

PHYSICS · JEE MAIN

Collision

Chapter-wise previous year questions, with answer key

22

PYQS

2020–2024

PAPERS

4

TOPICS

Coefficient of Restitution

Inelastic Collision

Elastic Collision

Oblique Collision

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

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Coefficient of Restitution · 2 PYQs

Q1 JEE Main 2023 · 6 Apr · Shift 2

A body is dropped on ground from a height ' h_1 ' and after hitting the ground, it rebounds to a height ' h_2 '. If the ratio of velocities of the body just before and after hitting ground is 4, then percentage loss in kinetic energy of the body is $\frac{x}{4}$. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/8HCL1u-KzM](https://www.prepwiser.in/questions/8HCL1u-KzM)

Q2 JEE Main 2023 · 31 Jan · Shift 2

A ball is dropped from a height of 20m. If the coefficient of restitution for the collision between ball and floor is 0.5, after hitting the floor, the ball rebounds to a height of _____ m.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/1J1cCsCJWI](https://www.prepwiser.in/questions/1J1cCsCJWI)

Inelastic Collision · 11 PYQs

Q3 JEE Main 2024 · 1 Feb · Shift 1

A simple pendulum of length 1m has a wooden bob of mass 1kg. It is struck by a bullet of mass 10^{-2} kg moving with a speed of $2 \times 10^2 \text{ms}^{-1}$. The bullet gets embedded into the bob. The height to which the bob rises before swinging back is. (use $g = 10 \text{m/s}^2$)

(A) 0.20m

(B) 0.40m

(C) 0.30m

(D) 0.35m

[Step-by-step solution ► prepwiser.in/questions/eqytjmbWMW](https://www.prepwiser.in/questions/eqytjmbWMW)

Q4 JEE Main 2023 · 10 Apr · Shift 1

A particle of mass m moving with velocity v collides with a stationary particle of mass $2m$. After collision, they stick together and continue to move together with velocity

(A) v

(B) $\frac{v}{3}$

(C) $\frac{v}{4}$

(D) $\frac{v}{2}$

[Step-by-step solution ► prepwiser.in/questions/XHg-6rJzSU](https://www.prepwiser.in/questions/XHg-6rJzSU)

Q5 JEE Main 2023 · 8 Apr · Shift 2

A bullet of mass 0.1kg moving horizontally with speed 400ms^{-1} hits a wooden block of mass 3.9kg kept on a horizontal rough surface. The bullet gets embedded into the block and moves 20m before coming to rest. The coefficient of friction between the block and the surface is _____.

(Given $g = 10 \text{m/s}^2$)

(A) 0.65

(B) 0.25

(C) 0.50

(D) 0.90

[Step-by-step solution ► prepwiser.in/questions/9C7MoSMelK](https://www.prepwiser.in/questions/9C7MoSMelK)

Q6 JEE Main 2023 · 30 Jan · Shift 1

A ball of mass 200g rests on a vertical post of height 20m. A bullet of mass 10g, travelling in horizontal direction, hits the centre of the ball. After collision both travels independently. The ball hits the ground at a distance 30m and the bullet at a distance of 120m from the foot of the post. The value of initial velocity of the bullet will be (if $g = 10\text{m/s}^2$) :

- (A) 120 m/s (B) 360 m/s
(C) 400 m/s (D) 60 m/s

[Step-by-step solution ► prepwiser.in/questions/wcFhOix_Jo](https://www.prepwiser.in/questions/wcFhOix_Jo)

Q7 JEE Main 2022 · 25 Jul · Shift 2

A bag of sand of mass 9.8 kg is suspended by a rope. A bullet of 200 g travelling with speed 10 ms^{-1} gets embedded in it, then loss of kinetic energy will be :

- (A) 4.9 J (B) 9.8 J
(C) 14.7 J (D) 19.6 J

[Step-by-step solution ► prepwiser.in/questions/jruL8iD6OI](https://www.prepwiser.in/questions/jruL8iD6OI)

Q8 JEE Main 2020 · 6 Sep · Shift 1

Two bodies of the same mass are moving with the same speed, but in different directions in a plane. They have a completely inelastic collision and move together thereafter with a final speed which is half of their initial speed. The angle between the initial velocities of the two bodies (in degree) is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/0kaeFJn2zY](https://www.prepwiser.in/questions/0kaeFJn2zY)

Q9 JEE Main 2020 · 5 Sep · Shift 1

A particle of mass $200\text{ MeV}/c^2$ collides with a hydrogen atom at rest. Soon after the collision the particle comes to rest, and the atom recoils and goes to its first excited state. The initial kinetic energy of the particle (in eV) is

$\frac{N}{4}$. The value of N is :

(Given the mass of the hydrogen atom to be $1\text{ GeV}/c^2$) _____ .

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/ztfXO1VgNX](https://www.prepwiser.in/questions/ztfXO1VgNX)

Q10 JEE Main 2020 · 3 Sep · Shift 2

A block of mass 1.9 kg is at rest at the edge of a table, of height 1 m. A bullet of mass 0.1 kg collides with the block and sticks to it. If the velocity of the bullet is 20 m/s in the horizontal direction just before the collision then the kinetic energy just before the combined system strikes the floor, is [Take $g = 10\text{ m/s}^2$. Assume there is no rotational motion and loss of energy after the collision is negligible.]

- (A) 23 J (B) 21 J
(C) 20 J (D) 19 J

[Step-by-step solution ► prepwiser.in/questions/f9l9QagDQh](https://www.prepwiser.in/questions/f9l9QagDQh)

Q11 JEE Main 2020 · 9 Jan · Shift 2

A particle of mass m is projected with a speed u from the ground at an angle $\theta = \frac{\pi}{3}$ w.r.t. horizontal (x -axis). When it has reached its maximum height, it collides completely inelastically with another particle of the same mass and velocity $u\hat{i}$. The horizontal distance covered by the combined mass before reaching the ground is:

- (A) $2\sqrt{2}\frac{u^2}{g}$ (B) $\frac{3\sqrt{3}}{8}\frac{u^2}{g}$
 (C) $\frac{3\sqrt{2}}{4}\frac{u^2}{g}$ (D) $\frac{5}{8}\frac{u^2}{g}$

[Step-by-step solution ► prepwiser.in/questions/SRB90V5xCN](https://www.prepwiser.in/questions/SRB90V5xCN)

Q12 JEE Main 2020 · 9 Jan · Shift 1

Two particles of equal mass m have respective initial velocities $u\hat{i}$ and $u\left(\frac{\hat{i}+\hat{j}}{2}\right)$.

They collide completely inelastically. The energy lost in the process is :

- (A) $\frac{1}{3}mu^2$ (B) $\frac{1}{8}mu^2$
 (C) $\frac{3}{4}mu^2$ (D) $\sqrt{\frac{2}{3}}mu^2$

[Step-by-step solution ► prepwiser.in/questions/wGnxjY2N_i](https://www.prepwiser.in/questions/wGnxjY2N_i)

Q13 JEE Main 2020 · 9 Jan · Shift 1

A body A of mass m is moving in a circular orbit of radius R about a planet. Another body B of mass $\frac{m}{2}$ collides with A with a velocity which is half $\left(\frac{\vec{v}}{2}\right)$ the instantaneous velocity $\vec{v}$ of A. The collision is completely inelastic. Then, the combined body :

- (A) starts moving in an elliptical orbit around the planet.
 (B) Falls vertically downwards towards the planet
 (C) Escapes from the Planet's Gravitational field.
 (D) continues to move in a circular orbit

[Step-by-step solution ► prepwiser.in/questions/TI0ieGNpib](https://www.prepwiser.in/questions/TI0ieGNpib)

Elastic Collision · 7 PYQs

Q14 JEE Main 2023 · 25 Jan · Shift 2

A body of mass 1 kg collides head on elastically with a stationary body of mass 3 kg. After collision, the smaller body reverses its direction of motion and moves with a speed of 2 m/s. The initial speed of the smaller body before collision is _____ ms^{-1} .

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/VdtFXs1-65](https://www.prepwiser.in/questions/VdtFXs1-65)

Q15 JEE Main 2022 · 25 Jul · Shift 2

Two billiard balls of mass 0.05 kg each moving in opposite directions with 10 ms^{-1} collide and rebound with the same speed. If the time duration of contact is $t = 0.005 \text{ s}$, then what is the force exerted on the ball due to each other?

- (A) 100 N (B) 200 N
 (C) 300 N (D) 400 N

[Step-by-step solution ► prepwiser.in/questions/Vkk48_t9t4](https://www.prepwiser.in/questions/Vkk48_t9t4)

Q16 JEE Main 2022 · 27 Jun · Shift 1

What percentage of kinetic energy of a moving particle is transferred to a stationary particle when it strikes the stationary particle of 5 times its mass?

(Assume the collision to be head-on elastic collision)

- (A) 50.0% (B) 66.6%
(C) 55.6% (D) 33.3%

[Step-by-step solution ► prepwiser.in/questions/9yon4frGrv](https://www.prepwiser.in/questions/9yon4frGrv)

Q17 JEE Main 2021 · 25 Jul · Shift 1

A body of mass 2 kg moving with a speed of 4 m/s. makes an elastic collision with another body at rest and continues to move in the original direction but with one fourth of its initial speed. The speed of the two body centre of mass is $\frac{x}{10}$ m/s. Then the value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/qh6E6Gnaph](https://www.prepwiser.in/questions/qh6E6Gnaph)

Q18 JEE Main 2021 · 26 Feb · Shift 1

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

Assertion A : Body 'P' having mass M moving with speed 'u' has head-on collision elastically with another body 'Q' having mass 'm' initially at rest. If $m \ll M$, body 'Q' will have a maximum speed equal to '2u' after collision.

Reason R : During elastic collision, the momentum and kinetic energy are both conserved.

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

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

[Step-by-step solution ► prepwiser.in/questions/X8b3hV9O7s](https://www.prepwiser.in/questions/X8b3hV9O7s)

Q19 JEE Main 2020 · 4 Sep · Shift 1

Particle A of mass $m_A = \frac{m}{2}$ moving along the x-axis with velocity v_0 collides elastically with another particle B at rest having mass $m_B = \frac{m}{3}$. If both particles move along the x-axis after the collision, the change $\Delta\lambda$ in de-Broglie wavelength of particle A, in terms of its de-Broglie wavelength (λ_0) before collision is :

- (A) $\Delta\lambda = \frac{5}{2}\lambda_0$
(B) $\Delta\lambda = \frac{3}{2}\lambda_0$
(C) $\Delta\lambda = 2\lambda_0$
(D) $\Delta\lambda = 4\lambda_0$

[Step-by-step solution ► prepwiser.in/questions/CUjPQQ8f69](https://www.prepwiser.in/questions/CUjPQQ8f69)

Q20 JEE Main 2020 · 8 Jan · Shift 1

A body A, of mass $m = 0.1 \text{ kg}$ has an initial velocity of $3\hat{i} \text{ ms}^{-1}$. It collides elastically with another body, B of the same mass which has an initial velocity of $5\hat{j} \text{ ms}^{-1}$. After collision, A moves with a velocity $\vec{v} = 4(\hat{i} + \hat{j})$. The energy of B after collision is written as $\frac{x}{10}$. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/kgPQLtgxMS](https://www.prepwisser.in/questions/kgPQLtgxMS)

Oblique Collision · 2 PYQs

Q21 JEE Main 2021 · 24 Feb · Shift 1

A ball with a speed of 9 m/s collides with another identical ball at rest. After the collision, the direction of each ball makes an angle of 30° with the original direction. The ratio of velocities of the balls after collision is $x : y$, where x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/oeo18foboV](https://www.prepwisser.in/questions/oeo18foboV)

Q22 JEE Main 2020 · 6 Sep · Shift 2

Particle A of mass m_1 moving with velocity $(\sqrt{3}\hat{i} + \hat{j}) \text{ ms}^{-1}$ collides with another particle B of mass m_2 which is at rest initially. Let $\vec{V}_1$ and $\vec{V}_2$ be the velocities of particles A and B after collision respectively. If $m_1 = 2m_2$ and after

collision $\vec{V}_1 = \left(\hat{i} + \sqrt{3} \hat{j} \right)$, the angle between $\vec{V}_1$ and $\vec{V}_2$ is :

(A) 105°

(B) 15°

(C) -45°

(D) 60°

[Step-by-step solution ► prepwisser.in/questions/IS0dcfei6X](https://www.prepwisser.in/questions/IS0dcfei6X)

Answer key — Collision

Numbers match the question numbers above. For full working, open the solution link under each question.

1	375	2	5	3	A	4	B	5	B	6	B	7	B	8	120
9	51	10	B	11	B	12	B	13	A	14	4	15	B	16	C
17	25	18	C	19	D	20	1	21	1	22	A				

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