jun 2022 | Shift 1)

- (A) $\frac{1}{2} \sin^{-1} \left(\frac{5t^2}{4R} \right)$ (B) $\frac{1}{2} \sin^{-1} \left(\frac{4R}{5t^2} \right)$
(C) $\tan^{-1} \left(\frac{4t^2}{5R} \right)$ (D) $\cot^{-1} \left(\frac{R}{20t^2} \right)$

49. The ranges and heights for two projectiles projected with the same initial velocity at angles 42° and 48° with the horizontal are R_1, R_2 and H_1, H_2 respectively. Choose the correct option : (1 Sept 2021 | Shift 2)
- (A) $R_1 > R_2$ and $H_1 = H_2$ (B) $R_1 = R_2$ and $H_1 < H_2$
(C) $R_1 < R_2$ and $H_1 < H_2$ (D) $R_1 = R_2$ and $H_1 = H_2$
-
50. A helicopter is flying horizontally with a speed ' v ' at an altitude ' h ' has to drop a food packet for a man on the ground. What is the distance of helicopter from the man when the food packet is dropped? (31 Aug 2021 | Shift 1)
- (A) $\sqrt{\frac{2ghv^2 + 1}{h^2}}$ (B) $\sqrt{2ghv^2 + h^2}$
(C) $\sqrt{\frac{2v^2h}{g} + h^2}$ (D) $\sqrt{\frac{2gh}{v^2} + h^2}$
-
51. A player kicks a football with an initial speed of 25 ms^{-1} at an angle of 45° from the ground. What are the maximum height and the time taken by the football to reach at the highest point during motion ? (Take $g = 10 \text{ ms}^{-2}$) (27 Aug 2021 | Shift 2)
- (A) $h_{\max} = 10 \text{ m}$ (B) $h_{\max} = 15.625 \text{ m}$
 $T = 2.5 \text{ s}$ $T = 3.54 \text{ s}$
(C) $h_{\max} = 15.625 \text{ m}$ (D) $h_{\max} = 3.54 \text{ m}$
 $T = 1.77 \text{ s}$ $T = 0.125 \text{ s}$
-
52. A bomb is dropped by fighter plane flying horizontally. To an observer sitting in the plane, the trajectory of the bomb is a : (26 Aug 2021 | Shift 2)
- (A) hyperbola (B) parabola in the direction of motion of plane
(C) straight line vertically down the plane (D) parabola in a direction opposite to the motion of plane
-
53. 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 (29 Apr 2012 | Single sitting)
- (A) $20\sqrt{2} \text{ m}$ (B) 10 m
(C) $10\sqrt{2} \text{ m}$ (D) 20 m

54. The projectile motion of a particle of mass 5 g is shown in the figure.



The initial velocity of the particle is $5\sqrt{2} \text{ ms}^{-1}$ and the air resistance is assumed to be negligible. The magnitude of the change in momentum between the points A and B is $x \times 10^{-2} \text{ kgms}^{-1}$. The value of x, to the nearest integer, is _____. (18 Mar 2021 | Shift 2)

55. The trajectory of a projectile in a vertical plane is $y = \alpha x - \beta x^2$, where α and β are constants and x & y are respectively the horizontal and vertical distances of the projectile from the point of projection. The angle of projection θ and the maximum height attained H are respectively given by :

(26 Feb 2021 | Shift 2)

- (A) $\tan^{-1}\alpha, \frac{\alpha^2}{4\beta}$ (B) $\tan^{-1}\alpha, \frac{4\alpha^2}{\beta}$
 (C) $\tan^{-1}\left(\frac{\beta}{\alpha}\right), \frac{\alpha^2}{\beta}$ (D) $\tan^{-1}\beta, \frac{\alpha^2}{2\beta}$

56. The trajectory of a projectile near the surface of the earth is given as $y = 2x - 9x^2$. If it were launched at an angle θ_0 with speed v_0 then ($g = 10 \text{ ms}^{-2}$) :

(12 Apr 2019 | Shift 1)

- (A) $\theta_0 = \cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$ and $v_0 = \frac{5}{3} \text{ ms}^{-1}$ (B) $\theta_0 = \cos^{-1}\left(\frac{2}{\sqrt{5}}\right)$ and $v_0 = \frac{3}{5} \text{ ms}^{-1}$
 (C) $\theta_0 = \sin^{-1}\left(\frac{2}{\sqrt{5}}\right)$ and $v_0 = \frac{3}{5} \text{ ms}^{-1}$ (D) $\theta_0 = \sin^{-1}\left(\frac{1}{\sqrt{5}}\right)$ and $v_0 = \frac{5}{3} \text{ ms}^{-1}$

57. A shell is fired from a fixed artillery gun with an initial speed u such that it hits the target on the ground at a distance R from it. If t_1 and t_2 are the values of the time taken by it to hit the target in two possible ways, the product $t_1 t_2$ is -

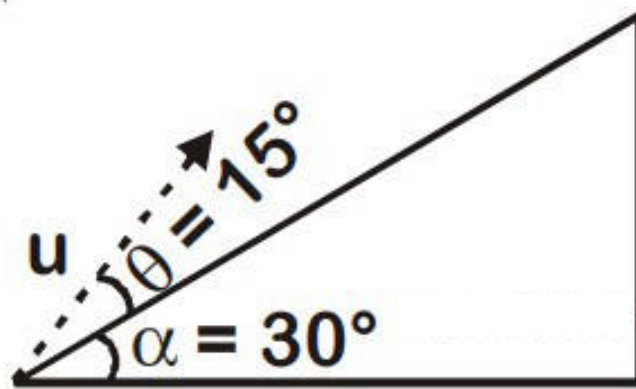
(12 Apr 2019 | Shift 1)

- (A) $\frac{2R}{g}$ (B) $\frac{R}{g}$
 (C) $\frac{R}{2g}$ (D) $\frac{R}{4g}$

58. Two particles are projected from the same point with the same speed u such that they have the same range R , but different maximum heights, h_1 and h_2 . Which of the following is correct ? (12 Apr 2019 | Shift 2)

- (A) $R^2 = h_1 h_2$ (B) $R^2 = 16 h_1 h_2$
(C) $R^2 = 4 h_1 h_2$ (D) $R^2 = 2 h_1 h_2$

59. A plane is inclined at an angle $\alpha = 30^\circ$ with respect to the horizontal. A particle is projected with a speed $u = 2 \text{ ms}^{-1}$, from the base of the plane, making an angle $\theta = 15^\circ$ 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 $g = 10 \text{ ms}^{-2}$)



(10 Apr 2019 | Shift 2)

- (A) 14 cm (B) 18 cm
(C) 20 cm (D) 26 cm

60. A body is projected at $t = 0$ with a velocity 10 ms^{-1} at an angle of 60° with the horizontal. The radius of curvature of its trajectory at $t = 1 \text{ s}$ is R . neglecting air resistance and taking acceleration due to gravity $g = 10 \text{ ms}^{-2}$, the value of R is :

(11 Jan 2019 | Shift 1)

- (A) 2.8 m (B) 5.1 m
(C) 2.5 m (D) 10.3 m

61. Two guns A and B can fire bullets at speeds 1 km/s and 2 km/s respectively. From a point on a horizontal ground, they are fired in all possible directions. The ratio of maximum areas covered by the bullets fired by the two guns, on the ground is -
(10 Jan 2019 | Shift 1)
- (A) 1 : 16 (B) 1 : 8
(C) 1 : 2 (D) 1 : 4
-
62. The initial speed of a bullet fired from a rifle is 630 m/s. The rifle is fired at the centre of a target 700 m away at the same level as the target. How far above the centre of the target ?
(11 Apr 2014 | Single slot)
- (A) 1.0 m (B) 4.2 m →
(C) 6.1 m (D) 9.8 m
-
63. The position of a projectile launched from the origin at $t = 0$ is given by $\vec{r} = (40\hat{i} + 50\hat{j})\text{m}$ at $t = 2\text{s}$. If the projectile was launched at an angle θ from the horizontal, then $\tan\theta$ is (take $g = 10\text{ ms}^{-2}$)
(9 Apr 2014 | Single slot)
- (A) $\tan^{-1}(3/2)$ (B) $\tan^{-1}(2/3)$
(C) $\tan^{-1}(7/4)$ (D) $\tan^{-1}(4/5)$
-
64. The maximum range of a bullet fired from a toy pistol mounted on a car at rest is $R_0 = 40\text{ m}$. What will be the acute angle of inclination of the pistol for maximum range when the car is moving in the direction of firing with uniform velocity $v = 20\text{ m/s}$ on a horizontal surface? ($g = 10\text{ m/s}^2$)
(25 Apr 2013 | Single slot)
- (A) 30° (B) 60°
(C) 75° (D) 45°
-
65. A ball projected from ground at an angle of 45° just clears a wall in front. If point of projection is 4 m from the foot of wall and ball strikes the ground at a distance of 6 m on the other side of the wall, the height of the wall is
(22 Apr 2013 | Single slot)
- (A) 4.4 m (B) 2.4 m
(C) 3.6 m (D) 1.6 m

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

(7 Apr 2013 | Single sitting)

- (A) $y = x - 5x^2$ (B) $y = 2x - 5x^2$
(C) $4y = 2x - 5x^2$ (D) $4y = 2x - 25x^2$
-

67. 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 :

(1 May 2011 | Single sitting)

- (A) $\pi \frac{v^4}{g^2}$ (B) $\frac{\pi}{2} \frac{v^4}{g^2}$
(C) $\pi \frac{v^2}{g^2}$ (D) $\pi \frac{v^2}{g}$
-

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

(23 May 2004 | Single sitting)

- (A) R (B) $\frac{1}{R}$
(C) $\frac{1}{R^2}$ (D) R^2
-

69. 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 instant 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 ?

(23 May 2004 | Single sitting)

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

70. A boy playing on the roof of a 10 m high building throws a ball with a speed of 10 m/s at an angle of 30° with the horizontal. How far from the throwing point will the ball be at the height of 10 m from the ground? $\left[g = 10 \text{ m/s}^2, \sin 30^\circ = \frac{1}{2}, \cos 30^\circ = \frac{\sqrt{3}}{2} \right]$

(26 Apr 2003 | Single sitting)

- (A) 5.20 m (B) 4.33 m
(C) 2.60 m (D) 8.66 m
-