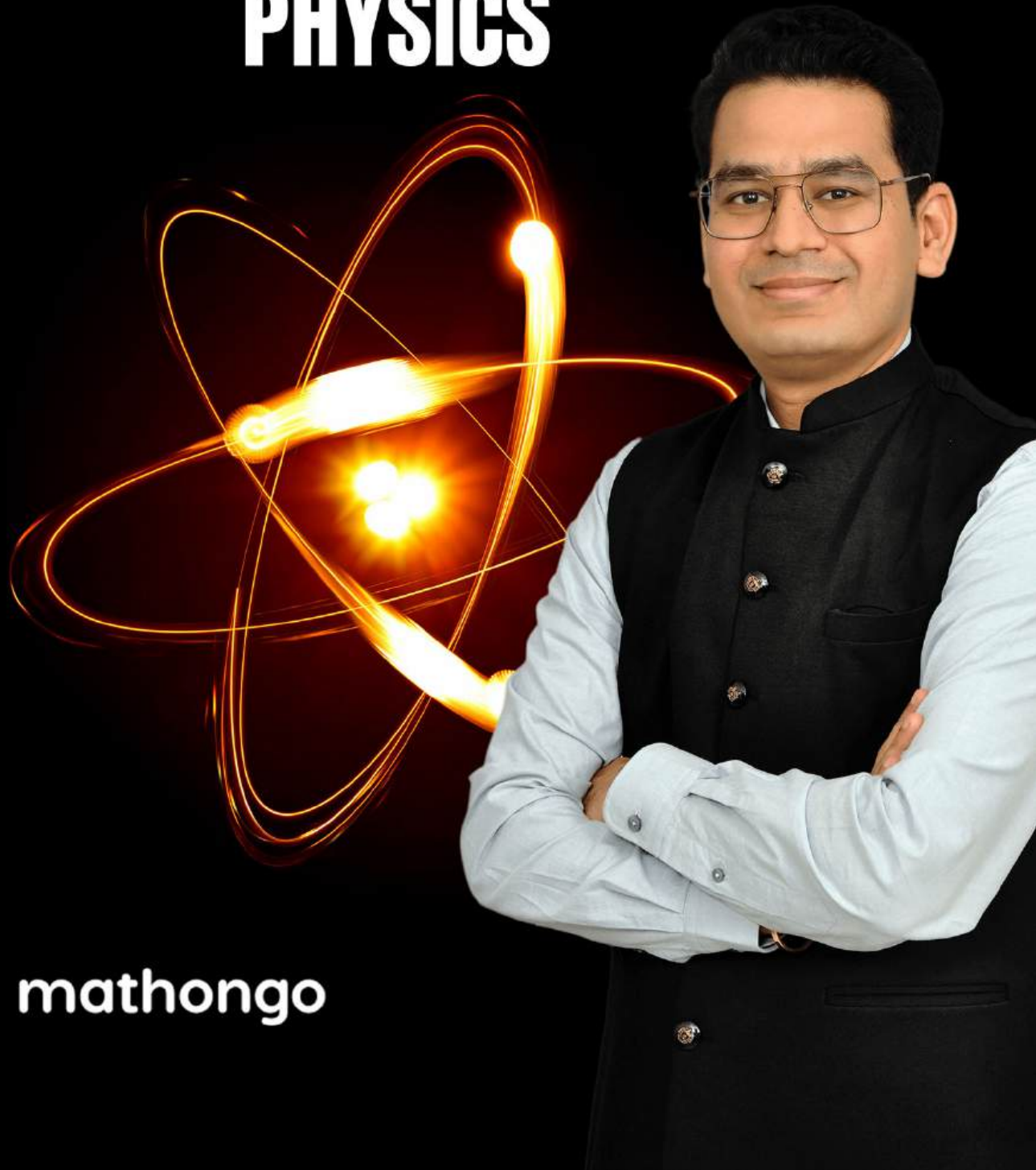


TOP 500

JEE MAIN PYQS

PHYSICS



Chapter: Mathematics in Physics**Q1. JEE Main 2025 (3 April Shift 2)**

A physical quantity C is related to four other quantities p, q, r and s as follows $C = \frac{pq^2}{r^3\sqrt{s}}$

The percentage errors in the measurement of p, q, r and s are 1%, 2%, 3% and 2% respectively.

The percentage error in the measurement of C will be ____%.

Q2. JEE Main 2025 (29 Jan Shift 2)

A physical quantity Q is related to four observables a, b, c, d as follows :

$$Q = \frac{ab^4}{cd}$$

where, $a = (60 \pm 3)\text{Pa}$; $b = (20 \pm 0.1)\text{m}$; $c = (40 \pm 0.2)\text{Nsm}^{-2}$ and $d = (50 \pm 0.1)\text{m}$, then the percentage error in

Q is $\frac{x}{1000}$, where $x =$ _____.

Q3. JEE Main 2025 (24 Jan Shift 1)

For an experimental expression $y = \frac{32.3 \times 1125}{27.4}$, where all the digits are significant. Then to report the value of y we should write

(1) $y = 1326.19$

(2) $y = 1330$

(3) $y = 1326.186$

(4) $y = 1326.2$

Q4. JEE Main 2025 (22 Jan Shift 2)

The maximum percentage error in the measurement of density of a wire is [Given, mass of wire = $(0.60 \pm 0.003)\text{g}$

radius of wire = $(0.50 \pm 0.01)\text{cm}$ length of wire = $(10.00 \pm 0.05)\text{cm}$]

(1) 8

(2) 5

(3) 4

(4) 7

Q5. JEE Main 2024 (01 Feb Shift 2)

Match List - I with List - II.

List - I (Number)

List - II (Significant figure)

(A) 1001

(I) 3

(B) 010. 1

(II) 4

(C) 100. 100

(III) 5

(D) 0. 0010010

(IV) 6

Choose the correct answer from the options given below:

(1) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

(2) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

(3) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

(4) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)

Q6. JEE Main 2022 (25 Jul Shift 2)

The maximum error in the measurement of resistance, current and time for which current flows in an electrical circuit are 1%, 2% and 3% respectively. The maximum percentage error in the detection of the dissipated heat will be:

- (1) 2 (2) 4
(3) 6 (4) 8

Q7. JEE Main 2021 (31 Aug Shift 2)

Statement-I : Two forces $(\vec{P} + \vec{Q})$ and $(\vec{P} - \vec{Q})$ where $\vec{P} \perp \vec{Q}$, when act at an angle θ_1 each other, the magnitude of their resultant is $\sqrt{3(P^2 + Q^2)}$, when they act at an angle θ_2 , the magnitude of their resultant becomes $\sqrt{2(P^2 + Q^2)}$. This is possible only when $\theta_1 < \theta_2$.

Statement-II : In the situation given above.

$$\theta_1 = 60^\circ \text{ and } \theta_2 = 90^\circ$$

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

- (1) Statement I is false but Statement II is true.
(2) Both Statement I and Statement II are true.
(3) Both Statement I and Statement II are false.
(4) Statement I is true but Statement II is false.

Q8. JEE Main 2021 (22 Jul Shift 1)

Three students S_1 , S_2 and S_3 perform an experiment for determining the acceleration due to gravity (g) using a simple pendulum. They use different lengths of pendulum and record time for different number of oscillations. The observations are as shown in the table.

Student No.	Length of pendulum (cm)	Number of oscillations (n)	Total time for n oscillations	Time period (s)
1.	64.0	8	128.0	16.0
2.	64.0	4	64.0	16.0
3.	20.0	4	36.0	9.0

(Least count of length = 0.1 m, least count for time = 0.1 s)

If E_1 , E_2 and E_3 are the percentage errors in g for students 1, 2 and 3, respectively, then the minimum percentage error is obtained by student no ____.

Chapter: Units and Dimensions**Q9. JEE Main 2025 (7 April Shift 2)**

The dimension of $\sqrt{\frac{\mu_0}{\epsilon_0}}$ is equal to that of :

(μ_0 = Vacuum permeability and ϵ_0 = Vacuum permittivity)

- (1) Voltage
- (2) Capacitance
- (3) Inductance
- (4) Resistance

Q10. JEE Main 2025 (4 April Shift 2)

Given below are two statements :

Statement (I) : The dimensions of Planck's constant and angular momentum are same.

Statement (II) : In Bohr's model electron revolve around the nucleus only in those orbits for which angular momentum is integral multiple of Planck's constant.

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

- (1) Both Statement I and Statement II are correct
- (2) Statement I is incorrect but Statement II is correct
- (3) Statement I is correct but Statement II is incorrect
- (4) Both Statement I and Statement II are incorrect

Q11. JEE Main 2025 (4 April Shift 2)

In an electromagnetic system, a quantity defined as the ratio of electric dipole moment and magnetic dipole moment has dimension of $[M^P L^Q T^R A^S]$. The value of P and Q are :

- (1) $-1, 0$
- (2) $-1, 1$
- (3) $1, -1$
- (4) $0, -1$

Q12. JEE Main 2025 (4 April Shift 1)

In an electromagnetic system, the quantity representing the ratio of electric flux and magnetic flux has dimension of $M^P L^Q T^R A^S$, where value of 'Q' and 'R' are

- (1) $(3, -5)$
- (2) $(-2, 2)$
- (3) $(-2, 1)$
- (4) $(1, -1)$

Q13. JEE Main 2025 (3 April Shift 1)

Match the LIST-I with LIST-II

	LIST-I		LIST-II
A.	Gravitational constant	I.	$[LT^{-2}]$
B.	Gravitational potential energy	II.	$[L^2 T^{-2}]$
C.	Gravitational potential	III.	$[ML^2 T^{-2}]$
D.	Acceleration due to gravity	IV.	$[M^{-1} L^3 T^{-2}]$

Choose the correct answer from the options given below :

- (1) A-IV, B-III, C-II, D-I
 (2) A-III, B-II, C-I, D-IV
 (3) A-II, B-IV, C-III, D-I
 (4) A-I, B-III, C-IV, D-II

Q14. JEE Main 2025 (29 Jan Shift 2)

Match List - I with List - II.

List - I**List - II**

- | | |
|------------------------------|---------------------------|
| (A) Young's Modulus | (I) $M L^{-1} T^{-1}$ |
| (B) Torque | (II) $M L^{-1} T^{-2}$ |
| (C) Coefficient of Viscosity | (III) $M^{-1} L^3 T^{-2}$ |
| (D) Gravitational Constant | (IV) $M L^2 T^{-2}$ |

Choose the correct answer from the options given below :

- (1) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
 (2) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)
 (3) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
 (4) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

Q15. JEE Main 2025 (29 Jan Shift 1)

The expression given below shows the variation of velocity (v) with time (t), $v = At^2 + \frac{Bt}{C+t}$. The dimension of ABC is :

- | | |
|------------------------|------------------------|
| (1) $[M^0 L^1 T^{-3}]$ | (2) $[M^0 L^2 T^{-2}]$ |
| (3) $[M^0 L^1 T^{-2}]$ | (4) $[M^0 L^2 T^{-3}]$ |

Q16. JEE Main 2025 (28 Jan Shift 1)

In a measurement, it is asked to find modulus of elasticity per unit torque applied on the system. The measured quantity has dimension of $[M^a L^b T^c]$. If $b = -3$, the value of c is _____

Q17. JEE Main 2025 (23 Jan Shift 2)

Match List - I with List - II.

List - I

List - II

- | | |
|--------------------------------|-----------------------------|
| (A) Permeability of free space | (I) $[M L^2 T^{-2}]$ |
| (B) Magnetic field | (II) $[M T^{-2} A^{-1}]$ |
| (C) Magnetic moment | (III) $[M L T^{-2} A^{-2}]$ |
| (D) Torsional constant | (IV) $[L^2 A]$ |

Choose the correct answer from the options given below :

- (1) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
 (2) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)
 (3) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)
 (4) (A)-(II), (B)-(I), (C)-(III), (D)-(IV)

Q18. JEE Main 2025 (22 Jan Shift 1)If B is magnetic field and μ_0 is permeability of free space, then the dimensions of (B/μ_0) is

- (1) $ML^2 T^{-2} A^{-1}$ (2) $MT^{-2} A^{-1}$
 (3) $L^{-1} A$ (4) $LT^{-2} A^{-1}$

Q19. JEE Main 2025 (2 April Shift 2)If μ_0 and ε_0 are the permeability and permittivity of free space, respectively, then the dimension of $\left(\frac{1}{\mu_0 \varepsilon_0}\right)$ is :

- (1) L/T^2 (2) L^2/T^2
 (3) T^2/L (4) T^2/L^2

Q20. JEE Main 2025 (2 April Shift 1)

Match List-I with List-II.

List-I

List-II

- | | |
|------------------------------|-------------------------|
| (A) Coefficient of viscosity | (I) $[ML^0 T^{-3}]$ |
| (B) Intensity of wave | (II) $[ML^{-2} T^{-2}]$ |
| (C) Pressure gradient | (III) $[M^{-1} L T^2]$ |
| (D) Compressibility | (IV) $[ML^{-1} T^{-1}]$ |

Choose the correct answer from the options given below :

- (1) (A) – (I), (B) – (IV), (C) – (III), (D) – (II)
 (2) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)
 (3) (A) – (IV), (B) – (II), (C) – (I), (D) – (III)
 (4) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

Q21. JEE Main 2024 (05 Apr Shift 1)

If G be the gravitational constant and u be the energy density then which of the following quantity have the dimensions as that of the \sqrt{uG} :

- (1) pressure gradient per unit mass
- (2) Gravitational potential
- (3) Energy per unit mass
- (4) Force per unit mass

Q22. JEE Main 2024 (04 Apr Shift 1)

The equation of stationary wave is: $y = 2a \sin\left(\frac{2\pi nt}{\lambda}\right) \cos\left(\frac{2\pi x}{\lambda}\right)$.

Which of the following is NOT correct :

- (1) The dimensions of n/λ is $[T]$
- (2) The dimensions of n is $[LT^{-1}]$
- (3) The dimensions of x is $[L]$
- (4) The dimensions of nt is $[L]$

Q23. JEE Main 2022 (27 Jul Shift 2)

An expression of energy density is given by $u = \frac{\alpha}{\beta} \sin\left(\frac{\alpha x}{kt}\right)$, where α , β are constants, x is displacement, k is Boltzmann constant and t is the temperature. The dimensions of β will be

- (1) $[ML^2 T^{-2} \theta^{-1}]$
- (2) $[M^0 L^2 T^{-2}]$
- (3) $[M^0 L^0 T^0]$
- (4) $[M^0 L^2 T^0]$

Q24. JEE Main 2021 (26 Aug Shift 2)

Match List - I with List - II :

List - I

- (a) Magnetic induction
- (b) Magnetic flux
- (c) Magnetic permeability
- (d) Magnetization

List - II

- (i) $ML^2 T^{-2} A^{-1}$
- (ii) $M^0 L^{-1} A$
- (iii) $MT^{-2} A^{-1}$
- (iv) $MLT^{-2} A^{-2}$

Choose the most appropriate answer from the options given below :

- (1) (a) – (iii), (b) – (ii), (c) – (iv), (d) – (i)
- (2) (a) – (iii), (b) – (i), (c) – (iv), (d) – (ii)
- (3) (a) – (ii), (b) – (iv), (c) – (i), (d) – (iii)
- (4) (a) – (ii), (b) – (i), (c) – (iv), (d) – (iii)

Q25. JEE Main 2020 (08 Jan Shift 1)

The dimension of stopping potential V_0 in photoelectric effect in units of Planck's constant ' h ', speed of light ' c ' and Gravitational constant ' G ' and ampere A is:

- (1) $h^{\frac{1}{3}} G^{\frac{2}{3}} c^{\frac{1}{3}} A^{-1}$
- (2) $h^0 c^5 G^{-1} A^{-1}$
- (3) $h^{-\frac{2}{3}} c^{-\frac{1}{3}} G^{\frac{4}{3}} A^{-1}$
- (4) $h^2 G^{\frac{3}{2}} c^{\frac{1}{3}} A^{-1}$

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Q26. JEE Main 2020 (04 Sep Shift 2)

A quantity x is given by $(1Fv^2/WL^4)$ in terms of moment of inertia I , force F , velocity v , work W and length L . The dimensional formula for x is same as that of :

- (1) planck's constant (2) force constant
(3) energy density (4) coefficient of viscosity

Chapter: Motion In One Dimension**Q27. JEE Main 2025 (7 April Shift 2)**

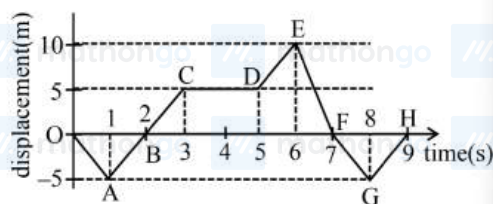
A helicopter flying horizontally with a speed of 360 km/h at an altitude of 2 km, drops an object at an instant. The object hits the ground at a point O, 20 s after it is dropped. Displacement of 'O' from the position of helicopter where the object was released is :

(use acceleration due to gravity $g = 10 \text{ m/s}^2$ and neglect air resistance)

- (1) $2\sqrt{5}$ km (2) 4 km
(3) 7.2 km (4) $2\sqrt{2}$ km

Q28. JEE Main 2025 (4 April Shift 2)

The displacement x versus time graph is shown below.



- (A) The average velocity during 0 to 3 s is 10 m/s
(B) The average velocity during 3 to 5 s is 0 m/s
(C) The instantaneous velocity at $t = 2$ s is 5 m/s
(D) The average velocity during 5 to 7 s and instantaneous velocity at $t = 6.5$ s are equal
(E) The average velocity from $t = 0$ to $t = 9$ s is zero

Choose the correct answer from the options given below:

- (1) (A), (D), (E) only (2) (B), (C), (D) only
(3) (B), (D), (E) only (4) (B), (C), (E) only

Q29. JEE Main 2025 (29 Jan Shift 2)

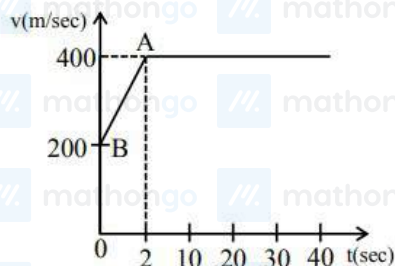
Two cars P and Q are moving on a road in the same direction. Acceleration of car P increases linearly with time whereas car Q moves with a constant acceleration. Both cars cross each other at time $t = 0$, for the first time. The maximum possible number of crossing(s) (including the crossing at $t = 0$) is _____.

Q30. JEE Main 2025 (29 Jan Shift 1)

The maximum speed of a boat in still water is 27 km/h. Now this boat is moving downstream in a river flowing at 9 km/h. A man in the boat throws a ball vertically upwards with speed of 10 m/s. Range of the ball as observed by an observer at rest on the river bank, is _____ cm. (Take $g = 10 \text{ m/s}^2$)

Q31. JEE Main 2025 (23 Jan Shift 1)

The motion of an airplane is represented by velocity-time graph as shown below. The distance covered by airplane in the first 30.5 second is _____ km.



(1) 12

(2) 3

(3) 6

(4) 9

Q32. JEE Main 2025 (2 April Shift 1)

A person travelling on a straight line moves with a uniform velocity v_1 for a distance x and with a uniform velocity v_2 for the next $\frac{3}{2}x$ distance. The average velocity in this motion is $\frac{50}{7} \text{ m/s}$. If v_1 is 5 m/s then $v_2 =$ _____ m/s.

Q33. JEE Main 2024 (31 Jan Shift 1)

The relation between time ' t ' and distance ' x ' is $t = \alpha x^2 + \beta x$, where α and β are constants. The relation between acceleration (a) and velocity (v) is:

(1) $a = -2\alpha v^3$

(2) $a = -5\alpha v^5$

(3) $a = -3\alpha v^2$

(4) $a = -4\alpha v^4$

Q34. JEE Main 2024 (27 Jan Shift 2)

A bullet is fired into a fixed target loses one third of its velocity after travelling 4 cm. It penetrates further $D \times 10^{-3} \text{ m}$ before coming to rest. The value of D is :

(1) 32

(2) 5

(3) 3

(4) 4

Q35. JEE Main 2023 (06 Apr Shift 1)

A particle of mass 10 g moves in a straight line with retardation $2x$, where x is the displacement in SI units. Its loss of kinetic energy for above displacement is $(\frac{10}{x})^{-n} \text{ J}$. The value of n will be _____.

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Q36. JEE Main 2023 (01 Feb Shift 2)

For a train engine moving with speed of 20 ms^{-1} , the driver must apply brakes at a distance of 500 m before the station for the train to come to rest at the station. If the brakes were applied at half of this distance, the train engine would cross the station with speed $\sqrt{x} \text{ ms}^{-1}$. The value of x is _____. (Assuming same retardation is produced by brakes)

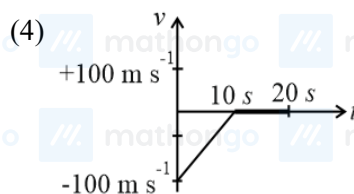
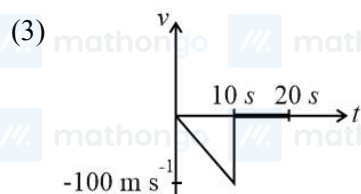
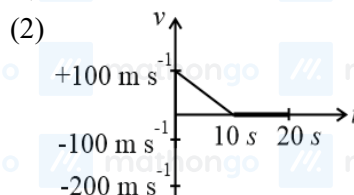
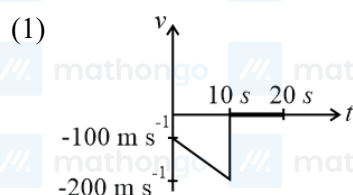
Q37. JEE Main 2022 (29 Jul Shift 2)

A juggler throws balls vertically upwards with same initial velocity in air. When the first ball reaches its highest position, he throws the next ball. Assuming the juggler throws n balls per second, the maximum height the balls can reach is

- (1) $\frac{g}{2n}$ (2) $\frac{g}{n}$
 (3) $2gn$ (4) $\frac{g}{2n^2}$

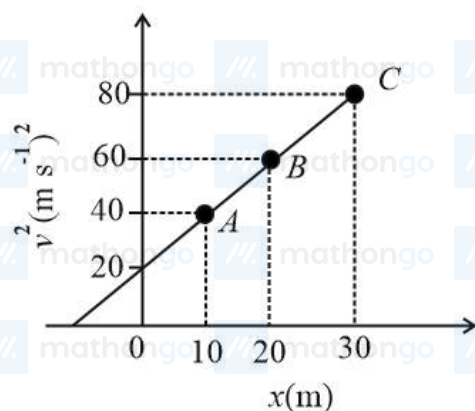
Q38. JEE Main 2022 (27 Jul Shift 1)

A bullet is shot vertically downwards with an initial velocity of 100 m s^{-1} from a certain height. Within 10 s, the bullet reaches the ground and instantaneously comes to rest due to the perfectly inelastic collision. The velocity-time curve for total time $t = 20 \text{ s}$ will be : (Take $g = 10 \text{ m s}^{-2}$)



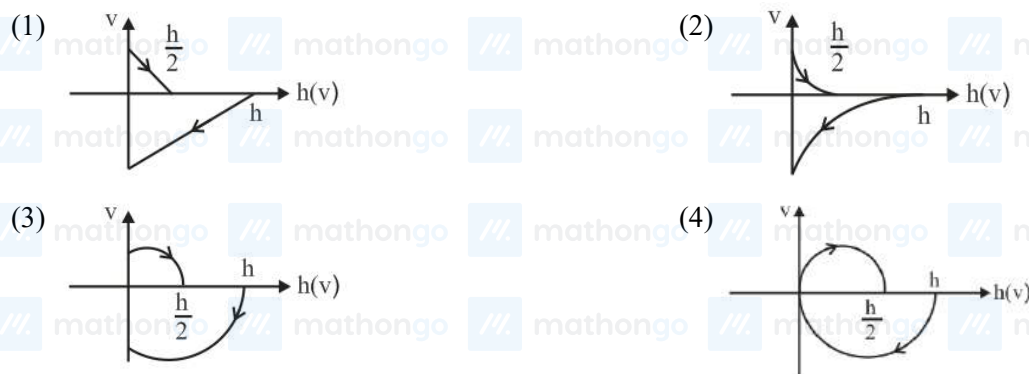
Q39. JEE Main 2021 (31 Aug Shift 2)

A particle is moving with constant acceleration a . Following graph shows v^2 versus x (displacement) plot. The acceleration of the particle is _____ m s^{-2} .



Q40. JEE Main 2020 (04 Sep Shift 1)

A tennis ball is released from a height h and after freely falling on a wooden floor it rebounds and reaches height $h/2$. The velocity versus height of the ball during its motion may be represented graphically by: (graphs are drawn schematically and on not to scale)



Q41. JEE Main 2020 (02 Sep Shift 1)

Train A and train B are running on parallel tracks in the opposite directions with speed of 36 km hour^{-1} and 72 km hour^{-1} , respectively. A person is walking in train A in the direction opposite to its motion with a speed of 1.8 km hour^{-1} . Speed (in m s^{-1}) of this person as observed from train B will be close to: (take the distance between the tracks as negligible)

- (1) 29.5 m s^{-1} (2) 28.5 m s^{-1}
(3) 31.5 m s^{-1} (4) 30.5 m s^{-1}

Chapter: Motion In Two Dimensions**Q42. JEE Main 2025 (7 April Shift 1)**

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

- (1) 1 (2) $\frac{1 - \tan \alpha}{1 + \tan \alpha}$
 (3) $\frac{1 + \sin 2\alpha}{1 - \sin 2\alpha}$ (4) $\frac{1 + \tan \alpha}{1 - \tan \alpha}$

Q43. JEE Main 2025 (3 April Shift 2)

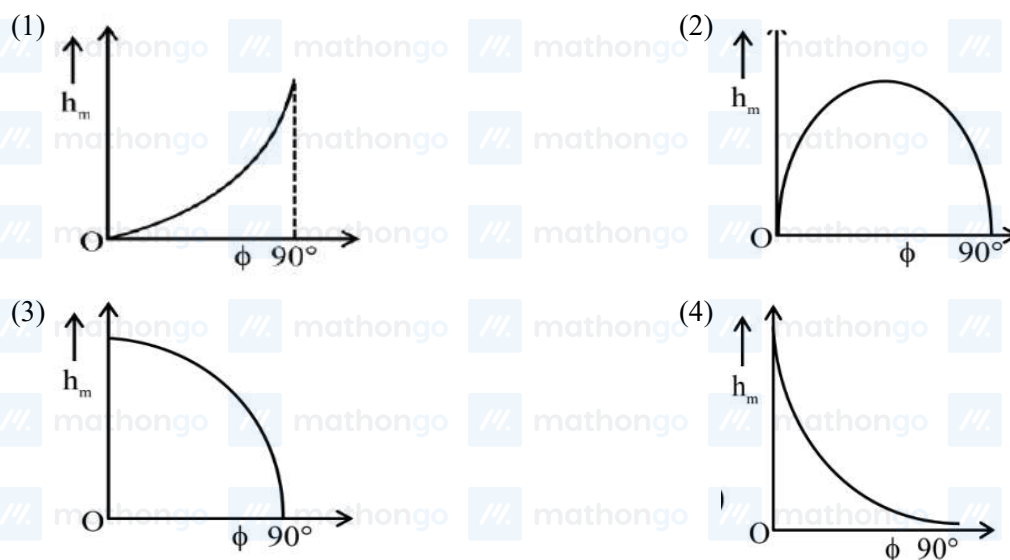
A particle is projected with velocity u so that its horizontal range is three times the maximum height attained by it.

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).

- (1) 6 (2) 18
 (3) 12 (4) 24

Q44. JEE Main 2025 (3 April Shift 1)

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

**Q45. JEE Main 2025 (29 Jan Shift 1)**

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 :

- (1) $\frac{1 - \tan \alpha}{1 + \tan \alpha}$ (2) $\frac{1 - \sin 2\alpha}{1 + \sin 2\alpha}$ (3) $\frac{1 + \sin 2\alpha}{1 - \sin 2\alpha}$ (4) $\frac{1 + \sin \alpha}{1 - \sin \alpha}$

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Q46. JEE Main 2025 (24 Jan Shift 2)

The position vector of a moving body at any instant of time is given as $\vec{r} = (5t^2\hat{i} - 5t\hat{j})$ m. The magnitude and direction of velocity at $t = 2$ s is,

- (1) $5\sqrt{15}$ m/s, making an angle of $\tan^{-1} 4$ with - ve Y axis
- (2) $5\sqrt{15}$ m/s, making an angle of $\tan^{-1} 4$ with + ve X axis
- (3) $5\sqrt{17}$ m/s, making an angle of $\tan^{-1} 4$ with + ve X axis
- (4) $5\sqrt{17}$ m/s, making an angle of $\tan^{-1} 4$ with - ve Y axis

Q47. JEE Main 2025 (22 Jan Shift 1)

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

Q48. JEE Main 2025 (2 April Shift 1)

A river is flowing from west to east direction with speed of 9 km h^{-1} . If a boat capable of moving at a maximum speed of 27 km h^{-1} in still water, crosses the river in half a minute, while moving with maximum speed at an angle of 150° to direction of river flow, then the width of the river is :

- (1) 300 m
- (2) 112.5 m
- (3) 75 m
- (4) $112.5 \times \sqrt{3}$ m

Q49. JEE Main 2023 (08 Apr Shift 2)

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.

- (1) 200 m
- (2) 10 m
- (3) 5 m
- (4) $10\sqrt{2}$ m

Q50. JEE Main 2022 (29 Jul Shift 1)

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.

Q51. JEE Main 2022 (27 Jun Shift 1)

A girl standing on road holds her umbrella at 45° with the vertical to keep the rain away. If she starts running without umbrella with a speed of $15\sqrt{2} \text{ km h}^{-1}$, the rain drops hit her head vertically. The speed of rain drops with respect to the moving girl is

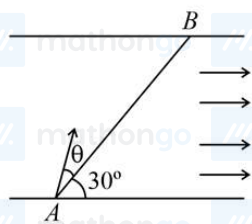
- (1) 30 km h^{-1} (2) $\frac{25}{\sqrt{2}} \text{ km h}^{-1}$
 (3) $\frac{30}{\sqrt{2}} \text{ km h}^{-1}$ (4) 25 km h^{-1}

Q52. JEE Main 2022 (26 Jul Shift 1)

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 $g = 10 \text{ m s}^{-2}$)

Q53. JEE Main 2021 (27 Jul Shift 2)

A swimmer wants to cross a river from point A to point B . Line AB makes an angle of 30° with the flow of the river. The magnitude of the velocity of the swimmer is the same as that of the river. The angle θ with the line AB should be _____, so that the swimmer reaches point B .

**Q54. JEE Main 2021 (24 Feb Shift 2)**

A particle is projected with velocity v_0 along x -axis. A damping force is acting on the particle which is proportional to the square of the distance from the origin i.e. $ma = -\alpha x^2$. The distance at which the particle stops:

- (1) $\left(\frac{2v_0}{3\alpha}\right)^{\frac{1}{3}}$ (2) $\left(\frac{3mv_0^2}{2\alpha}\right)^{\frac{1}{3}}$
 (3) $\left(\frac{3v_0^2}{2\alpha}\right)^{\frac{1}{2}}$ (4) $\left(\frac{2v_0^2}{3\alpha}\right)^{\frac{1}{2}}$

Chapter: Laws of Motion**Q55. JEE Main 2025 (7 April Shift 1)**

A cubic block of mass m is sliding down on an inclined plane at 60° with an acceleration of $\frac{g}{2}$, the value of coefficient of kinetic friction is

- (1) $\sqrt{3} - 1$ (2) $\frac{\sqrt{3}}{2}$
 (3) $\frac{\sqrt{2}}{3}$ (4) $1 - \frac{\sqrt{3}}{2}$

Q56. JEE Main 2025 (4 April Shift 1)

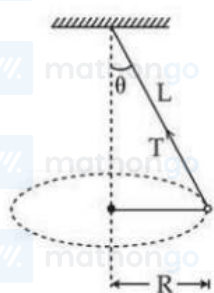
A body of mass m is suspended by two strings making angles θ_1 and θ_2 with the horizontal ceiling with tensions T_1 and T_2 simultaneously. T_1 and T_2 are related by $T_1 = \sqrt{3}T_2$. the angles θ_1 and θ_2 are

(1) $\theta_1 = 30^\circ \theta_2 = 60^\circ$ with $T_2 = \frac{3mg}{4}$

(2) $\theta_1 = 60^\circ \theta_2 = 30^\circ$ with $T_2 = \frac{mg}{2}$

(3) $\theta_1 = 45^\circ \theta_2 = 45^\circ$ with $T_2 = \frac{3mg}{4}$

(4) $\theta_1 = 30^\circ \theta_2 = 60^\circ$ with $T_2 = \frac{4mg}{5}$

Q57. JEE Main 2025 (24 Jan Shift 2)

A string of length L is fixed at one end and carries a mass of M at the other end. The mass makes $\left(\frac{3}{\pi}\right)$ rotations per second about the vertical axis passing through end of the string as shown. The tension in the string is ML.

Q58. JEE Main 2025 (24 Jan Shift 1)

A car of mass ' m ' moves on a banked road having radius ' r ' and banking angle θ . To avoid slipping from banked road, the maximum permissible speed of the car is v_0 . The coefficient of friction μ between the wheels of the car and the banked road is

(1) $\mu = \frac{v_0^2 + rg \tan \theta}{rg + v_0^2 \tan \theta}$

(2) $\mu = \frac{v_0^2 - rg \tan \theta}{rg - v_0^2 \tan \theta}$

(3) $\mu = \frac{v_0^2 - rg \tan \theta}{rg + v_0^2 \tan \theta}$

(4) $\mu = \frac{v_0^2 + rg \tan \theta}{rg - v_0^2 \tan \theta}$

Q59. JEE Main 2025 (23 Jan Shift 2)

A massless spring gets elongated by amount x_1 under a tension of 5 N. Its elongation is x_2 under the tension of 7 N.

For the elongation of $(5x_1 - 2x_2)$, the tension in the spring will be,

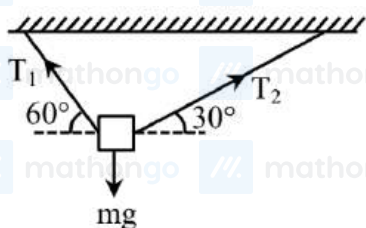
(1) 39 N

(2) 15 N

(3) 11 N

(4) 20 N

Q60. JEE Main 2025 (2 April Shift 2)

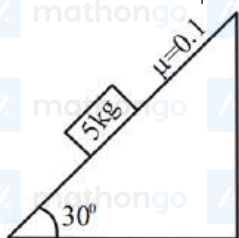


A body of mass 1 kg is suspended with the help of two strings making angles as shown in figure. Magnitude of tensions T_1 and T_2 , respectively, are (in N) :

- (1) $5, 5\sqrt{3}$ (2) $5\sqrt{3}, 5$
 (3) $5\sqrt{3}, 5\sqrt{3}$ (4) $5, 5$

Q61. JEE Main 2024 (31 Jan Shift 2)

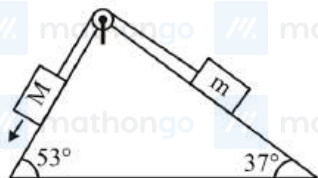
A block of mass 5 kg is placed on a rough inclined surface as shown in the figure. If \vec{F}_1 is the force required to just move the block up the inclined plane and \vec{F}_2 is the force required to just prevent the block from sliding down, then the value of $|\vec{F}_1| - |\vec{F}_2|$ is: [Use $g = 10 \text{ m s}^{-2}$]



- (1) $25\sqrt{3} \text{ N}$ (2) $5\sqrt{3} \text{ N}$
 (3) $\frac{5\sqrt{3}}{2} \text{ N}$ (4) 10 N

Q62. JEE Main 2024 (31 Jan Shift 1)

In the given arrangement of a doubly inclined plane two blocks of masses M and m are placed. The blocks are connected by a light string passing over an ideal pulley as shown. The coefficient of friction between the surface of the plane and the blocks is 0.25. The value of m , for which $M = 10 \text{ kg}$ will move down with an acceleration of 2 m s^{-2} , is: (take $g = 10 \text{ m s}^{-2}$ and $\tan 37^\circ = \frac{3}{4}$)



- (1) 9 kg (2) 4.5 kg (3) 6.5 kg (4) 2.25 kg

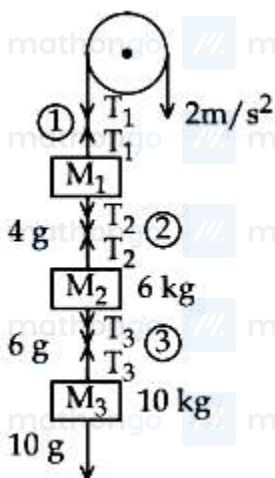
Q63. JEE Main 2024 (06 Apr Shift 1)

A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (where $m_2 > m_1$). If the acceleration of the system is $\frac{g}{\sqrt{2}}$, then the ratio of the masses $\frac{m_1}{m_2}$ is:

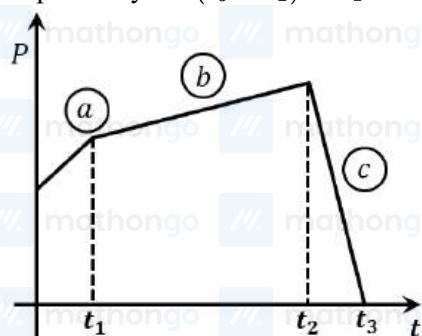
- (1) $\frac{1+\sqrt{5}}{\sqrt{5}-1}$ (2) $\frac{\sqrt{2}-1}{\sqrt{2}+1}$ (3) $\frac{1+\sqrt{5}}{\sqrt{2}-1}$ (4) $\frac{\sqrt{3}+1}{\sqrt{2}-1}$

Q64. JEE Main 2024 (05 Apr Shift 1)

Three blocks M_1, M_2, M_3 having masses 4 kg, 6 kg and 10 kg respectively are hanging from a smooth pulley using rope 1, 2 and 3 as shown in figure. The tension in the rope 1, T_1 when they are moving upward with acceleration of 2 ms^{-2} is _____ N (if $g = 10 \text{ m/s}^2$).


Q65. JEE Main 2023 (30 Jan Shift 1)

The figure represents the momentum time ($p-t$) curve for a particle moving along an axis under the influence of the force. Identify the regions on the graph where the magnitude of the force is maximum and minimum respectively? If $(t_3 - t_2) < t_1$



- (1) c and a (2) b and c
(3) c and b (4) a and b

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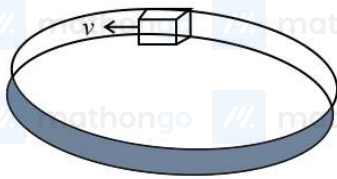
Q66. JEE Main 2023 (01 Feb Shift 1)

A block of mass 5 kg is placed at rest on a table of rough surface. Now, if a force of 30 N is applied in the direction parallel to surface of the table, the block slides through a distance of 50 m in an interval of time 10 s. Coefficient of kinetic friction is (given, $g = 10 \text{ m s}^{-2}$):

- (1) 0.60 (2) 0.75 (3) 0.50 (4) 0.25

Q67. JEE Main 2022 (29 Jul Shift 1)

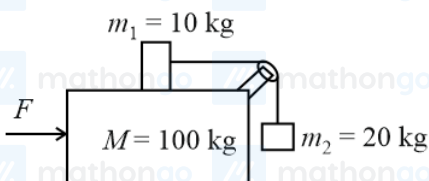
A smooth circular groove has a smooth vertical wall as shown in figure. A block of mass m moves against the wall with a speed v . Which of the following curve represents the correct relation between the normal reaction on the block by the wall (N) and speed of the block (v)?



- (1) (2) (3) (4)

Q68. JEE Main 2022 (26 Jul Shift 1)

Three masses $M = 100 \text{ kg}$, $m_1 = 10 \text{ kg}$ and $m_2 = 20 \text{ kg}$ are arranged in a system as shown in figure. All the surfaces are frictionless and strings are inextensible and weightless. The pulleys are also weightless and frictionless. A force F is applied on the system so that the mass m_2 moves upward with an acceleration of 2 ms^{-2} . The value of F is (Take $g = 10 \text{ ms}^{-2}$)



- (1) 3360 N (2) 3380 N (3) 3120N (4) 3240N

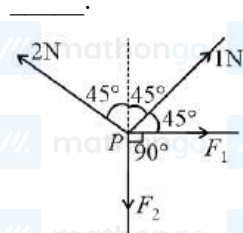
Q69. JEE Main 2022 (26 Jul Shift 1)

A monkey of mass 50 kg climbs on a rope which can withstand the tension (T) of 350 N. If monkey initially climbs down with an acceleration of 4 m s^{-2} and then climbs up with an acceleration of 5 m s^{-2} . Choose the correct option ($g = 10 \text{ m s}^{-2}$)

- (1) $T = 700 \text{ N}$ while climbing upward
- (2) $T = 350 \text{ N}$ while going downward
- (3) Rope will break while climbing upward
- (4) Rope will break while going downward

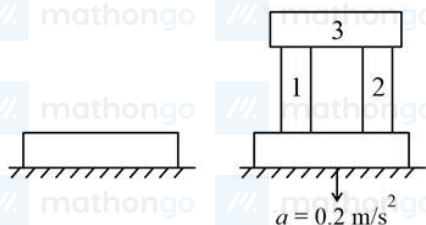
Q70. JEE Main 2022 (25 Jul Shift 1)

Four forces are acting at a point P in equilibrium as shown in figure. The ratio of force F_1 to F_2 is $1 : x$ where $x =$



Q71. JEE Main 2021 (20 Jul Shift 1)

A steel block of 10 kg rests on a horizontal floor as shown. When three iron cylinders are placed on it as shown, the block and cylinders go down with an acceleration 0.2 m s^{-2} . The normal reaction R' by the floor if mass of the iron cylinders are equal and of 20 kg each is (in N), [Take $g = 10 \text{ m s}^{-2}$ and $\mu_s = 0.2$]

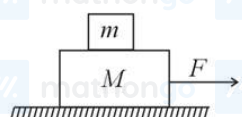


- (1) 716
- (2) 686
- (3) 714
- (4) 684

Q72. JEE Main 2021 (17 Mar Shift 1)

Two blocks ($m = 0.5 \text{ kg}$ and $M = 4.5 \text{ kg}$) are arranged on a horizontal frictionless table as shown in the figure.

The coefficient of static friction between the two blocks is $\frac{3}{7}$. Then the maximum horizontal force that can be applied on the larger block so that the blocks move together is N . (Round off to the Nearest Integer) [Take g as 9.8 m s^{-2}]



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Chapter: Work Power Energy**Q73. JEE Main 2025 (3 April Shift 1)**

A particle is released from height S above the surface of the earth. At certain height its kinetic energy is three times its potential energy. The height from the surface of the earth and the speed of the particle at that instant are respectively.

- (1) $\frac{S}{2}, \sqrt{\frac{3gS}{2}}$ (2) $\frac{S}{2}, \frac{3gS}{2}$
(3) $\frac{S}{4}, \frac{3gS}{2}$ (4) $\frac{S}{4}, \sqrt{\frac{3gS}{2}}$

Q74. JEE Main 2025 (29 Jan Shift 2)

A sand dropper drops sand of mass $m(t)$ on a conveyer belt at a rate proportional to the square root of speed (v) of the belt, i.e. $\frac{dm}{dt} \propto \sqrt{v}$. If P is the power delivered to run the belt at constant speed then which of the following relationship is true?

- (1) $P \propto \sqrt{v}$ (2) $P \propto v$
(3) $P^2 \propto v^5$ (4) $P^2 \propto v^3$

Q75. JEE Main 2025 (29 Jan Shift 1)

A body of mass ' m ' connected to a massless and unstretchable string goes in verticle circle of radius ' R ' under gravity g . The other end of the string is fixed at the center of circle. If velocity at top of circular path is $n\sqrt{gR}$, where, $n \geq 1$, then ratio of kinetic energy of the body at bottom to that at top of the circle is

- (1) $\frac{n^2}{n^2+4}$ (2) $\frac{n^2+4}{n^2}$ (3) $\frac{n+4}{n}$ (4) $\frac{n}{n+4}$

Q76. JEE Main 2025 (28 Jan Shift 1)

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

Assertion A: In a central force field, the work done is independent of the path chosen.

Reason R: Every force encountered in mechanics does not have an associated potential energy.

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

- (1) A is false but R is true
(2) Both A and R are true but R is NOT the correct explanation of A
(3) A is true but R is false
(4) Both A and R are true and R is the correct explanation of A

Q77. JEE Main 2025 (23 Jan Shift 2)

A ball having kinetic energy KE, is projected at an angle of 60° from the horizontal. What will be the kinetic energy of ball at the highest point of its flight ?

- (1) $\frac{(KE)}{8}$ (2) $\frac{(KE)}{2}$ (3) $\frac{(KE)}{16}$ (4) $\frac{(KE)}{4}$

Q78. JEE Main 2025 (22 Jan Shift 2)

A force $\vec{F} = 2\hat{i} + b\hat{j} + \hat{k}$ is applied on a particle and it undergoes a displacement $\hat{i} - 2\hat{j} - \hat{k}$. What will be the value of b , if work done on the particle is zero.

- (1) 0 (2) $\frac{1}{2}$ (3) 2 (4) $\frac{1}{3}$

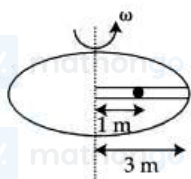
Q79. JEE Main 2024 (27 Jan Shift 2)

A ball suspended by a thread swings in a vertical plane so that its magnitude of acceleration in the extreme position and lowest position are equal. The angle (θ) of thread deflection in the extreme position will be :

- (1) $\tan^{-1}(\sqrt{2})$ (2) $2 \tan^{-1}(\frac{1}{2})$
(3) $\tan^{-1}(\frac{1}{2})$ (4) $2 \tan^{-1}(\frac{1}{\sqrt{5}})$

Q80. JEE Main 2024 (08 Apr Shift 2)

A circular table is rotating with an angular velocity of ω rad/s about its axis (see figure). There is a smooth groove along a radial direction on the table. A steel ball is gently placed at a distance of 1 m on the groove. All the surfaces are smooth. If the radius of the table is 3 m, the radial velocity of the ball w.r.t. the table at the time ball leaves the table is $x\sqrt{2}\omega$ m/s, where the value of x is _____.



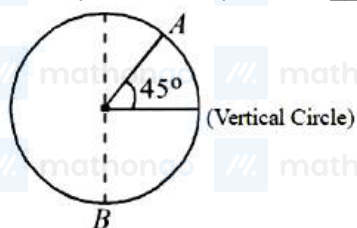
Q81. JEE Main 2024 (05 Apr Shift 2)

A body is moving unidirectionally under the influence of a constant power source. Its displacement in time t is proportional to :

- (1) t (2) $t^{3/2}$ (3) t^2 (4) $t^{2/3}$

Q82. JEE Main 2024 (04 Apr Shift 2)

A body of m kg slides from rest along the curve of vertical circle from point A to B in friction less path. The velocity of the body at B is _____ (given, $R = 14$ m, $g = 10$ m/s² and $\sqrt{2} = 1.4$)



- (1) 16.7 m/s (2) 19.8 m/s
(3) 10.6 m/s (4) 21.9 m/s

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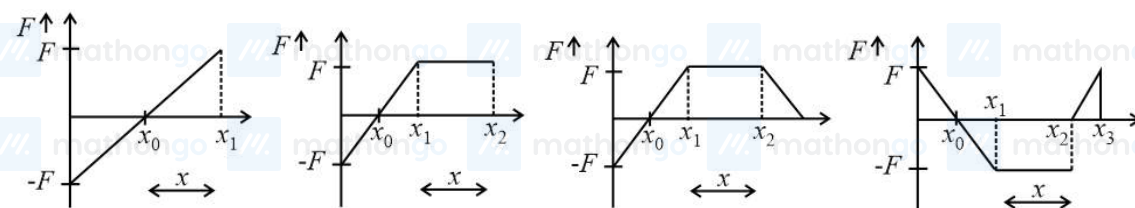
Q83. JEE Main 2024 (04 Apr Shift 1)

If a rubber ball falls from a height h and rebounds upto the height of $h/2$. The percentage loss of total energy of the initial system as well as velocity ball before it strikes the ground, respectively, are :

- (1) 50%, $\sqrt{2gh}$ (2) 50%, \sqrt{gh}
 (3) 40%, $\sqrt{2gh}$ (4) 50%, $\sqrt{\frac{gh}{2}}$

Q84. JEE Main 2022 (26 Jun Shift 2)

Arrange the four graphs in descending order of total work done; where W_1, W_2, W_3 and W_4 are the work done corresponding to figure a, b, c and d respectively.



- (1) $W_3 > W_2 > W_1 > W_4$
 (2) $W_3 > W_2 > W_4 > W_1$
 (3) $W_2 > W_3 > W_4 > W_1$
 (4) $W_2 > W_3 > W_1 > W_4$

Q85. JEE Main 2022 (25 Jul Shift 1)

A body of mass 0.5 kg travels on straight line path with velocity $v = (3x^2 + 4) \text{ m s}^{-1}$. The net work done by the force during its displacement from $x = 0$ to $x = 2 \text{ m}$ is

- (1) 64 J (2) 60 J (3) 120 J (4) 128 J

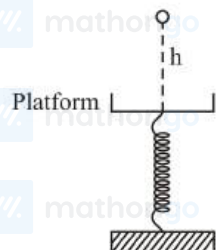
Q86. JEE Main 2022 (24 Jun Shift 2)

Potential energy as a function of r is given by $U = \frac{A}{r^{10}} - \frac{B}{r^5}$, where r is the interatomic distance, A and B are positive constants. The equilibrium distance between the two atoms will be :

- (1) $\left(\frac{A}{B}\right)^{\frac{1}{5}}$ (2) $\left(\frac{B}{A}\right)^{\frac{1}{5}}$ (3) $\left(\frac{2A}{B}\right)^{\frac{1}{5}}$ (4) $\left(\frac{B}{2A}\right)^{\frac{1}{5}}$

Q87. JEE Main 2022 (24 Jun Shift 1)

A ball of mass 100 g is dropped from a height $h = 10$ cm on a platform fixed at the top of a vertical spring (as shown in figure). The ball stays on the platform and the platform is depressed by a distance $\frac{h}{2}$. The spring constant is _____ N m^{-1} (Use $g = 10 \text{ m s}^{-2}$)

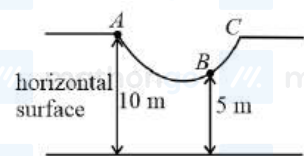
**Q88. JEE Main 2021 (25 Feb Shift 1)**

The potential energy (U) of a diatomic molecule is a function dependent on r (interatomic distance) as

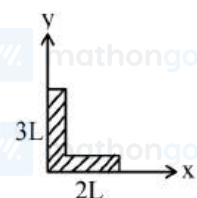
$$U = \frac{\alpha}{r^{10}} - \frac{\beta}{r^5} - 3 \text{ where, } \alpha \text{ and } \beta \text{ are positive constants. The equilibrium distance between two atoms will be } \left(\frac{2\alpha}{\beta}\right)^{\frac{a}{b}}, \text{ where } a = \text{_____}.$$

Q89. JEE Main 2021 (18 Mar Shift 1)

As shown in the figure, a particle of mass 10 kg is placed at a point A . When the particle is slightly displaced to its right, it starts moving and reaches the point B . The speed of the particle at B is $x \text{ m s}^{-1}$. (Take $g = 10 \text{ m s}^{-2}$) The value of x to the nearest integer is

**Chapter: Center of Mass Momentum and Collision****Q90. JEE Main 2025 (7 April Shift 1)**

A rod of length $5L$ is bent right angle keeping one side length as $2L$.



The position of the centre of mass of the system: (Consider $L = 10 \text{ cm}$)

(1) $2\hat{i} + 3\hat{j}$

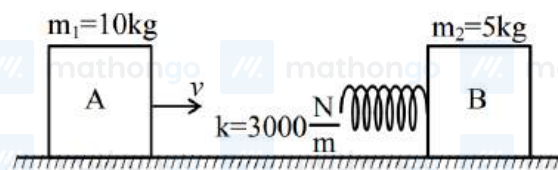
(2) $3\hat{i} + 7\hat{j}$

(3) $5\hat{i} + 8\hat{j}$

(4) $4\hat{i} + 9\hat{j}$

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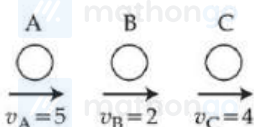
Q91. JEE Main 2025 (3 April Shift 2)

Consider two blocks A and B of masses $m_1 = 10 \text{ kg}$ and $m_2 = 5 \text{ kg}$ that are placed on a frictionless table. The block A moves with a constant speed $v = 3 \text{ m/s}$ towards the block B kept at rest. A spring with spring constant $k = 3000 \text{ N/m}$ is attached with the block B as shown in the figure. After the collision, suppose that the blocks A and B, along with the spring in constant compression state, move together, then the compression in the spring is, (Neglect the mass of the spring)

- (1) 0.2 m (2) 0.4 m (3) 0.1 m (4) 0.3 m

Q92. JEE Main 2025 (29 Jan Shift 2)

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



Assertion (A) :

Three identical spheres of same mass undergo one dimensional motion as shown in figure with initial velocities $v_A = 5 \text{ m/s}$, $v_B = 2 \text{ m/s}$, $v_C = 4 \text{ m/s}$. If we wait sufficiently long for elastic collision to happen, then $v_A = 4 \text{ m/s}$, $v_B = 2 \text{ m/s}$, $v_C = 5 \text{ m/s}$ will be the final velocities.

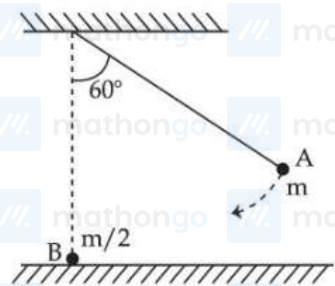
Reason (R): In an elastic collision between identical masses, two objects exchange their velocities.

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

- (1) (A) is false but (R) is true
 (2) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
 (3) Both (A) and (R) are true and (R) is the correct explanation of (A)
 (4) (A) is true but (R) is false

Q93. JEE Main 2025 (29 Jan Shift 1)

As shown below, bob A of a pendulum having massless string of length 'R' is released from 60° to the vertical. It hits another bob B of half the mass that is at rest on a frictionless table in the center. Assuming elastic collision, the magnitude of the velocity of bob A after the collision will be (take g as acceleration due to gravity.)



- (1) $\frac{4}{3}\sqrt{Rg}$ (2) $\frac{2}{3}\sqrt{Rg}$
 (3) \sqrt{Rg} (4) $\frac{1}{3}\sqrt{Rg}$

Q94. JEE Main 2025 (23 Jan Shift 1)

Consider a circular disc of radius 20 cm with centre located at the origin. A circular hole of radius 5 cm is cut from this disc in such a way that the edge of the hole touches the edge of the disc. The distance of centre of mass of residual or remaining disc from the origin will be

- (1) 2.0 cm (2) 1.5 cm (3) 1.0 cm (4) 0.5 cm

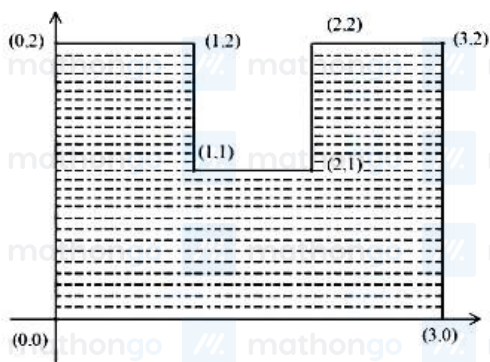
Q95. JEE Main 2024 (30 Jan Shift 1)

A spherical body of mass 100 g is dropped from a height of 10 m from the ground. After hitting the ground, the body rebounds to a height of 5 m. The impulse of force imparted by the ground to the body is given by: (given $g = 9.8 \text{ m s}^{-2}$)

- (1) 4.32 kg m s^{-1} (2) 43.2 kg m s^{-1} (3) 23.9 kg m s^{-1} (4) 2.39 kg m s^{-1}

Q96. JEE Main 2024 (08 Apr Shift 1)

A uniform thin metal plate of mass 10 kg with dimensions is shown. The ratio of x and y coordinates of center of mass of plate in $\frac{n}{9}$. The value of n is _____



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Q97. JEE Main 2024 (01 Feb Shift 2)

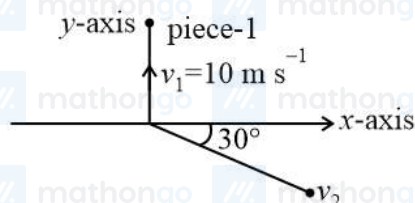
A uniform rod AB of mass 2 kg and Length 30 cm at rest on a smooth horizontal surface. An impulse of force 0.2 N s is applied to end B . The time taken by the rod to turn through at right angles will be $\frac{\pi}{x} \text{ s}$, where $x =$ _____.

Q98. JEE Main 2023 (11 Apr Shift 2)

A nucleus disintegrates into two nuclear parts, in such a way that ratio of their nuclear sizes is $1 : 2^{1/3}$. Their respective speed have a ratio of $n : 1$. The value of n is _____.

Q99. JEE Main 2021 (18 Mar Shift 1)

A ball of mass 10 kg moving with a velocity $10\sqrt{3} \text{ m s}^{-1}$ along the x -axis, hits another ball of mass 20 kg which is at rest. After the collision, first ball comes to rest while the second ball disintegrates into two equal pieces. One piece starts moving along y -axis with a speed of 10 m s^{-1} . The second piece starts moving at an angle of 30° with respect to the x -axis. The velocity of the ball moving at 30° with x -axis is $x \text{ m s}^{-1}$. The configuration of pieces after the collision is shown in the figure below. The value of x to the nearest integer is

**Q100. JEE Main 2020 (09 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:

- (1) $\frac{3\sqrt{3}}{8} \frac{u^2}{g}$ (2) $\frac{3\sqrt{2}}{4} \frac{u^2}{g}$
 (3) $\frac{5}{8} \frac{u^2}{g}$ (4) $2\sqrt{2} \frac{u^2}{g}$

Q101. JEE Main 2020 (08 Jan Shift 2)

As shown in figure. When a spherical cavity (centred at O) of radius 1 is cut out of a uniform sphere of radius R (centred at C), the centre of mass of remaining (shaded part of sphere is at G , i.e., on the surface of the cavity). R can be determined by the equation:



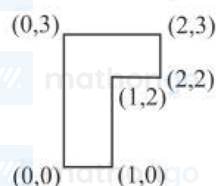
- (1) $(R^2 + R + 1)(2 - R) = 1$ (2) $(R^2 - R - 1)(2 - R) = 1$
 (3) $(R^2 - R + 1)(2 - R) = 1$ (4) $(R^2 + R - 1)(2 - R) = 1$

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Q102. JEE Main 2020 (08 Jan Shift 1)

The coordinates of the centre of mass of a uniform flag-shaped lamina (thin flat plate) of mass 4 kg. (The coordinates of the same are shown in the figure) are:



- (1) (1.25 m, 1.50 m) (2) (0.75 m, 1.75 m)
(3) (0.75 m, 0.75 m) (4) (1 m, 1.75 m)

Chapter: Rotational Motion**Q103. JEE Main 2025 (8 April Shift 2)**

A rod of linear mass density ' λ ' and length ' L ' is bent to form a ring of radius ' R '. Moment of inertia of ring about any of its diameter is :

- (1) $\frac{\lambda L^3}{16\pi^2}$ (2) $\frac{\lambda L^3}{12}$ (3) $\frac{\lambda L^3}{4\pi^2}$ (4) $\frac{\lambda L^3}{8\pi^2}$

Q104. JEE Main 2025 (8 April Shift 2)

A thin solid disk of 1 kg is rotating along its diameter axis at the speed of 1800 rpm. By applying an external torque of $25\pi\text{Nm}$ for 40 s, the speed increases to 2100 rpm. The diameter of the disk is _____ m.

Q105. JEE Main 2025 (8 April Shift 2)

A cube having a side of 10 cm with unknown mass and 200 gm mass were hung at two ends of an uniform rigid rod of 27 cm long. The rod along with masses was placed on a wedge keeping the distance between wedge point and 200 gm weight as 25 cm. Initially the masses were not at balance. A beaker is placed beneath the unknown mass and water is added slowly to it. At given point the masses were in balance and half volume of the unknown mass was inside the water.

(Take the density of unknown mass is more than that of the water, the mass did not absorb water and water density is 1gm/cm^3 .) The unknown mass is _____ kg.

Q106. JEE Main 2025 (4 April Shift 2)

A solid sphere with uniform density and radius R is rotating initially with constant angular velocity (ω_1) about its diameter. After some time during the rotation it starts losing mass at a uniform rate, with no change in its shape.

The angular velocity of the sphere when its radius become $R/2$ is $x\omega_1$. The value of x is _____

Q107. JEE Main 2025 (4 April Shift 2)

A wheel is rolling on a plane surface. The speed of a particle on the highest point of the rim is 8 m/s. The speed of the particle on the rim of the wheel at the same level as the centre of wheel, will be :

- (1) $4\sqrt{2}$ m/s (2) 8 m/s
(3) 4 m/s (4) $8\sqrt{2}$ m/s

Q108. JEE Main 2025 (4 April Shift 1)

Which of the following are correct expression for torque acting on a body?

B. $\vec{\tau} = \frac{d}{dt}(\vec{r} \times \vec{p})$

C. $\vec{\tau} = \vec{r} \times \frac{d\vec{p}}{dt}$

D. $\vec{\tau} = I\vec{\alpha}$

E. $\vec{\tau} = \vec{r} \times \vec{F}$

(\vec{r} = position vector; \vec{p} = linear momentum;

\vec{L} = angular momentum; $\vec{\alpha}$ = angular acceleration;

I = moment of inertia; \vec{F} = force; t = time)

Choose the correct answer from the options given below :

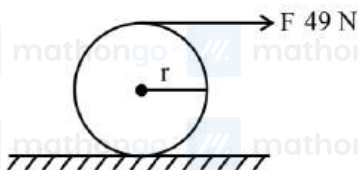
- (1) B, D and E Only (2) C and D Only
(3) B, C, D and E Only (4) A, B, D and E Only

Q109. JEE Main 2025 (4 April Shift 1)

A circular ring and a solid sphere having same radius roll down on an inclined plane from rest without slipping. The ratio of their velocities when reached at the bottom of the plane is $\sqrt{\frac{x}{5}}$ where $x =$ _____

Q110. JEE Main 2025 (3 April Shift 1)

A force of 49 N acts tangentially at the highest point of a sphere (solid) of mass 20 kg, kept on a rough horizontal plane. If the sphere rolls without slipping, then the acceleration of the center of the sphere is



- (1) 3.5 m/s^2 (2) 0.35 m/s^2
(3) 2.5 m/s^2 (4) 0.25 m/s^2

Q111. JEE Main 2025 (28 Jan Shift 1)

The moment of inertia of a solid disc rotating along its diameter is 2.5 times higher than the moment of inertia of a ring rotating in similar way. The moment of inertia of a solid sphere which has same radius as the disc and rotating in similar way, is n times higher than the moment of inertia of the given ring. Here, $n =$ _____
(Consider all the bodies have equal masses)

Q112. JEE Main 2025 (24 Jan Shift 2)

A solid sphere and a hollow sphere of the same mass and of same radius are rolled on an inclined plane. Let the time taken to reach the bottom by the solid sphere and the hollow sphere be t_1 and t_2 , respectively, then

- (1) $t_1 > t_2$ (2) $t_1 = t_2$ (3) $t_1 < t_2$ (4) $t_1 = 2t_2$

Q113. JEE Main 2025 (23 Jan Shift 1)

A solid sphere of mass ' m ' and radius ' r ' is allowed to roll without slipping from the highest point of an inclined plane of length ' L ' and makes an angle 30° with the horizontal. The speed of the particle at the bottom of the plane is v_1 . If the angle of inclination is increased to 45° while keeping L constant. Then the new speed of the sphere at the bottom of the plane is v_2 . The ratio $v_1^2 : v_2^2$ is

- (1) $1 : \sqrt{2}$ (2) $1 : \sqrt{3}$ (3) $1 : 3$ (4) $1 : 2$

Q114. JEE Main 2025 (22 Jan Shift 1)

The position vectors of two 1 kg particles, (A) and (B), are given by

$$\vec{r}_A = (\alpha_1 t^2 \hat{i} + \alpha_2 t \hat{j} + \alpha_3 t \hat{k}) \text{ m and } \vec{r}_B = (\beta_1 t \hat{i} + \beta_2 t^2 \hat{j} + \beta_3 t \hat{k}) \text{ m, respectively;}$$

($\alpha_1 = 1 \text{ m/s}^2, \alpha_2 = 3n \text{ m/s}, \alpha_3 = 2 \text{ m/s}, \beta_1 = 2 \text{ m/s}, \beta_2 = -1 \text{ m/s}^2, \beta_3 = 4p \text{ m/s}$), where t is time, n and p are constants. At $t = 1 \text{ s}$, $|\vec{V}_A| = |\vec{V}_B|$ and velocities \vec{V}_A and \vec{V}_B of the particles are orthogonal to each other. At $t = 1 \text{ s}$, the magnitude of angular momentum of particle (A) with respect to the position of particle (B) is $\sqrt{L} \text{ kg m}^2 \text{ s}^{-1}$. The value of L is _____.

Q115. JEE Main 2025 (2 April Shift 2)

The moment of inertia of a circular ring of mass M and diameter r about a tangential axis lying in the plane of the ring is :

- (1) $\frac{1}{2} Mr^2$ (2) $\frac{3}{8} Mr^2$ (3) $\frac{3}{2} Mr^2$ (4) $2Mr^2$

Q116. JEE Main 2025 (2 April Shift 1)

Moment of inertia of a rod of mass ' M ' and length ' L ' about an axis passing through its center and normal to its length is ' α '. Now the rod is cut into two equal parts and these parts are joined symmetrically to form a cross shape. Moment of inertia of cross about an axis passing through its center and normal to plane containing cross is :

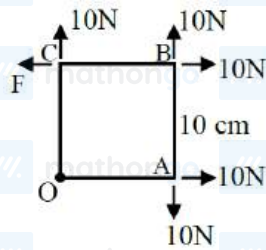
- (1) α (2) $\alpha/4$ (3) $\alpha/8$ (4) $\alpha/2$

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Q117. JEE Main 2025 (2 April Shift 1)

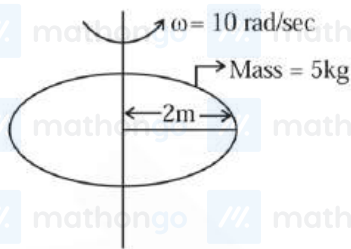
A square Lamina OABC of length 10 cm is pivoted at 'O'. Forces act at Lamina as shown in figure. If Lamina remains stationary, then the magnitude of F is :



- (1) 20 N
(2) 0 (zero)
(3) 10 N
(4) $10\sqrt{2}$ N

Q118. JEE Main 2024 (30 Jan Shift 1)

Consider a disc of mass 5 kg, radius 2 m, rotating with angular velocity of 10 rad s^{-1} about an axis perpendicular to the plane of rotation. An identical disc is kept gently over the rotating disc along the same axis. The energy dissipated so that both the discs continue to rotate together without slipping is _____ J.

**Q119. JEE Main 2024 (29 Jan Shift 1)**

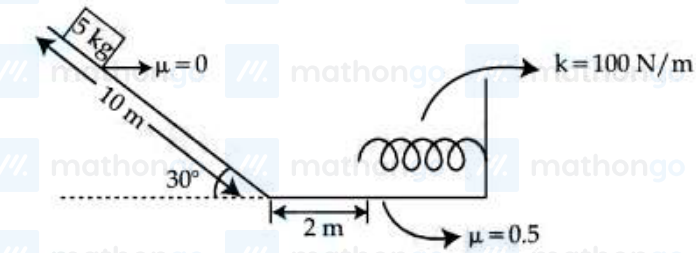
A cylinder is rolling down on an inclined plane of inclination 60° . Its acceleration during rolling down will be $\frac{x}{\sqrt{3}} \text{ m s}^{-2}$, where $x =$ _____ (use $g = 10 \text{ m s}^{-2}$).

Q120. JEE Main 2024 (27 Jan Shift 1)

Four particles, each of mass 1 kg are placed at four corners of a square of side 2 m. The moment of inertia of the system about an axis perpendicular to its plane and passing through one of its vertex is _____ kg m^2 .

Q121. JEE Main 2024 (08 Apr Shift 2)

A block is simply released from the top of an inclined plane as shown in the figure above. The maximum compression in the spring when the block hits the spring is:



- (1) $\sqrt{6} \text{ m}$ (2) $\sqrt{5} \text{ m}$ (3) 1 m (4) 2 m

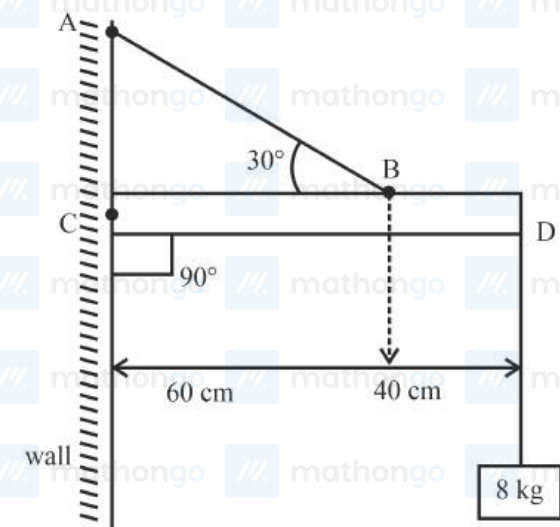
Q122. JEE Main 2024 (06 Apr Shift 1)

If the radius of earth is reduced to three-fourth of its present value without change in its mass then value of duration of the day of earth will be _____ hours 30 minutes.

Q123. JEE Main 2023 (25 Jan Shift 1)

An object of mass 8 kg is hanging from one end of a uniform rod CD of mass 2 kg and length 1 m pivoted at its end C on a vertical wall as shown in figure. It is supported by a cable AB such that the system is in equilibrium. The tension in the cable is:

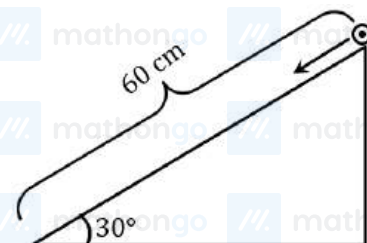
(Take $g = 10 \text{ m s}^{-2}$)



- (1) 240 N (2) 90 N (3) 300 N (4) 30 N

Q124. JEE Main 2023 (01 Feb Shift 1)

A solid cylinder is released from rest from the top of an inclined plane of inclination 30° and length 60 cm. If the cylinder rolls without slipping, its speed upon reaching the bottom of the inclined plane is _____ m s^{-1} . (Given $g = 10 \text{ m s}^{-2}$)

**Q125. JEE Main 2022 (25 Jun Shift 2)**

Moment of Inertia (M.I.) of four bodies having same mass M and radius $2R$ are as follows

I_1 = M.I. of solid sphere about its diameter I_2 = M.I. of solid cylinder about its axis

I_3 = M.I. of solid circular disc about its diameter

I_4 = M.I. of thin circular ring about its diameter

If $2(I_2 + I_3) + I_4 = xI_1$ then the value of x will be _____.

Q126. JEE Main 2021 (27 Aug Shift 2)

Two discs have moments of inertia I_1 and I_2 about their respective axes perpendicular to the plane and passing through the centre. They are rotating with angular speeds, ω_1 and ω_2 respectively and are brought into contact face to face with their axes of rotation coaxial. The loss in kinetic energy of the system in the process is given by:

(1) $\frac{I_1 I_2}{(I_1 + I_2)} (\omega_1 - \omega_2)^2$

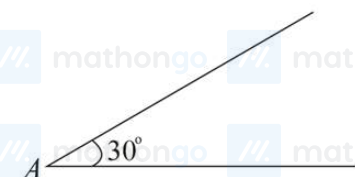
(2) $\frac{(\omega_1 - \omega_2)^2}{2(I_1 + I_2)}$

(3) $\frac{I_1 I_2}{2(I_1 + I_2)} (\omega_1 - \omega_2)^2$

(4) $\frac{(I_1 - I_2)^2 \omega_1 \omega_2}{2(I_1 + I_2)}$

Q127. JEE Main 2021 (17 Mar Shift 2)

A sphere of mass 2 kg and radius 0.5 m is rolling with an initial speed of 1 m s^{-1} goes up an inclined plane which makes an angle of 30° with the horizontal plane, without slipping. How low will the sphere take to return to the starting point A?



(1) 0.60 s

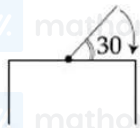
(2) 0.52 s

(3) 0.56 s

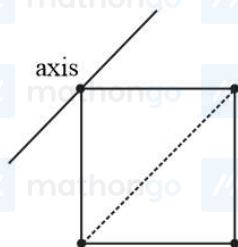
(4) 0.80 s

Q128. JEE Main 2020 (09 Jan Shift 1)

One end of a straight uniform $1m$ long bar is pivoted on horizontal table. It is released from rest when it makes an angle 30° from the horizontal (see figure). Its angular speed when it hits the table is given as $\sqrt{n} \text{ rad s}^{-1}$, where n is an integer. The value of n is _____

**Q129. JEE Main 2020 (06 Sep Shift 1)**

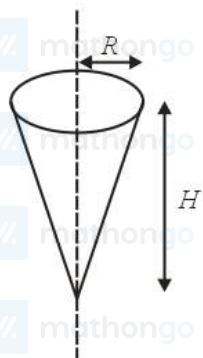
Four point masses, each of mass m , are fixed at the corners of a square of side l . The square is rotating with angular frequency ω , about an axis passing through one of the corners of the square and parallel to its diagonal, as shown in the figure. The angular momentum of the square about the axis is



- (1) $m l^2 \omega$ (2) $4m l^2 \omega$ (3) $3m l^2 \omega$ (4) $2m l^2 \omega$

Q130. JEE Main 2020 (06 Sep Shift 1)

Shown in the figure is a hollow ice-cream cone (it is open at top). If its mass is M , radius of its top is R and height, H , then its moment of inertia about its axis is



- (1) $\frac{MR^2}{2}$ (2) $\frac{M(R^2+H^2)}{4}$
 (3) $\frac{MH^2}{3}$ (4) $\frac{MR^2}{3}$

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Q131. JEE Main 2020 (03 Sep Shift 1)

Moment of inertia of a cylinder of mass m , length L and radius R about an axis passing through its centre and perpendicular to the axis of the cylinder is $I = M\left(\frac{R^2}{4} + \frac{L^2}{12}\right)$. If such a cylinder is to be made for a given mass of a material, the ratio $\frac{L}{R}$ for it to have minimum possible I is:

- (1) $\frac{2}{3}$ (2) $\frac{3}{2}$ (3) $\sqrt{\frac{3}{2}}$ (4) $\sqrt{\frac{2}{3}}$

Chapter: Gravitation**Q132. JEE Main 2025 (7 April Shift 2)**

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

Assertion (A) : The radius vector from the Sun to a planet sweeps out equal areas in equal intervals of time and thus areal velocity of planet is constant.

Reason (R) : For a central force field the angular momentum is a constant.

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

- (1) Both (A) and (R) are correct and (R) is the correct explanation of (A)
 (2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
 (3) (A) is correct but (R) is not correct
 (4) (A) is not correct but (R) is correct

Q133. JEE Main 2025 (4 April Shift 1)

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

The kinetic energy needed to project a body of mass m from earth surface to infinity is $\frac{1}{2}mgR$, where R is the radius of earth.

Reason R : The maximum potential energy of a body is zero when it is projected to infinity from earth surface.

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

- (1) A False but R is true
 (2) Both A and R are true and R is the correct explanation of A
 (3) A is true but R is false
 (4) Both A and R are true but R is NOT the correct explanation of A

Q134. JEE Main 2025 (3 April Shift 1)

Three identical spheres of mass m , are placed at the vertices of an equilateral triangle of length a . When released, they interact only through gravitational force and collide after a time $T = 4$ seconds. If the sides of the triangle are increased to length $2a$ and also the masses of the spheres are made $2m$, then they will collide after _____ seconds.

Q135. JEE Main 2025 (29 Jan Shift 2)

Two planets, A and B are orbiting a common star in circular orbits of radii R_A and R_B , respectively, with $R_B = 2R_A$. The planet B is $4\sqrt{2}$ times more massive than planet A. The ratio $\left(\frac{L_B}{L_A}\right)$ of angular momentum (L_B) of planet B to that of planet A (L_A) is closest to integer _____.

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Q136. JEE Main 2025 (24 Jan Shift 2)

Acceleration due to gravity on the surface of earth is ' g '. If the diameter of earth is reduced to one third of its original value and mass remains unchanged, then the acceleration due to gravity on the surface of the earth is :.....
g.

Q137. JEE Main 2025 (24 Jan Shift 1)

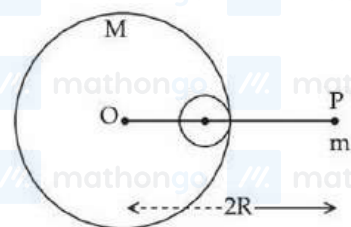
A satellite is launched into a circular orbit of radius ' R ' around the earth. A second satellite is launched into an orbit of radius $1.03 R$. The time period of revolution of the second satellite is larger than the first one approximately by
(1) 9% (2) 3% (3) 4.5% (4) 2.5%

Q138. JEE Main 2025 (23 Jan Shift 2)

A satellite of mass $\frac{M}{2}$ is revolving around earth in a circular orbit at a height of $\frac{R}{3}$ from earth surface. The angular momentum of the satellite is $M\sqrt{\frac{GMR}{x}}$. The value of x is _____, where M and R are the mass and radius of earth, respectively. (G is the gravitational constant)

Q139. JEE Main 2025 (22 Jan Shift 1)

A small point of mass m is placed at a distance $2R$ from the centre ' O ' of a big uniform solid sphere of mass M and radius R . The gravitational force on ' m ' due to M is F_1 . A spherical part of radius $R/3$ is removed from the big sphere as shown in the figure and the gravitational force on m due to remaining part of M is found to be F_2 . The value of ratio $F_1 : F_2$ is



- (1) 12 : 11 (2) 11 : 10
(3) 12 : 9 (4) 16 : 9

Q140. JEE Main 2024 (31 Jan Shift 1)

Four identical particles of mass m are kept at the four corners of a square. If the gravitational force exerted on one of the masses by the other masses is $\left(\frac{2\sqrt{2}+1}{32}\right)\frac{Gm^2}{L^2}$, the length of the sides of the square is

- (1) $\frac{L}{2}$ (2) $4L$
(3) $3L$ (4) $2L$

Q141. JEE Main 2024 (29 Jan Shift 1)

At what distance above and below the surface of the earth a body will have same weight? (Take radius of earth as R)

- (1) $\sqrt{5}R - R$ (2) $\frac{\sqrt{3}R - R}{2}$
 (3) $\frac{R}{2}$ (4) $\frac{\sqrt{5}R - R}{2}$

Q142. JEE Main 2024 (27 Jan Shift 2)

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

Assertion (A) : The angular speed of the moon in its orbit about the earth is more than the angular speed of the earth in its orbit about the sun.

Reason (R): The moon takes less time to move around the earth than the time taken by the earth to move around the sun.

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

- (1) (A) is correct but (R) is not correct
 (2) Both (A) and (R) are correct and (R) is the correct explanation of A.
 (3) Both (A) and (R) are correct but (R) is not the correct explanation of A.
 (4) (A) is not correct but (R) is correct

Q143. JEE Main 2024 (09 Apr Shift 2)

A satellite of 10^3 kg mass is revolving in circular orbit of radius $2R$. If $\frac{10^4 R}{6}$ J energy is supplied to the satellite, it would revolve in a new circular orbit of radius

(use $g = 10 \text{ m/s}^2$, $R = \text{radius of earth}$)

- (1) $2.5R$ (2) $3R$ (3) $4R$ (4) $6R$

Q144. JEE Main 2024 (08 Apr Shift 1)

Two planets A and B having masses m_1 and m_2 move around the sun in circular orbits of r_1 and r_2 radii respectively. If angular momentum of A is L and that of B is $3L$, the ratio of time period $\left(\frac{T_A}{T_B}\right)$ is:

- (1) $\left(\frac{r_2}{r_1}\right)^{\frac{3}{2}}$ (2) $\frac{1}{27} \left(\frac{m_2}{m_1}\right)^3$
 (3) $27 \left(\frac{m_1}{m_2}\right)^3$ (4) $\left(\frac{r_1}{r_2}\right)^3$

Q145. JEE Main 2024 (05 Apr Shift 1)

In hydrogen like system the ratio of coulombic force and gravitational force between an electron and a proton is in the order of :

- (1) 10^{39} (2) 10^{29} (3) 10^{19} (4) 10^{36}

Q146. JEE Main 2024 (05 Apr Shift 1)

Match List I with List II :

	LIST I		LIST II
A.	Kinetic energy of planet	I.	$-GMm/a$
B.	Gravitation Potential energy of sunplanet system	II.	$GMm/2a$
C.	Total mechanical energy of planet	III.	$\frac{Gm}{r}$
D.	Escape energy at the surface of planet for unit mass object	IV.	$-GMm/2a$

(1) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

(2) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

(3) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)

(4) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)

Q147. JEE Main 2023 (01 Feb Shift 1)

If earth has a mass nine times and radius twice to the of a planet P . Then $\frac{v_e}{3}\sqrt{x}ms^{-1}$ will be the minimum velocity required by a rocket to pull out of gravitational force of P , where v_e is escape velocity on earth. The value of x is

(1) 2

(2) 3

(3) 18

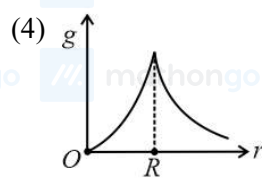
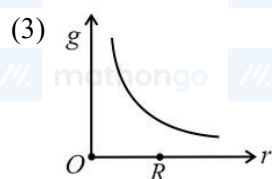
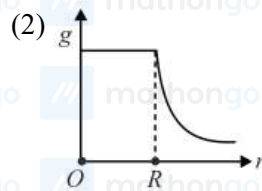
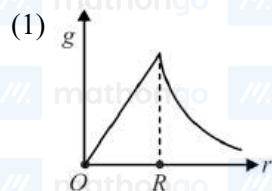
(4) 1

Q148. JEE Main 2022 (29 Jun Shift 1)

The escape velocity of a body on a planet A is 12 km s^{-1} . The escape velocity of the body on another planet B , whose density is four times and radius is half of the planet A , is

(1) 12 km s^{-1} (2) 24 km s^{-1} (3) 36 km s^{-1} (4) 6 km s^{-1} **Q149. JEE Main 2022 (26 Jun Shift 1)**

The variation of acceleration due to gravity (g) with distance (r) from the center of the earth is correctly represented by (Given R = radius of earth)



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Q150. JEE Main 2021 (16 Mar Shift 2)

If one wants to remove all the mass of the earth to infinity in order to break it up completely. The amount of energy that needs to be supplied will be $\frac{x}{5} \frac{GM^2}{R}$ where x is _____. (Round off to the Nearest Integer) (M is the mass of earth, R is the radius of earth, G is the gravitational constant)

Q151. JEE Main 2020 (09 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 $\left(\frac{v}{2}\right)$ the instantaneous velocity \vec{v} of A. The collision is completely inelastic. Then, the combined body:

- (1) continues to move in a circular orbit
- (2) Escapes from the Planet's Gravitational field
- (3) Falls vertically downwards towards the planet
- (4) starts moving in an elliptical orbit around the planet

Q152. JEE Main 2020 (07 Jan Shift 1)

A satellite of mass M is launched vertically upwards with an initial speed u from the surface of the earth. After it reaches height R (R = radius of the earth), it ejects a rocket of mass $\frac{M}{10}$ so that subsequently the satellite moves in a circular orbit. The kinetic energy of the rocket is (G is the gravitational constant; M_e is the mass of the earth):

- (1) $\frac{M}{20} \left(u^2 + \frac{113}{200} \frac{GM_e}{R} \right)$
- (2) $5M \left(u^2 - \frac{119}{200} \frac{GM_e}{R} \right)$
- (3) $\frac{3M}{8} \left(u + \sqrt{\frac{5GM_e}{6R}} \right)^2$
- (4) $\frac{M}{20} \left(u - \sqrt{\frac{2GM_e}{3R}} \right)^2$

Chapter: Mechanical Properties of Solids**Q153. JEE Main 2025 (8 April Shift 2)**

A sample of a liquid is kept at 1 atm. It is compressed to 5 atm which leads to change of volume of 0.8 cm^3 . If the bulk modulus of the liquid is 2 GPa, the initial volume of the liquid was _____ litre. (Take $1 \text{ atm} = 10^5 \text{ Pa}$)

Q154. JEE Main 2025 (7 April Shift 1)

Two wires A and B are made of same material having ratio of lengths $\frac{L_A}{L_B} = \frac{1}{3}$ and their diameters ratio $\frac{d_A}{d_B} = 2$. If both the wires are stretched using same force, what would be the ratio of their respective elongations?

- (1) 1 : 6
- (2) 1 : 12
- (3) 3 : 4
- (4) 1 : 3

Q155. JEE Main 2025 (4 April Shift 2)

A cylindrical rod of length 1 m and radius 4 cm is mounted vertically. It is subjected to a shear force of 10^5 N at the top. Considering infinitesimally small displacement in the upper edge, the angular displacement θ of the rod axis from its original position would be : (shear moduli, $G = 10^{10}$ N/m²)

- (1) $1/160\pi$ (2) $1/4\pi$ (3) $1/40\pi$ (4) $1/2\pi$

Q156. JEE Main 2025 (29 Jan Shift 1)

The fractional compression $\left(\frac{\Delta V}{V}\right)$ of water at the depth of 2.5 km below the sea level is _____ %. Given, the Bulk modulus of water = 2×10^9 N m⁻², density of water = 10^3 kg m⁻³, acceleration due to gravity = $g = 10$ m s⁻².

- (1) 1.25 (2) 1.0 (3) 1.75 (4) 1.5

Q157. JEE Main 2025 (28 Jan Shift 2)

The volume contraction of a solid copper cube of edge length 10 cm, when subjected to a hydraulic pressure of 7×10^6 Pa, would be _____ mm³.

(Given bulk modulus of copper = 1.4×10^{11} N m⁻²)

Q158. JEE Main 2024 (27 Jan Shift 1)

If average depth of an ocean is 4000 m and the bulk modulus of water is 2×10^9 N m⁻², then fractional compression $\frac{\Delta V}{V}$ of water at the bottom of ocean is $\alpha \times 10^{-2}$. The value of α is _____, (Given, $g = 10$ m s⁻², $\rho = 1000$ kg m⁻³)

Q159. JEE Main 2024 (05 Apr Shift 2)

Match List-I with List-II :

	List-I		List-II
(A)	A force that restores an elastic body of unit area to its original state	(I)	Bulk modulus
(B)	Two equal and opposite forces parallel to opposite faces	(II)	Young's modulus
(C)	Forces perpendicular everywhere to the surface per unit area same everywhere	(III)	Stress
(D)	Two equal and opposite forces perpendicular to opposite faces	(IV)	Shear modulus

Choose the correct answer from the options given below :

- (1) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)
 (2) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
 (3) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
 (4) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)

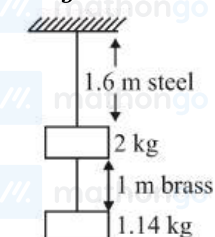
Q160. JEE Main 2023 (13 Apr Shift 1)

Under isothermal condition, the pressure of a gas is given by $P = aV^{-3}$, where a is a constant and V is the volume of the gas. The bulk modulus at constant temperature is equal to

- (1) $3P$ (2) P (3) $2P$ (4) $\frac{P}{2}$

Q161. JEE Main 2023 (10 Apr Shift 1)

Two wires each of radius 0.2 cm and negligible mass, one made of steel and the other made of brass are loaded as shown in the figure. The elongation of the steel wire is _____ 10^{-6} m. [Young's modulus for steel = 2×10^{11} N m⁻² and $g = 10$ m s⁻²]



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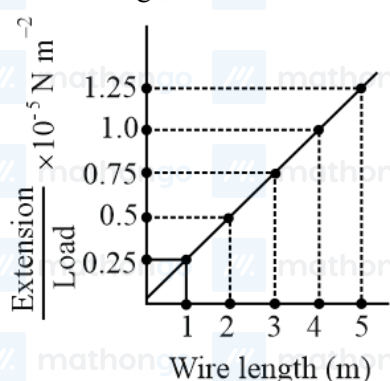
Q162. JEE Main 2022 (27 Jul Shift 2)

A steel wire of length 3.2 m ($Y_S = 2.0 \times 10^{11} \text{ N m}^{-2}$) and a copper wire of length 4.4 m ($Y_C = 1.1 \times 10^{11} \text{ N m}^{-2}$), both of radius 1.4 mm are connected end to end. When stretched by a load, the net elongation is found to be 1.4 mm. The load applied, in Newton, will be: (Given $\pi = \frac{22}{7}$)

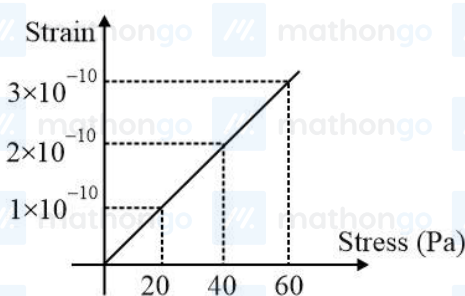
- (1) 360 (2) 180 (3) 1080 (4) 154

Q163. JEE Main 2022 (27 Jul Shift 2)

In an experiment to determine the Young's modulus, steel wires of five different lengths (1, 2, 3, 4 and 5) but of same cross-section (2 mm^2) were taken and curves between extension and load were obtained. The slope (extension/load) of the curves were plotted with the wire length and the following graph is obtained. If the Young's modulus of given steel wires is $x \times 10^{11} \text{ N m}^{-2}$, then the value of x is _____.

**Q164. JEE Main 2022 (26 Jun Shift 1)**

The elastic behaviour of material for linear stress and linear strain, is shown in the figure. The energy density for a linear strain of 5×10^{-4} is _____ kJ m^{-3} . Assume that material is elastic upto the linear strain of 5×10^{-4} ,

**Q165. JEE Main 2020 (07 Jan Shift 1)**

Speed of a transverse wave on a straight wire (mass 6.0 g, length 60 cm and area of cross-section 1.0 mm^2) is 90 m s^{-1} . If the Young's modulus of wire is $16 \times 10^{11} \text{ N m}^{-2}$, the extension of wire over its natural length is:

- (1) 0.03 mm (2) 0.02 mm
(3) 0.04 mm (4) 0.01 mm

Chapter: Mechanical Properties of Fluids**Q166. JEE Main 2025 (7 April Shift 2)**

A capillary tube of radius 0.1 mm is partly dipped in water (surface tension 70 dyn/cm and glass water contact angle $\simeq 0^\circ$) with 30° inclined with vertical. The length of water risen in the capillary is _____ cm.

(Take $g = 9.8 \text{ m/s}^2$)

- (1) $\frac{82}{5}$ (2) $\frac{57}{2}$ (3) $\frac{71}{5}$ (4) $\frac{68}{5}$

Q167. JEE Main 2025 (3 April Shift 2)

A solid steel ball of diameter 3.6 mm acquired terminal velocity $2.45 \times 10^{-2} \text{ m/s}$ while falling under gravity through an oil of density 925 kg m^{-3} . Take density of steel as 7825 kg m^{-3} and g as 9.8 m/s^2 . The viscosity of the oil in SI unit is

- (1) 2.18 (2) 2.38 (3) 1.68 (4) 1.99

Q168. JEE Main 2025 (3 April Shift 1)

Consider a completely full cylindrical water tank of height 1.6 m and cross-sectional area 0.5 m^2 . It has a small hole in its side at a height 90 cm from the bottom. Assume, the cross-sectional area of the hole to be negligibly small as compared to that of the water tank. If a load 50 kg is applied at the top surface of the water in the tank then the velocity of the water coming out at the instant when the hole is opened is : ($g = 10 \text{ m/s}^2$)

- (1) 3 m/s (2) 5 m/s (3) 2 m/s (4) 4 m/s

Q169. JEE Main 2025 (29 Jan Shift 1)

In a hydraulic lift, the surface area of the input piston is 6 cm^2 and that of the output piston is 1500 cm^2 . If 100 N force is applied to the input piston to raise the output piston by 20 cm, then the work done is _____ kJ.

Q170. JEE Main 2025 (28 Jan Shift 2)

A 400 g solid cube having an edge of length 10 cm floats in water. How much volume of the cube is outside the water ?

(Given : density of water = 1000 kg m^{-3})

- (1) 1400 cm^3 (2) 600 cm^3
(3) 4000 cm^3 (4) 400 cm^3

Q171. JEE Main 2025 (28 Jan Shift 2)

A thin transparent film with refractive index 1.4, is held on circular ring of radius 1.8 cm. The fluid in the film evaporates such that transmission through the film at wavelength 560 nm goes to a minimum every 12 seconds.

Assuming that the film is flat on its two sides, the rate of evaporation is _____ $\pi \times 10^{-13} \text{ m}^3/\text{s}$.

Q172. JEE Main 2025 (28 Jan Shift 1)

In the experiment for measurement of viscosity ' η ' of given liquid with a ball having radius R , consider following statements.

- A. Graph between terminal velocity V and R will be a parabola.
- B. The terminal velocities of different diameter balls are constant for a given liquid.
- C. Measurement of terminal velocity is dependent on the temperature.
- D. This experiment can be utilized to assess the density of a given liquid.
- E. If balls are dropped with some initial speed, the value of η will change.

Choose the correct answer from the options given below:

- (1) A, B and E Only
- (2) B, D and E Only
- (3) A, C and D Only
- (4) C, D and E Only

Q173. JEE Main 2025 (24 Jan Shift 1)

The amount of work done to break a big water drop of radius ' R ' into 27 small drops of equal radius is 10 J. The work done required to break the same big drop into 64 small drops of equal radius will be

- (1) 15 J
- (2) 5 J
- (3) 20 J
- (4) 10 J

Q174. JEE Main 2025 (22 Jan Shift 2)

A tube of length L is shown in the figure. The radius of cross section at the point (1) is 2 cm and at the point (2) is 1 cm, respectively. If the velocity of water entering at point (1) is 2 m/s, then velocity of water leaving the point (2) will be

- (1) 4 m/s
- (2) 2 m/s
- (3) 6 m/s
- (4) 8 m/s

Q175. JEE Main 2025 (22 Jan Shift 2)

A tube of length 1 m is filled completely with an ideal liquid of mass $2M$, and closed at both ends. The tube is rotated uniformly in horizontal plane about one of its ends. If the force exerted by the liquid at the other end is F then angular velocity of the tube is $\sqrt{\frac{F}{\alpha M}}$ in SI unit. The value of α is _____.

Q176. JEE Main 2025 (22 Jan Shift 1)

Two soap bubbles of radius 2 cm and 4 cm, respectively, are in contact with each other. The radius of curvature of the common surface, in cm, is _____.

Q177. JEE Main 2025 (2 April Shift 1)

A vessel with square cross-section and height of 6 m is vertically partitioned. A small window of 100 cm^2 with hinged door is fitted at a depth of 3 m in the partition wall. One part of the vessel is filled completely with water and the other side is filled with the liquid having density $1.5 \times 10^3 \text{ kg/m}^3$. What force one needs to apply on the hinged door so that it does not get opened ?

(Acceleration due to gravity = 10 m/s^2)

Q178. JEE Main 2023 (13 Apr Shift 2)

Given below are two statements: one is labelled as

Assertion A and the other is labelled as **Reason R**

Assertion A : A spherical body of radius $(5 \pm 0.1) \text{ mm}$ having a particular density is falling through a liquid of constant density. The percentage error in the calculation of its terminal velocity is 4%.

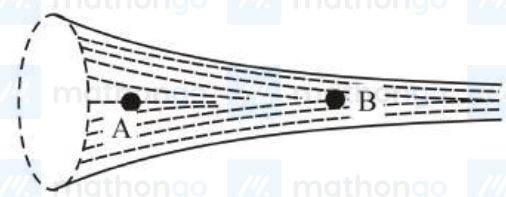
Reason R : The terminal velocity of the spherical body falling through the liquid is inversely proportional to its radius.

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

- (1) Both A and R are true and R is the correct explanation of A
- (2) Both A and R are true but R is NOT the correct explanation of A
- (3) A is true but R is false
- (4) A is false but R is true

Q179. JEE Main 2023 (13 Apr Shift 1)

The figure shows a liquid of given density flowing steadily in horizontal tube of varying cross-section. Cross-sectional areas at A is 1.5 cm^2 , and B is 25 mm^2 , if the speed of liquid at B is 60 cm s^{-1} then $(P_A - P_B)$ is _____
(Given P_A and P_B are liquid pressures at A and B points. Density $\rho = 1000 \text{ kg m}^{-3}$. A and B are on the axis of tube)



- (1) $135 Pa$
- (2) $27 Pa$
- (3) $175 Pa$
- (4) $36 Pa$

Q180. JEE Main 2022 (28 Jul Shift 2)

A pressure-pump has a horizontal tube of cross-sectional area 10 cm^2 for the outflow of water at a speed of 20 m s^{-1} . The force exerted on the vertical wall just in front of the tube which stops water horizontally flowing out of the tube, is: [given : density of water = 1000 kg m^{-3}]

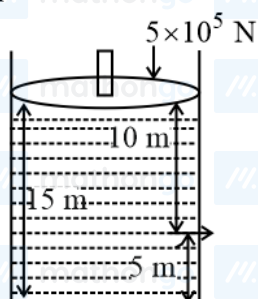
- (1) 300 N
- (2) 500 N
- (3) 250 N
- (4) 400 N

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Q181. JEE Main 2022 (28 Jul Shift 2)

Consider a cylindrical tank of radius 1 m is filled with water. The top surface of water is at 15 m from the bottom of the cylinder. There is a hole on the wall of cylinder at a height of 5 m from the bottom. A force of 5×10^5 N is applied on the top surface of water using a piston. The speed of efflux from the hole will be: (given atmospheric pressure $P_A = 1.01 \times 10^5$ Pa, density of water $\rho_w = 1000$ kg m⁻³ and gravitational acceleration $g = 10$ m s⁻²)



- (1) 11.6 m s^{-1} (2) 10.8 m s^{-1}
 (3) 17.8 m s^{-1} (4) 14.4 m s^{-1}

Q182. JEE Main 2022 (27 Jun Shift 1)

The velocity of a small ball of mass m and density d_1 , when dropped in a container filled with glycerine, becomes constant after some time. If the density of glycerine is d_2 , then the viscous force acting on the ball, will be

- (1) $mg\left(1 - \frac{d_1}{d_2}\right)$ (2) $mg\left(1 - \frac{d_2}{d_1}\right)$
 (3) $mg\left(\frac{d_1}{d_2} - 1\right)$ (4) $mg\left(\frac{d_2}{d_1} - 1\right)$

Q183. JEE Main 2022 (26 Jul Shift 1)

A water drop of radius 1 cm is broken into 729 equal droplets. If surface tension of water is 75 dyne cm^{-1} , then the gain in surface energy upto first decimal place will be [Given $\pi = 3.14$]

- (1) $8.5 \times 10^{-4} \text{ J}$ (2) $8.2 \times 10^{-4} \text{ J}$
 (3) $7.5 \times 10^{-4} \text{ J}$ (4) $5.3 \times 10^{-4} \text{ J}$

Q184. JEE Main 2021 (24 Feb Shift 1)

A hydraulic press can lift 100 kg when a mass m is placed on the smaller piston. It can lift kg when the diameter of the larger piston is increased by 4 times and that of the smaller piston is decreased by 4 times keeping the same mass m on the smaller piston.

Q185. JEE Main 2020 (09 Jan Shift 2)

A small spherical droplet of density d is floating exactly half immersed in a liquid of density ρ and surface tension T . The radius of the droplet is (take note that the surface tension applies an upward force on the droplet):

- (1) $r = \sqrt{\frac{2T}{3(d+\rho)g}}$ (2) $r = \sqrt{\frac{T}{(d-\rho)g}}$
 (3) $r = \sqrt{\frac{T}{(d+\rho)g}}$ (4) $r = \sqrt{\frac{3T}{(2d-\rho)g}}$

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Q186. JEE Main 2020 (06 Sep Shift 2)

A fluid is flowing through a horizontal pipe of varying cross-section, with $v \text{ ms}^{-1}$ at a point where the pressure is P Pascal. At another point where pressure $\frac{P}{2}$ Pascal its speed is $V \text{ ms}^{-1}$. If the density of the fluid is $\rho \text{ kg m}^{-3}$ and the flow is streamline, then V is equal to

- (1) $\sqrt{\frac{P}{\rho} + v}$ (2) $\sqrt{\frac{2P}{\rho} + v^2}$
 (3) $\sqrt{\frac{P}{2\rho} + v^2}$ (4) $\sqrt{\frac{P}{\rho} + v^2}$

Q187. JEE Main 2020 (03 Sep Shift 1)

When a long glass capillary tube of radius 0.015 cm is dipped in a liquid, the liquid rises to a height of 15 cm within it. If the contact angle between the liquid and glass is close to 0° , the surface tension of the liquid, in $\text{milliNewton m}^{-1}$, is $[\rho_{(\text{liquid})} = 900 \text{ kg m}^{-3}, g = 10 \text{ m s}^{-2}]$ (Given answer in closed integer)

Chapter: Oscillations**Q188. JEE Main 2025 (8 April Shift 2)**

The amplitude and phase of a wave that is formed by the superposition of two harmonic travelling waves, $y_1(x, t) = 4 \sin(kx - \omega t)$ and $y_2(x, t) = 2 \sin(kx - \omega t + \frac{2\pi}{3})$, are :

(Take the angular frequency of initial waves same as ω)

- (1) $[6, \frac{2\pi}{3}]$ (2) $[6, \frac{\pi}{3}]$
 (3) $[\sqrt{3}, \frac{\pi}{6}]$ (4) $[2\sqrt{3}, \frac{\pi}{6}]$

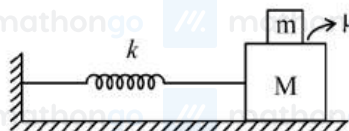
Q189. JEE Main 2025 (4 April Shift 1)

Two simple pendulums having lengths l_1 and l_2 with negligible string mass undergo angular displacements θ_1 and θ_2 , from their mean positions, respectively. If the angular accelerations of both pendulums are same, then which expression is correct?

- (1) $\theta_1 l_2^2 = \theta_2 l_1^2$ (2) $\theta_1 l_1 = \theta_2 l_2$
 (3) $\theta_1 l_1^2 = \theta_2 l_2^2$ (4) $\theta_1 l_2 = \theta_2 l_1$

Q190. JEE Main 2025 (3 April Shift 1)

Two blocks of masses m and M , ($M > m$), are placed on a frictionless table as shown in figure. A massless spring with spring constant k is attached with the lower block. If the system is slightly displaced and released then (μ = coefficient of friction between the two blocks)



- (A) The time period of small oscillation of the two blocks is $T = 2\pi\sqrt{\frac{(m+M)}{k}}$
 (B) The acceleration of the blocks is $a = \frac{kx}{M+m}$ (x = displacement of the blocks from the mean position)
 (C) The magnitude of the frictional force on the upper block is $\frac{m\mu|x|}{M+m}$
 (D) The maximum amplitude of the upper block, if it does not slip, is $\frac{\mu(M+m)g}{k}$
 (E) Maximum frictional force can be $\mu(M+m)g$.

Choose the correct answer from the options given below:

- (1) A, B, D Only
 (2) B, C, D Only
 (3) C, D, E Only
 (4) A, B, C Only

Q191. JEE Main 2025 (28 Jan Shift 2)

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

Assertion (A) : Knowing initial position x_0 and initial momentum p_0 is enough to determine the position and momentum at any time t for a simple harmonic motion with a given angular frequency ω .

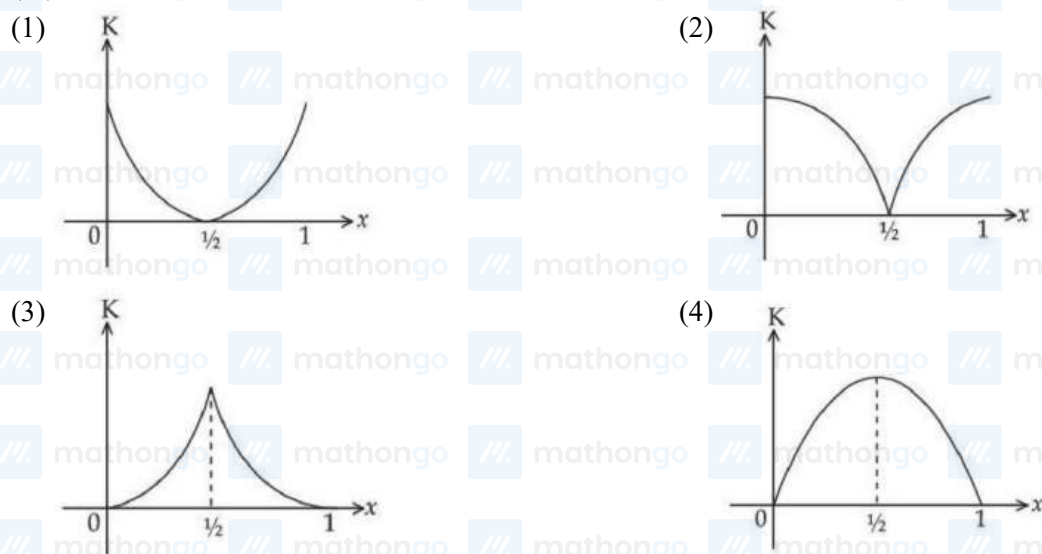
Reason (R): The amplitude and phase can be expressed in terms of x_0 and p_0 .

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

- (1) (A) is false but (R) is true
 (2) (A) is true but (R) is false
 (3) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
 (4) Both (A) and (R) are true and (R) is the correct explanation of (A)

Q192. JEE Main 2025 (24 Jan Shift 2)

A particle oscillates along the x -axis according to the law, $x(t) = x_0 \sin^2\left(\frac{t}{2}\right)$ where $x_0 = 1$ m. The kinetic energy (K) of the particle as a function of x is correctly represented by the graph

**Q193. JEE Main 2025 (24 Jan Shift 1)**

A particle is executing simple harmonic motion with time period 2 s and amplitude 1 cm. If D and d are the total distance and displacement covered by the particle in 12.5 s, then $\frac{D}{d}$ is

- (1) $\frac{16}{5}$ (2) 10
(3) $\frac{15}{4}$ (4) 25

Q194. JEE Main 2025 (23 Jan Shift 1)

A light hollow cube of side length 10 cm and mass 10 g, is floating in water. It is pushed down and released to execute simple harmonic oscillations. The time period of oscillations is $y\pi \times 10^{-2}$ s, where the value of y is

(Acceleration due to gravity, $g = 10$ m/s², density of water = 10^3 kg/m³)

- (1) 6 (2) 2
(3) 4 (4) 1

Q195. JEE Main 2025 (22 Jan Shift 2)

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

Assertion (A) : A simple pendulum is taken to a planet of mass and radius, 4 times and 2 times, respectively, than the Earth. The time period of the pendulum remains same on earth and the planet.

Reason (R): The mass of the pendulum remains unchanged at Earth and the other planet.

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

- (1) (A) is false but (R) is true
(2) (A) is true but (R) is false
(3) Both (A) and (R) are true and (R) is the correct explanation of (A)
(4) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

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Q196. JEE Main 2024 (30 Jan Shift 2)

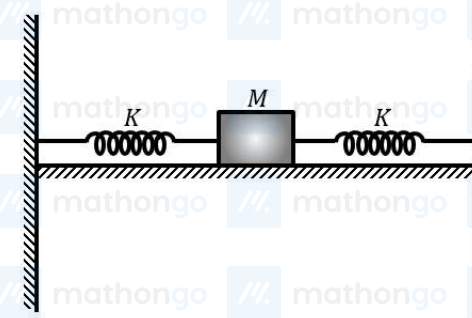
A simple pendulum is placed at a place where its distance from the earth's surface is equal to the radius of the earth. If the length of the string is 4 m, then the time period of small oscillations will be _____ s.
[take $g = \pi^2 \text{ m s}^{-2}$]

Q197. JEE Main 2024 (09 Apr Shift 1)

The position, velocity and acceleration of a particle executing simple harmonic motion are found to have magnitudes of 4 m, 2 ms^{-1} and 16 ms^{-2} at a certain instant. The amplitude of the motion is \sqrt{x} , m where x is _____

Q198. JEE Main 2023 (31 Jan Shift 1)

In the figure given below, a block of mass $M = 490 \text{ g}$ placed on a frictionless table is connected with two springs having same spring constant ($K = 2 \text{ N m}^{-1}$). If the block is horizontally displaced through X m then the number of complete oscillations it will make in 14π seconds will be _____.

**Q199. JEE Main 2022 (28 Jul Shift 2)**

The potential energy of a particle of mass 4 kg in motion along the x -axis is given by $U = 4(1 - \cos 4x)$ J. The time period of the particle for small oscillation ($\sin \theta \simeq \theta$) ($\frac{\pi}{K}$) s. The value of K is _____.

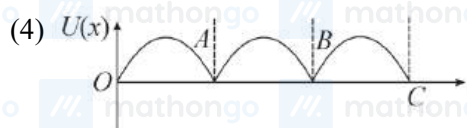
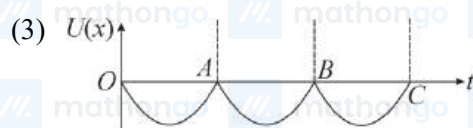
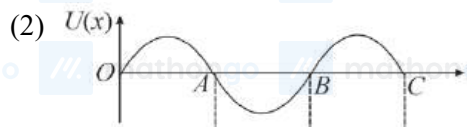
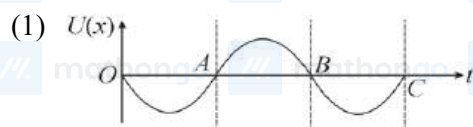
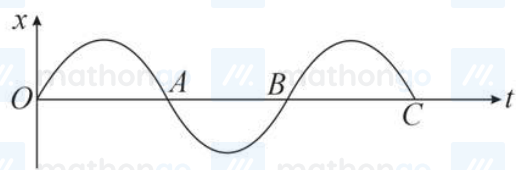
Q200. JEE Main 2021 (27 Aug Shift 2)

Two simple harmonic motion, are represented by the equations

$y_1 = 10 \sin(3\pi t + \frac{\pi}{3})$; $y_2 = 5(\sin 3\pi t + \sqrt{3} \cos 3\pi t)$. Ratio of amplitude of y_1 to $y_2 = x : 1$. The value of x is

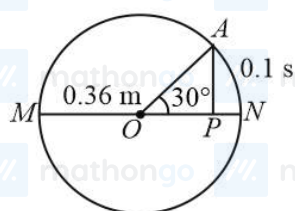
Q201. JEE Main 2021 (27 Aug Shift 1)

The variation of displacement with time of a particle executing free simple harmonic motion is shown in the figure. The potential energy $U(x)$ versus time (t) plot of the particle is correctly shown in figure:


Q202. JEE Main 2021 (25 Feb Shift 2)

The point A moves with a uniform speed along the circumference of a circle of radius 0.36 m and covers 30° in 0.1 s . The perpendicular projection P from A on the diameter MN represents the simple harmonic motion of P .

The restoration force per unit mass when P touches M will be :



(1) 0.49 N

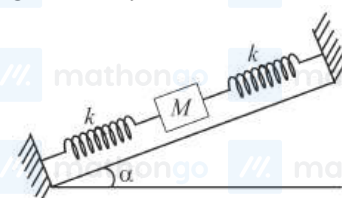
(2) 9.87 N

(3) 50 N

(4) 100 N

Q203. JEE Main 2021 (24 Feb Shift 2)

In the given figure, a body of mass M is held between two massless springs, on a smooth inclined plane. The free ends of the springs are attached to firm supports. If each spring has spring constant k , the frequency of oscillation of given body is:



(1) $\frac{1}{2\pi} \sqrt{\frac{2k}{Mg \sin \alpha}}$

(2) $\frac{1}{2\pi} \sqrt{\frac{k}{Mg} \sin \alpha}$

(3) $\frac{1}{2\pi} \sqrt{\frac{k}{2M}}$

(4) $\frac{1}{2\pi} \sqrt{\frac{2k}{M}}$

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Q204. JEE Main 2021 (20 Jul Shift 2)

A particle is making simple harmonic motion along the X -axis. If at distances x_1 and x_2 from the mean position the velocities of the particle are v_1 and v_2 , respectively. The time period of its oscillation is given as:

$$(1) T = 2\pi\sqrt{\frac{x_2^2 + x_1^2}{v_1^2 - v_2^2}}$$

$$(2) T = 2\pi\sqrt{\frac{x_2^2 - x_1^2}{v_1^2 + v_2^2}}$$

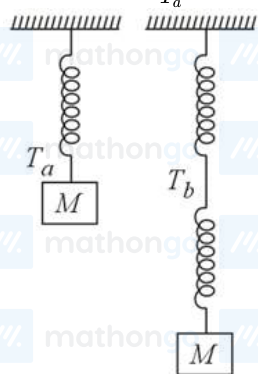
$$(3) T = 2\pi\sqrt{\frac{x_2^2 - x_1^2}{v_1^2 + v_2^2}}$$

$$(4) T = 2\pi\sqrt{\frac{x_2^2 + x_1^2}{v_1^2 - v_2^2}}$$

Q205. JEE Main 2021 (17 Mar Shift 1)

Consider two identical springs each of spring constant k and negligible mass compared to the mass M as shown.

Fig. 1 shows one of them and Fig. 2 shows their series combination. The ratios of time period of oscillation of the two SHM is $\frac{T_b}{T_a} = \sqrt{x}$, where value of x is _____. (Round off to the Nearest Integer)

**Chapter: Waves and Sound****Q206. JEE Main 2025 (8 April Shift 2)**

Two strings with circular cross section and made of same material, are stretched to have same amount of tension. A transverse wave is then made to pass through both the strings. The velocity of the wave in the first string having the radius of cross section R is v_1 , and that in the other string having radius of cross section $R/2$ is v_2 . Then $\frac{v_2}{v_1} =$

$$(1) \sqrt{2}$$

$$(2) 2$$

$$(3) 8$$

$$(4) 4$$

Q207. JEE Main 2025 (7 April Shift 1)

Two harmonic waves moving in the same direction superimpose to form a wave $x = a \cos(1.5t) \cos(50.5t)$ where t is in seconds. Find the period with which they beat (close to nearest integer)

$$(1) 6 \text{ s}$$

$$(2) 4 \text{ s}$$

$$(3) 1 \text{ s}$$

$$(4) 2 \text{ s}$$

Q208. JEE Main 2025 (4 April Shift 2)

Displacement of a wave is expressed as $x(t) = 5 \cos \left(628t + \frac{\pi}{2} \right) m$. The wavelength of the wave when its velocity is 300 m/s is :

- (1) 5 m (2) 3 m
(3) 0.5 m (4) 0.33 m

Q209. JEE Main 2025 (3 April Shift 2)

In the resonance experiment, two air columns (closed at one end) of 100 cm and 120 cm long, give 15 beats per second when each one is sounding in the respective fundamental modes. The velocity of sound in the air column is :

- (1) 335 m/s (2) 370 m/s
(3) 340 m/s (4) 360 m/s

Q210. JEE Main 2025 (28 Jan Shift 1)

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

Assertion A: A sound wave has higher speed in solids than gases.

Reason R: Gases have higher value of Bulk modulus than solids.

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

- (1) Both A and R are true but R is NOT the correct explanation of A
(2) A is true but R is false
(3) A is false but R is true
(4) Both A and R are true and R is the correct explanation of A

Q211. JEE Main 2025 (22 Jan Shift 1)

A closed organ and an open organ tube are filled by two different gases having same bulk modulus but different densities ρ_1 and ρ_2 , respectively. The frequency of 9th harmonic of closed tube is identical with 4th harmonic of open tube. If the length of the closed tube is 10 cm and the density ratio of the gases is $\rho_1 : \rho_2 = 1 : 16$, then the length of the open tube is :

- (1) $\frac{15}{7}$ cm (2) $\frac{20}{7}$ cm
(3) $\frac{15}{9}$ cm (4) $\frac{20}{9}$ cm

Q212. JEE Main 2022 (28 Jun Shift 1)

The velocity of sound in a gas, in which two wavelengths 4.08 m and 4.16 m produce 40 beats in 12 s, will be

- (1) 282.8 m s^{-1} (2) 175.5 m s^{-1}
(3) 353.6 m s^{-1} (4) 707.2 m s^{-1}

Q213. JEE Main 2022 (26 Jun Shift 2)

A set of 20 tuning forks is arranged in a series of increasing frequencies. If each fork gives 4 beats with respect to the preceding fork and the frequency of the last fork is twice the frequency of the first, then the frequency of last fork is _____ Hz.

Q214. JEE Main 2022 (26 Jul Shift 2)

A transverse wave is represented by $y = 2 \sin(\omega t - kx)$ cm. The value of wavelength (in cm) for which the wave velocity becomes equal to the maximum particle velocity, will be

- (1) 4π (2) 2π
(3) π (4) 2

Q215. JEE Main 2022 (25 Jun Shift 1)

The first overtone frequency of an open organ pipe is equal to the fundamental frequency of a closed organ pipe. If the length of the closed organ pipe is 20 cm. The length of the open organ pipe is _____ cm

Q216. JEE Main 2021 (31 Aug Shift 1)

A wire having a linear mass density $9.0 \times 10^{-4} \text{ kg m}^{-1}$ is stretched between two rigid supports with a tension of 900 N. The wire resonates at a frequency of 500 Hz. The next higher frequency at which the same wire resonates is 550 Hz. The length of the wire is _____ m.

Q217. JEE Main 2021 (26 Aug Shift 1)

Two travelling waves produces a standing wave represented by equation.

$y = (1.0 \text{ mm}) \cos[(1.57 \text{ cm}^{-1})x] \sin[(78.5 \text{ s}^{-1})t]$. The node closest to the origin in the region $x > 0$ will be at $x = \dots\dots$ (in cm).

Q218. JEE Main 2021 (20 Jul Shift 1)

The amplitude of wave disturbance propagating in the positive x -direction is given by $y = \frac{1}{(1+x)^2}$ at time $t = 0$ and $y = \frac{1}{1+(x-2)^2}$ at $t = 1 \text{ s}$, where x and y are in metres. The shape of wave does not change during the propagation.

The velocity of the wave will be m s^{-1} .

Q219. JEE Main 2020 (05 Sep Shift 1)

In a resonance tube experiment when the tube is filled with water up to a height of 17.0 cm, from bottom, it resonates with a given tuning fork. When the water level is raised the next resonance with the same tuning fork occurs at a height of 24.5 cm. If the velocity of sound in air is 330 m s^{-1} , the tuning fork frequency is :

- (1) 2200 Hz (2) 550 Hz
(3) 1100 Hz (4) 3300 Hz

Chapter: Thermal Properties of Matter**Q220. JEE Main 2025 (8 April Shift 2)**

Water falls from a height of 200 m into a pool. Calculate the rise in temperature of the water assuming no heat dissipation from the water in the pool.

(Take $g = 10 \text{ m/s}^2$, specific heat of water = 4200 J/(kgK))

- (1) 0.23 K (2) 0.36 K
(3) 0.14 K (4) 0.48 K

Q221. JEE Main 2025 (7 April Shift 2)

Two cylindrical rods A and B made of different materials, are joined in a straight line. The ratio of lengths, radii and thermal conductivities of these rods are :

$\frac{L_A}{L_B} = \frac{1}{2}$, $\frac{r_A}{r_B} = 2$ and $\frac{K_A}{K_B} = \frac{1}{2}$. The free ends of rods A and B are maintained at 400 K, 200 K, respectively. The temperature of rods interface is _____ K, when equilibrium is established.

Q222. JEE Main 2025 (7 April Shift 1)

A wire of length 10 cm and diameter 0.5 mm is used in a bulb. The temperature of the wire is 1727°C and power radiated by the wire is 94.2 W. Its emissivity is $\frac{x}{8}$ where $x =$ _____

(Given $\sigma = 6.0 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$, $\pi = 3.14$ and assume that the emissivity of wire material is same at all wavelength.)

Q223. JEE Main 2025 (29 Jan Shift 2)

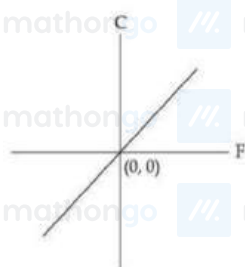
A cup of coffee cools from 90°C to 80°C in t minutes when the room temperature is 20°C . The time taken by the similar cup of coffee to cool from 80°C to 60°C at the same room temperature is :

- (1) $\frac{13}{10}t$ (2) $\frac{10}{13}t$
(3) $\frac{5}{13}t$ (4) $\frac{13}{5}t$

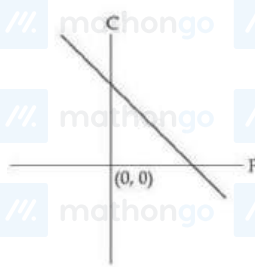
Q224. JEE Main 2025 (24 Jan Shift 2)

Which of the following figure represents the relation between Celsius and Fahrenheit temperatures ?

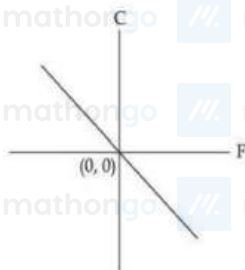
(1)



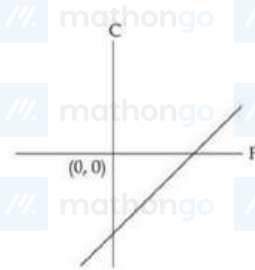
(2)



(3)



(4)

**Q225. JEE Main 2025 (23 Jan Shift 1)**

A gun fires a lead bullet of temperature 300 K into a wooden block. The bullet having melting temperature of 600 K penetrates into the block and melts down. If the total heat required for the process is 625 J, then the mass of the bullet is _____ grams.

(Latent heat of fusion of lead = $2.5 \times 10^4 \text{ J Kg}^{-1}$ and specific heat capacity of lead = $125 \text{ J Kg}^{-1} \text{ K}^{-1}$)

(1) 10

(2) 20

(3) 5

(4) 15

Q226. JEE Main 2024 (31 Jan Shift 1)

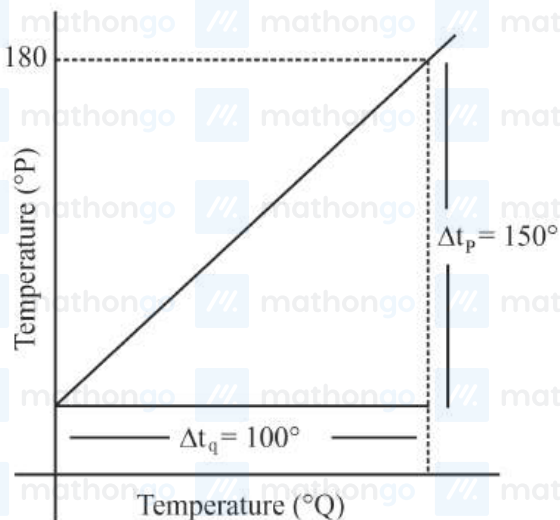
Two conductors have the same resistances at 0°C but their temperature coefficients of resistance are α_1 and α_2 .

The respective temperature coefficients for their series and parallel combinations are :

(1) $\alpha_1 + \alpha_2, \frac{\alpha_1 + \alpha_2}{2}$ (2) $\frac{\alpha_1 + \alpha_2}{2}, \frac{\alpha_1 + \alpha_2}{2}$ (3) $\alpha_1 + \alpha_2, \frac{\alpha_1 \alpha_2}{\alpha_1 + \alpha_2}$ (4) $\frac{\alpha_1 + \alpha_2}{2}, \alpha_1 + \alpha_2$

Q227. JEE Main 2023 (25 Jan Shift 2)

The graph between two temperature scales P and Q is shown in the figure. Between upper fixed point and lower fixed point there are 150 equal divisions of scale P and 100 divisions on scale Q . The relationship for conversion between the two scales is given by :



- (1) $\frac{t_Q}{150} = \frac{t_P - 180}{100}$ (2) $\frac{t_Q}{100} = \frac{t_P - 30}{150}$ (3) $\frac{t_P}{180} = \frac{t_Q - 40}{100}$ (4) $\frac{t_Q}{100} = \frac{t_P - 180}{150}$

Q228. JEE Main 2022 (29 Jun Shift 2)

At what temperature a gold ring of diameter 6.230 cm be heated so that it can be fitted on a wooden bangle of diameter 6.241 cm? Both the diameters have been measured at room temperature (27°C). (Given: coefficient of linear thermal expansion of gold $\alpha_L = 1.4 \times 10^{-5} \text{ K}^{-1}$)

- (1) 125.7°C (2) 91.7°C
(3) 425.7°C (4) 152.7°C

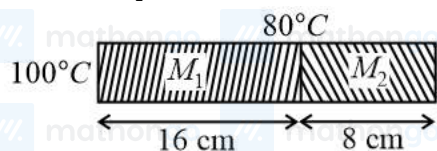
Q229. JEE Main 2022 (25 Jul Shift 1)

A unit scale is to be prepared whose length does not change with temperature and remains 20 cm, using a bimetallic strip made of brass and iron each of different length. The length of both components would change in such a way that difference between their lengths remains constant. If length of brass is 40 cm and length of iron will be _____ cm.

($\alpha_{\text{iron}} = 1.2 \times 10^{-5} \text{ K}^{-1}$ and $\alpha_{\text{brass}} = 1.8 \times 10^{-5} \text{ K}^{-1}$).

Q230. JEE Main 2022 (24 Jun Shift 1)

Two metallic blocks M_1 and M_2 of same area of cross-section are connected to each other (as shown in figure). If the thermal conductivity of M_2 is K then the thermal conductivity of M_1 will be : [Assume steady state heat conduction]



- (1) $10K$ (2) $8K$
 (3) $12.5K$ (4) $2K$

Q231. JEE Main 2020 (03 Sep Shift 2)

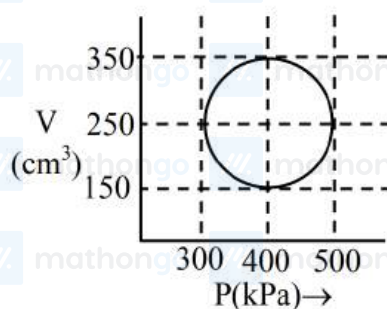
A calorimeter of water equivalent 20 g contains 180 g of water at 25°C . 'm' grams of steam at 100°C is mixed in it till the temperature of the mixture is 31°C . The value of 'm' is close to (Latent heat of water = 540 cal g^{-1} , specific heat of water = $1\text{ cal g}^{-1}\text{C}^{-1}$)

- (1) 2 (2) 4
 (3) 3.2 (4) 2.6

Chapter: Thermodynamics**Q232. JEE Main 2025 (7 April Shift 1)**

An ideal gas has undergone through the cyclic process as shown in the figure. Work done by the gas in the entire cycle is _____ $\times 10^{-1}\text{ J}$.

(Take $\pi = 3.14$)



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Q233. JEE Main 2025 (4 April Shift 2)

Match List-I with List-II.

	List - I		List - II
(A)	Isobaric	(I)	$\Delta Q = \Delta W$
(B)	Isochoric	(II)	$\Delta Q = \Delta U$
(C)	Adiabatic	(III)	$\Delta Q = \text{zero}$
(D)	Isothermal	(IV)	$\Delta Q = \Delta U + P\Delta V$

 ΔQ = Heat supplied ΔW = Work done by the system ΔU = Change in internal energy P = Pressure of the system ΔV = Change in volume of the system

Choose the correct answer from the options given below:

(1) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)

(2) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)

(3) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

(4) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)

Q234. JEE Main 2025 (3 April Shift 2)

Pressure of an ideal gas, contained in a closed vessel, is increased by 0.4% when heated by 1°C . Its initial temperature must be :

(1) 25°C

(2) 2500 K

(3) 250 K

(4) 250°C **Q235. JEE Main 2025 (29 Jan Shift 2)**

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

Assertion (A) : With the increase in the pressure of an ideal gas, the volume falls off more rapidly in an isothermal process in comparison to the adiabatic process.

Reason (R) : In isothermal process, $PV = \text{constant}$, while in adiabatic process $PV^\gamma = \text{constant}$. Here γ is the ratio of specific heats, P is the pressure and V is the volume of the ideal gas.

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

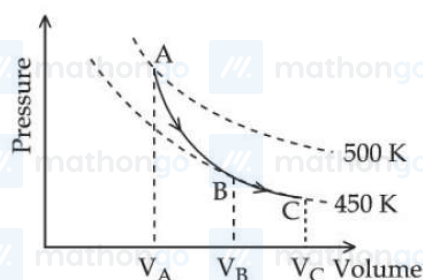
(1) Both (A) and (R) are true and (R) is the correct explanation of (A)

(2) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

(3) (A) is true but (R) is false

(4) (A) is false but (R) is true

Q236. JEE Main 2025 (29 Jan Shift 2)



A poly-atomic molecule ($C_V = 3R, C_P = 4R$, where R is gas constant) goes from phase space point A ($P_A = 10^5 \text{ Pa}, V_A = 4 \times 10^{-6} \text{ m}^3$) to point B ($P_B = 5 \times 10^4 \text{ Pa}, V_B = 6 \times 10^{-6} \text{ m}^3$) to point C ($P_C = 10^4 \text{ Pa}, V_C = 8 \times 10^{-6} \text{ m}^3$). A to B is an adiabatic path and B to C is an isothermal path.

The net heat absorbed per unit mole by the system is :

- (1) $500R(\ln 3 + \ln 4)$ (2) $450R(\ln 4 - \ln 3)$
 (3) $500R \ln 2$ (4) $400R \ln 4$

Q237. JEE Main 2025 (29 Jan Shift 1)

A container of fixed volume contains a gas at 27°C . To double the pressure of the gas, the temperature of gas should be raised to _____ $^\circ\text{C}$.

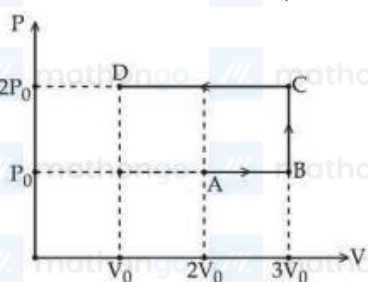
Q238. JEE Main 2025 (28 Jan Shift 1)

A Carnot engine (E) is working between two temperatures 473 K and 273 K. In a new system two engines - engine E_1 works between 473 K to 373 K and engine E_2 works between 373 K to 273 K.

If η_{12} , η_1 and η_2 are the efficiencies of the engines E, E_1 and E_2 , respectively, then

- (1) $\eta_{12} = \eta_1 \eta_2$ (2) $\eta_{12} \geq \eta_1 + \eta_2$
 (3) $\eta_{12} = \eta_1 + \eta_2$ (4) $\eta_{12} < \eta_1 + \eta_2$

Q239. JEE Main 2025 (23 Jan Shift 2)



Using the given P - V diagram, the work done by an ideal gas along the path ABCD is :

- (1) $3P_0 V_0$ (2) $-4P_0 V_0$
 (3) $-3P_0 V_0$ (4) $4P_0 V_0$

Q240. JEE Main 2025 (23 Jan Shift 2)

Water of mass m gram is slowly heated to increase the temperature from T_1 to T_2 . The change in entropy of the water, given specific heat of water is $1\text{Jkg}^{-1}\text{K}^{-1}$, is :

- (1) $m \ln \left(\frac{T_2}{T_1} \right)$ (2) zero
(3) $m \ln \left(\frac{T_1}{T_2} \right)$ (4) $m (T_2 - T_1)$

Q241. JEE Main 2025 (23 Jan Shift 1)

An ideal gas initially at 0°C temperature is compressed suddenly to one fourth of its volume. If the ratio of specific heat at constant pressure to that at constant volume is $3/2$, the change in temperature due to the thermodynamics process is _____ K.

Q242. JEE Main 2025 (22 Jan Shift 2)

Given are statements for certain thermodynamic variables,

- (A) Internal energy, volume (V) and mass (M) are extensive variables.
(B) Pressure (P), temperature (T) and density (ρ) are intensive variables.
(C) Volume (V), temperature (T) and density (ρ) are intensive variables.
(D) Mass (M), temperature (T) and internal energy are extensive variables.

Choose the correct answer from the options given below :

- (1) (B) and (C) Only (2) (C) and (D) Only
(3) (D) and (A) Only (4) (A) and (B) Only

Q243. JEE Main 2025 (22 Jan Shift 2)

For a diatomic gas, if $\gamma_1 = \left(\frac{C_p}{C_v} \right)$ for rigid molecules and $\gamma_2 = \left(\frac{C_p}{C_v} \right)$ for another diatomic molecules, but also having vibrational modes. Then, which one of the following options is correct ? (C_p and C_v are specific heats of the gas at constant pressure and volume)

- (1) $\gamma_2 = \gamma_1$ (2) $2\gamma_2 = \gamma_1$
(3) $\gamma_2 < \gamma_1$ (4) $\gamma_2 > \gamma_1$

Q244. JEE Main 2025 (2 April Shift 2)

The internal energy of air in $4\text{ m} \times 4\text{ m} \times 3\text{ m}$ sized room at 1 atmospheric pressure will be _____ $\times 10^6\text{ J}$.
(Consider air as diatomic molecule)

Q245. JEE Main 2025 (2 April Shift 1)

In an adiabatic process, which of the following statements is true?

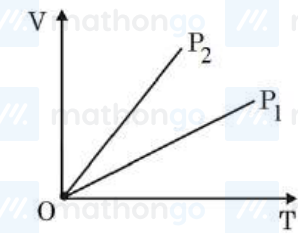
- (1) The molar heat capacity is infinite
(2) Work done by the gas equals the increase in internal energy
(3) The molar heat capacity is zero
(4) The internal energy of the gas decreases as the temperature increases

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Q246. JEE Main 2024 (31 Jan Shift 1)

The given figure represents two isobaric processes for the same mass of an ideal gas, then



(1) $P_2 \geq P_1$

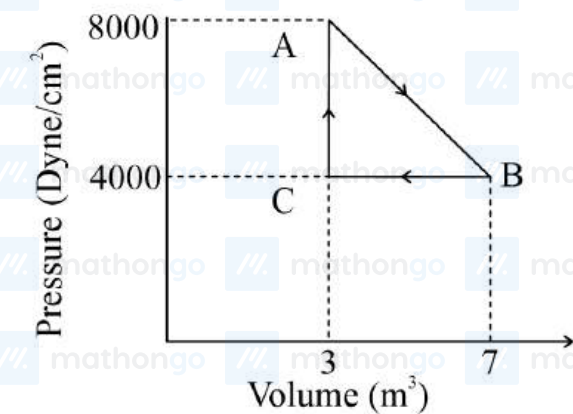
(2) $P_2 > P_1$

(3) $P_1 = P_2$

(4) $P_1 > P_2$

Q247. JEE Main 2024 (29 Jan Shift 1)

A thermodynamic system is taken from an original state A to an intermediate state B by a linear process as shown in the figure. Its volume is then reduced to the original value from B to C by an isobaric process. The total work done by the gas from A to B and B to C would be :



(1) 33800 J

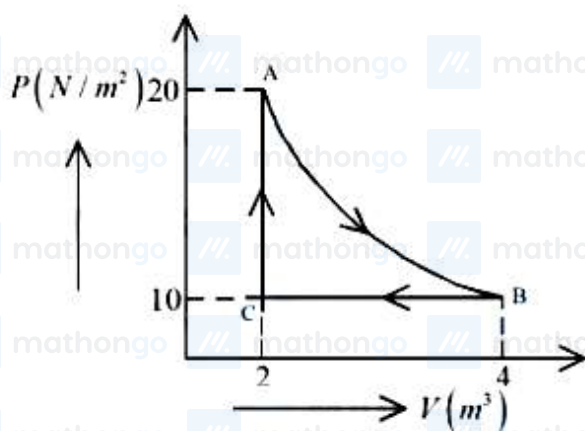
(2) 2200 J

(3) 600 J

(4) 800 J

Q248. JEE Main 2024 (09 Apr Shift 2)

A real gas within a closed chamber at 27°C undergoes the cyclic process as shown in figure. The gas obeys $PV^3 = RT$ equation for the path A to B . The net work done in the complete cycle is (assuming $R = 8 \text{ J/molK}$):



- (1) 20 J (2) 205 J (3) -20 J (4) 225 J

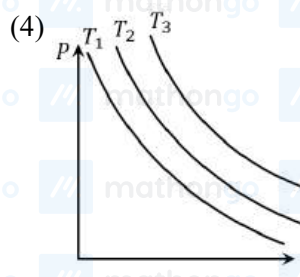
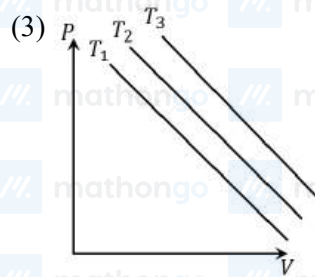
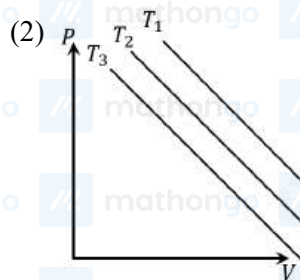
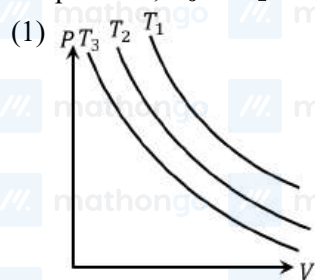
Q249. JEE Main 2024 (09 Apr Shift 1)

A sample of 1 mole gas at temperature T is adiabatically expanded to double its volume. If adiabatic constant for the gas is $\gamma = \frac{3}{2}$, then the work done by the gas in the process is:

- (1) $\frac{R}{T} [2 - \sqrt{2}]$ (2) $\frac{T}{R} [2 + \sqrt{2}]$
 (3) $RT [2 - \sqrt{2}]$ (4) $RT [2 + \sqrt{2}]$

Q250. JEE Main 2023 (24 Jan Shift 2)

In an Isothermal change, the change in pressure and volume of a gas can be represented for three different temperature; $T_3 > T_2 > T_1$ as:



Q251. JEE Main 2023 (24 Jan Shift 2)

Let γ_1 be the ratio of molar specific heat at constant pressure and molar specific heat at constant volume of a monoatomic gas and γ_2 be the similar ratio of diatomic gas. Considering the diatomic gas molecule as a rigid rotator, the ratio $\frac{\gamma_1}{\gamma_2}$ is:

- (1) $\frac{27}{35}$ (2) $\frac{35}{27}$ (3) $\frac{25}{21}$ (4) $\frac{21}{25}$

Q252. JEE Main 2022 (28 Jul Shift 2)

At a certain temperature, the degrees of freedom per molecule for gas is 8. The gas performs 150 J of work when it expands under constant pressure. The amount of heat absorbed by the gas will be _____ J.

Q253. JEE Main 2021 (27 Jul Shift 2)

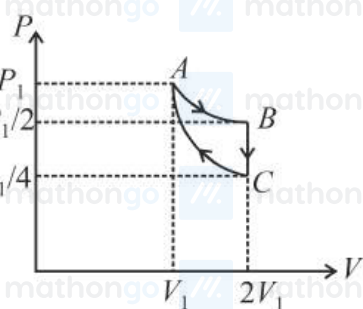
One mole of an ideal gas is taken through an adiabatic process where the temperature rises from 27°C to 37°C . If the ideal gas is composed of polyatomic molecule that has 4 vibrational modes, which of the following is true?

$$[R = 8.314 \text{ J mol}^{-1}\text{K}^{-1}]$$

- (1) work done by the gas is close to 332 J
 (2) work done on the gas is close to 582 J
 (3) work done by the gas is close to 582 J
 (4) work done on the gas is close to 332 J

Q254. JEE Main 2021 (24 Feb Shift 2)

If one mole of an ideal gas at (P_1, V_1) is allowed to expand reversibly and isothermally (A to B) its pressure is reduced to one-half of the original pressure (see figure). This is followed by a constant volume cooling till its pressure is reduced to one-fourth of the initial value ($B \rightarrow C$). Then it is restored to its initial state by a reversible adiabatic compression (C to A). The net workdone by the gas is equal to:



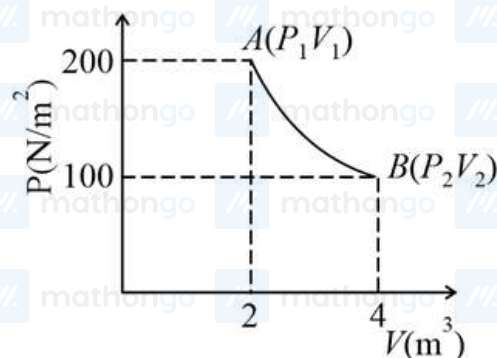
- (1) 0 (2) $RT \ln(2)$
 (3) $-\frac{RT}{2(\gamma-1)}$ (4) $RT \left[\ln(2) - \frac{1}{2(\gamma-1)} \right]$

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Q255. JEE Main 2021 (20 Jul Shift 2)

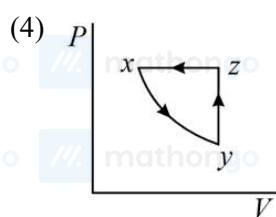
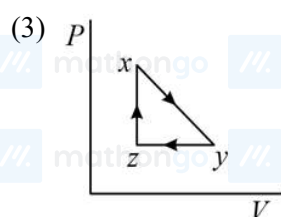
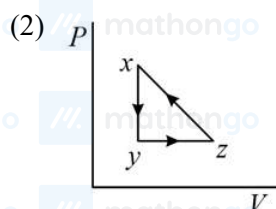
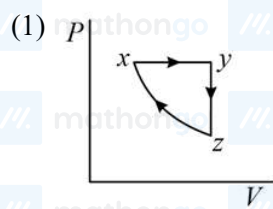
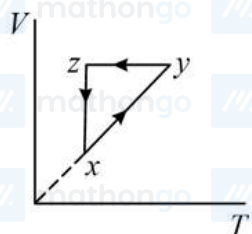
One mole of an ideal gas at 27°C is taken from A to B as shown in the given PV indicator diagram. The work done by the system will be $\underline{\hspace{2cm}} \times 10^{-1}$ J. [Given, $R = 8.3 \text{ J mole}^{-1} \text{ K}$, $\ln 2 = 0.6931$] (Round off to the nearest integer)

**Q256. JEE Main 2020 (09 Jan Shift 2)**

Starting at temperature 300K , one mole of an ideal diatomic gas ($\gamma = 1.4$) is first compressed adiabatically from volume V_1 to $V_2 = \frac{V_1}{16}$. It is then allowed to expand isobarically to volume $2V_2$. If all the processes are the quasi-static then the final temperature of the gas (in $^\circ\text{K}$) is (to the nearest integer) $\underline{\hspace{2cm}}$.

Q257. JEE Main 2020 (08 Jan Shift 1)

A thermodynamic cycle $xyzx$ is shown on a $V - T$ diagram. The $P - V$ diagram that best describes this cycle is: (Diagrams are schematic and not to scale)



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Chapter: Kinetic Theory of Gases**Q258. JEE Main 2025 (7 April Shift 1)**

Match the List – I with List – II

	List-I		List-II
A.	Triatomic rigid gas	I.	$\frac{C_P}{C_V} = \frac{5}{3}$
B.	Diatomic non-rigid gas	II.	$\frac{C_P}{C_V} = \frac{7}{5}$
C.	Monoatomic gas	III.	$\frac{C_P}{C_V} = \frac{4}{3}$
D.	Diatomic rigid gas	IV.	$\frac{C_P}{C_V} = \frac{9}{7}$

Choose the correct answer from the options given below :

- (1) A-III, B-IV, C-I, D-II
(2) A-III, B-II, C-IV, D-I
(3) A-II, B-IV, C-I, D-III
(4) A-IV, B-II, C-III, D-I

Q259. JEE Main 2025 (4 April Shift 1)

The mean free path and the average speed of oxygen molecules at 300 K and 1 atm are 3×10^{-7} m and 600 m/s respectively. Find the frequency of its collisions.

- (1) $2 \times 10^{10}/s$ (2) $9 \times 10^5/s$
(3) $2 \times 10^9/s$ (4) $5 \times 10^8/s$

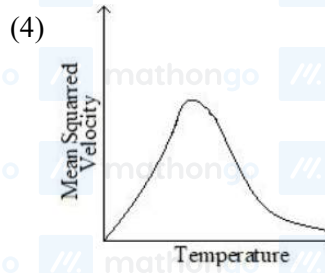
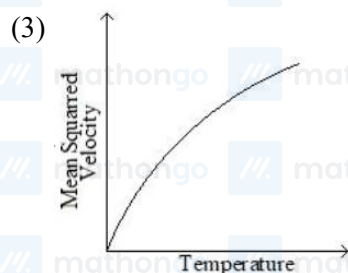
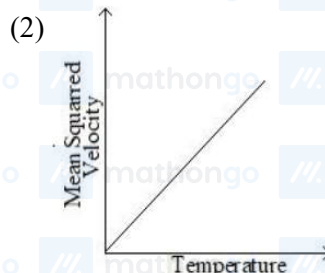
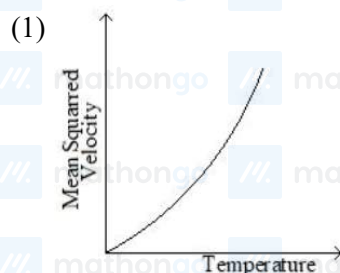
Q260. JEE Main 2025 (28 Jan Shift 2)

The kinetic energy of translation of the molecules in 50 g of CO_2 gas at 17°C is

- (1) 4205.5 J (2) 4102.8 J
(3) 3582.7 J (4) 3986.3 J

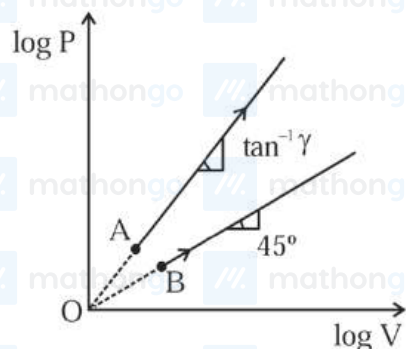
Q261. JEE Main 2025 (28 Jan Shift 1)

For a particular ideal gas which of the following graphs represents the variation of mean squared velocity of the gas molecules with temperature?

**Q262. JEE Main 2024 (30 Jan Shift 1)**

Two thermodynamical process are shown in the figure. The molar heat capacity for process A and B are C_A and C_B . The molar heat capacity at constant pressure and constant volume are represented by C_P and C_V , respectively.

Choose the correct statement.



- (1) $C_P > C_B > C_V$
- (2) $C_A = 0$ and $C_B = \infty$
- (3) $C_P > C_V > C_A = C_B$
- (4) $C_A > C_P > C_V$

Q263. JEE Main 2024 (05 Apr Shift 2)

If n is the number density and d is the diameter of the molecule, then the average distance covered by a molecule between two successive collisions (i.e. mean free path) is represented by :

- (1) $\sqrt{2}n\pi d^2$
- (2) $\frac{1}{\sqrt{2}n\pi d^2}$
- (3) $\frac{1}{\sqrt{2}n\pi d^2}$
- (4) $\frac{1}{\sqrt{2}n^2\pi^2 d^2}$

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Q264. JEE Main 2023 (06 Apr Shift 1)

The number of air molecules per cm^3 is increased from 3×10^{19} to 12×10^{19} . The ratio of collision frequency of air molecules before and after the increase in number respectively is :

- (1) 0.75 (2) 1.25
(3) 0.50 (4) 0.25

Q265. JEE Main 2022 (27 Jun Shift 1)

A mixture of hydrogen and oxygen has volume 2000 cm^3 , temperature 300 K , pressure 100 kPa and mass 0.76 g . The ratio of number of moles of hydrogen to number of moles of oxygen in the mixture will be [Take gas constant $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$]

- (1) $\frac{1}{3}$ (2) $\frac{3}{1}$ (3) $\frac{1}{16}$ (4) $\frac{16}{1}$

Q266. JEE Main 2022 (26 Jul Shift 2)

A gas has n degrees of freedom. The ratio of specific heat of gas at constant volume to the specific heat of gas at constant pressure will be

- (1) $\frac{n}{n+2}$ (2) $\frac{n+2}{n}$ (3) $\frac{n}{2n+2}$ (4) $\frac{n}{n-2}$

Q267. JEE Main 2021 (20 Jul Shift 1)

Consider a mixture of gas molecule of types A , B and C having masses $m_A < m_B < m_C$. The ratio of their root mean square speeds at normal temperature and pressure is:

- (1) $v_A = v_B = v_C = 0$ (2) $\frac{1}{v_A} > \frac{1}{v_B} > \frac{1}{v_C}$
(3) $v_A = v_B \neq v_C$ (4) $\frac{1}{v_A} < \frac{1}{v_B} < \frac{1}{v_C}$

Q268. JEE Main 2021 (17 Mar Shift 2)

If one mole of the polyatomic gas is having two vibrational modes and β is the ratio of molar specific heats for polyatomic gas $\left(\beta = \frac{C_p}{C_v}\right)$ then the value of β is :

- (1) 1.02 (2) 1.2 (3) 1.25 (4) 1.35

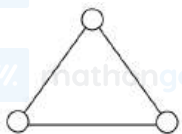
Q269. JEE Main 2021 (17 Mar Shift 1)

Two ideal polyatomic gases at temperatures T_1 and T_2 are mixed so that there is no loss of energy. If F_1 and F_2 , m_1 and m_2 , n_1 and n_2 be the degrees of freedom, masses, number of molecules of the first and second gas respectively, the temperature of mixture of these two gases is:

- (1) $\frac{n_1 T_1 + n_2 T_2}{n_1 + n_2}$ (2) $\frac{n_1 F_1 T_1 + n_2 F_2 T_2}{n_1 F_1 + n_2 F_2}$ (3) $\frac{n_1 F_1 T_1 + n_2 F_2 T_2}{F_1 + F_2}$ (4) $\frac{n_1 F_1 T_1 + n_2 F_2 T_2}{n_1 + n_2}$

Q270. JEE Main 2020 (03 Sep Shift 1)

Consider a gas of triatomic molecules. The molecules are assumed to be triangular and made of massless rigid rods whose vertices are occupied by atoms. The internal energy of a mole of the gas at temperature T is:



- (1) $\frac{5}{2}RT$ (2) $\frac{3}{2}RT$ (3) $\frac{9}{2}RT$ (4) $3RT$

Q271. JEE Main 2020 (02 Sep Shift 1)

A gas mixture consists of 3 moles of oxygen and 5 moles of argon at temperature T . Assuming the gases to be ideal and the oxygen bond to be rigid, the total internal energy (in units of RT) of the mixture is :

- (1) 15 (2) 13 (3) 20 (4) 11

Chapter: Electrostatics**Q272. JEE Main 2025 (8 April Shift 2)**

Two metal spheres of radius R and $3R$ have same surface charge density σ . If they are brought in contact and then separated, the surface charge density on smaller and bigger sphere becomes σ_1 and σ_2 , respectively. The ratio $\frac{\sigma_1}{\sigma_2}$ is.

- (1) $\frac{1}{9}$ (2) 9 (3) $\frac{1}{3}$ (4) 3

Q273. JEE Main 2025 (8 April Shift 2)

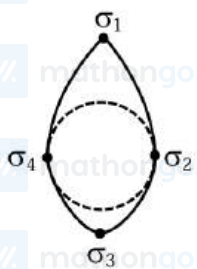
An infinitely long wire has uniform linear charge density $\lambda = 2\text{ nC/m}$. The net flux through a Gaussian cube of side length $\sqrt{3}\text{ cm}$, if the wire passes through any two corners of the cube, that are maximally displaced from each other, would be $x\text{ Nm}^2\text{ C}^{-1}$, where x is :

[Neglect any edge effects and use $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9\text{ SI units}$]

- (1) 0.72π (2) 1.44π (3) 6.48π (4) 2.16π

Q274. JEE Main 2025 (8 April Shift 2)

Electric charge is transferred to an irregular metallic disk as shown in figure. If $\sigma_1, \sigma_2, \sigma_3$ and σ_4 are charge densities at given points then, choose the correct answer from the options given below:



- (A) $\sigma_1 > \sigma_3$; $\sigma_2 = \sigma_4$ (B) $\sigma_1 > \sigma_2$; $\sigma_3 > \sigma_4$
 (C) $\sigma_1 > \sigma_3 > \sigma_2 = \sigma_4$ (D) $\sigma_1 < \sigma_3 < \sigma_2 = \sigma_4$
 (E) $\sigma_1 = \sigma_2 = \sigma_3 = \sigma_4$

- (1) A, B and C Only (2) A and C Only
 (3) D and E Only (4) B and C Only

Q275. JEE Main 2025 (8 April Shift 2)

An electron is released from rest near an infinite non-conducting sheet of uniform charge density ' $-\sigma$ '. The rate of change of de-Broglie wave length associated with the electron varies inversely as n^{th} power of time. The numerical value of n is _____.

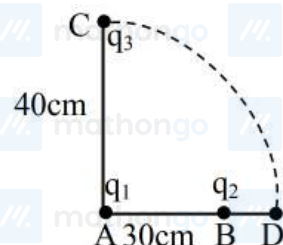
Q276. JEE Main 2025 (7 April Shift 2)

A dipole with two electric charges of $2\mu\text{C}$ magnitude each, with separation distance $0.5\mu\text{m}$, is placed between the plates of a capacitor such that its axis is parallel to an electric field established between the plates when a potential difference of 5V is applied. Separation between the plates is 0.5mm . If the dipole is rotated by 30° from the axis, it tends to realign in the direction due to a torque. The value of torque is :

- (1) $5 \times 10^{-9}\text{Nm}$ (2) $5 \times 10^{-3}\text{Nm}$
 (3) $2.5 \times 10^{-12}\text{Nm}$ (4) $2.5 \times 10^{-9}\text{Nm}$

Q277. JEE Main 2025 (7 April Shift 1)

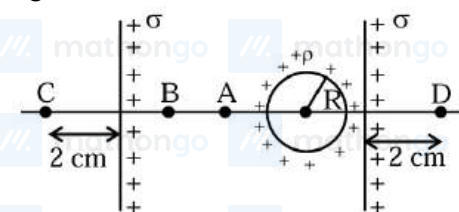
Two charges q_1 and q_2 are separated by a distance of 30 cm. A third charge q_3 initially at 'C' as shown in the figure, is moved along the circular path of radius 40 cm from C to D. If the difference in potential energy due to movement of q_3 from C to D is given by $\frac{q_3 K}{4\pi\epsilon_0}$, the value of K is :



- (1) $8q_2$ (2) $6q_2$
(3) $8q_1$ (4) $6q_1$

Q278. JEE Main 2025 (4 April Shift 1)

Two infinite identical charged sheets and a charged spherical body of charge density ' ρ ' are arranged as shown in figure. Then the correct relation between the electrical fields at A, B, C and D points is :



- (1) $\vec{E}_A = \vec{E}_B; \vec{E}_C = \vec{E}_D$ (2) $\vec{E}_A > \vec{E}_B; \vec{E}_C = \vec{E}_D$
(3) $\vec{E}_C \neq \vec{E}_D; \vec{E}_A > \vec{E}_B$ (4) $|\vec{E}_A| = |\vec{E}_B|; \vec{E}_C > \vec{E}_D$

Q279. JEE Main 2025 (29 Jan Shift 1)

An electric dipole of mass m , charge q , and length l is placed in a uniform electric field $\vec{E} = E_0 \hat{i}$. When the dipole is rotated slightly from its equilibrium position and released, the time period of its oscillations will be:

- (1) $\frac{1}{2\pi} \sqrt{\frac{ml}{2qE_0}}$ (2) $2\pi \sqrt{\frac{ml}{qE_0}}$
(3) $\frac{1}{2\pi} \sqrt{\frac{2ml}{qE_0}}$ (4) $2\pi \sqrt{\frac{ml}{2qE_0}}$

Q280. JEE Main 2025 (28 Jan Shift 2)

An electric dipole of dipole moment $6 \times 10^{-6} \text{ C}\cdot\text{m}$ is placed in uniform electric field of magnitude 10^6 V/m .

Initially, the dipole moment is parallel to electric field. The work that needs to be done on the dipole to make its dipole moment opposite to the field, will be ____ J.

Q281. JEE Main 2025 (28 Jan Shift 1)

Three infinitely long wires with linear charge density λ are placed along the x - axis, y -axis and z - axis respectively. Which of the following denotes an equipotential surface?

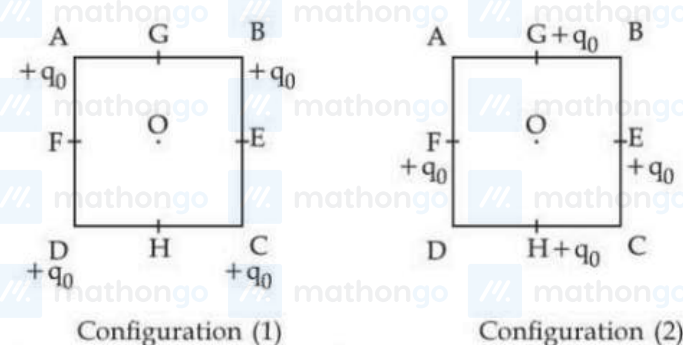
- (1) $xyz = \text{constant}$
- (2) $xy + yz + zx = \text{constant}$
- (3) $(x^2 + y^2)(y^2 + z^2)(z^2 + x^2) = \text{constant}$
- (4) $(x + y)(y + z)(z + x) = \text{constant}$

Q282. JEE Main 2025 (24 Jan Shift 2)

A small uncharged conducting sphere is placed in contact with an identical sphere but having $4 \times 10^{-8} \text{C}$ charge and then removed to a distance such that the force of repulsion between them is $9 \times 10^{-3} \text{N}$. The distance between them is (Take $\frac{1}{4\pi\epsilon_0}$ as 9×10^9 in SI units)

- (1) 3 cm
- (2) 2 cm
- (3) 4 cm
- (4) 1 cm

Q283. JEE Main 2025 (24 Jan Shift 2)



In the first configuration (1) as shown in the figure, four identical charges (q_0) are kept at the corners A, B, C and D of square of side length 'a'. In the second configuration (2), the same charges are shifted to mid points G, E, H and F, of the square, If $K = \frac{1}{4\pi\epsilon_0}$, the difference between the potential energies of configuration (2) and (1) is given by :

- (1) $\frac{Kq_0^2}{a}(4\sqrt{2} - 2)$
- (2) $\frac{Kq_0^2}{a}(3 - \sqrt{2})$
- (3) $\frac{Kq_0^2}{a}(4 - 2\sqrt{2})$
- (4) $\frac{Kq_0^2}{a}(3\sqrt{2} - 2)$

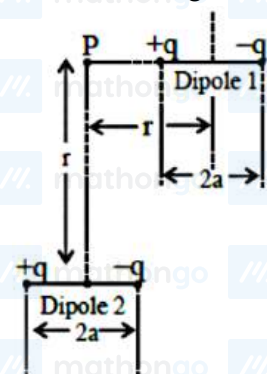
Q284. JEE Main 2025 (23 Jan Shift 2)

Two charges $7\mu\text{C}$ and $-4\mu\text{C}$ are placed at $(-7 \text{ cm}, 0, 0)$ and $(7 \text{ cm}, 0, 0)$ respectively. Given, $\epsilon_0 = 8.85 \times 10^{-12} \text{C}^2 \text{N}^{-1} \text{m}^{-2}$, the electrostatic potential energy of the charge configuration is :

- (1) -1.8 J
- (2) -2.0 J
- (3) -1.5 J
- (4) -1.2 J

Q285. JEE Main 2025 (23 Jan Shift 1)

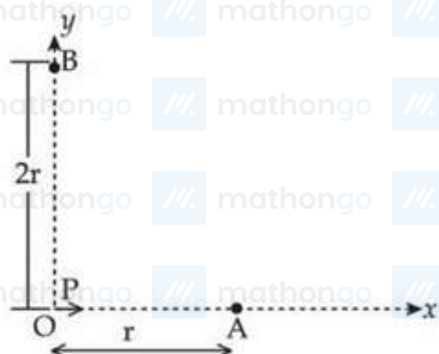
A point particle of charge Q is located at P along the axis of an electric dipole 1 at a distance r as shown in the figure. The point P is also on the equatorial plane of a second electric dipole 2 at a distance r . The dipoles are made of opposite charge q separated by a distance $2a$. For the charge particle at P not to experience any net force, which of the following correctly describes the situation?



- (1) $\frac{a}{r} \sim 10$ (2) $\frac{a}{r} \sim 20$
 (3) $\frac{a}{r} \sim 0.5$ (4) $\frac{a}{r} \sim 3$

Q286. JEE Main 2025 (22 Jan Shift 2)

For a short dipole placed at origin O , the dipole moment P is along x -axis, as shown in the figure. If the electric potential and electric field at A are V_0 and E_0 , respectively, then the correct combination of the electric potential and electric field, respectively, at point B on the y -axis is given by



- (1) V_0 and $\frac{E_0}{4}$ (2) zero and $\frac{E_0}{16}$
 (3) zero and $\frac{E_0}{8}$ (4) $\frac{V_0}{2}$ and $\frac{E_0}{16}$

Q287. JEE Main 2025 (22 Jan Shift 1)

An electron is made to enter symmetrically between two parallel and equally but oppositely charged metal plates, each of 10 cm length. The electron emerges out of the electric field region with a horizontal component of velocity 10^6 m/s. If the magnitude of the electric field between the plates is 9.1 V/cm, then the vertical component of velocity of electron is (mass of electron = 9.1×10^{-31} kg and charge of electron = 1.6×10^{-19} C)

- (1) 0 (2) 1×10^6 m/s
 (3) 16×10^6 m/s (4) 16×10^4 m/s

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Q288. JEE Main 2025 (2 April Shift 2)

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

Assertion (A) : Net dipole moment of a polar linear isotropic dielectric substance is not zero even in the absence of an external electric field.

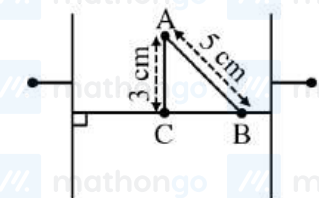
Reason (R) : In absence of an external electric field, the different permanent dipoles of a polar dielectric substance are oriented in random directions.

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

- (1) (A) is correct but (R) is not correct
- (2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (3) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (4) (A) is not correct but (R) is correct

Q289. JEE Main 2025 (2 April Shift 2)

Two large plane parallel conducting plates are kept 10 cm apart as shown in figure. The potential difference between them is V . The potential difference between the points A and B (shown in the figure) is :



- (1) $\frac{1}{4} V$
- (2) $\frac{2}{5} V$
- (3) $\frac{3}{4} V$
- (4) $1 V$

Q290. JEE Main 2024 (30 Jan Shift 2)

Two identical charged spheres are suspended by strings of equal lengths. The string make an angle of 37° with each other. When suspended in a liquid of density 0.7 g cm^{-3} , the angle remains same. If density of material of the sphere is 1.4 g cm^{-3} , the dielectric constant of the liquid is _____ ($\tan 37^\circ = \frac{3}{4}$)

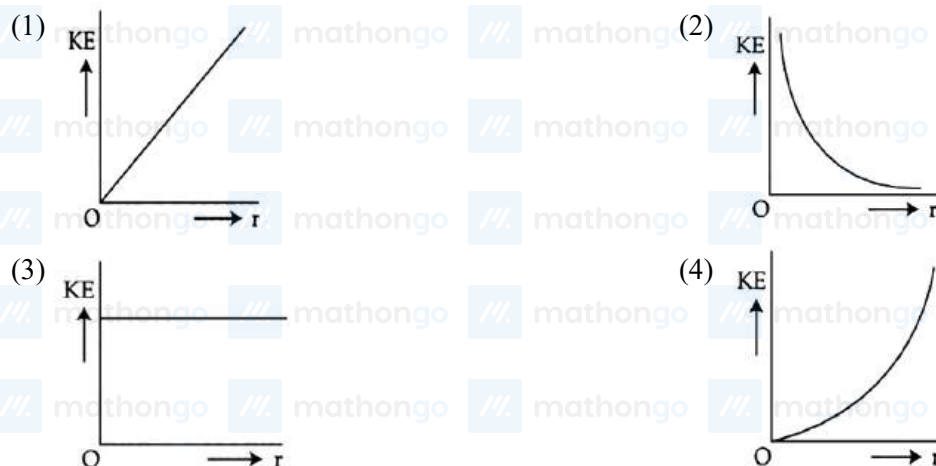
Q291. JEE Main 2024 (27 Jan Shift 1)

A thin metallic wire having cross sectional area of 10^{-4} m^2 is used to make a ring of radius 30 cm. A positive charge of $2\pi \text{ C}$ is uniformly distributed over the ring, while another positive charge of 30 pC is kept at the centre of the ring. The tension in the ring is _____ N; provided that the ring does not get deformed (neglect the influence of gravity).

(Given, $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ SI units}$)

Q292. JEE Main 2024 (04 Apr Shift 1)

An infinitely long positively charged straight thread has a linear charge density $\lambda \text{ Cm}^{-1}$. An electron revolves along a circular path having axis along the length of the wire. The graph that correctly represents the variation of the kinetic energy of electron as a function of radius of circular path from the wire is :

**Q293. JEE Main 2024 (04 Apr Shift 1)**

An infinite plane sheet of charge having uniform surface charge density $+\sigma_s \text{ C/m}^2$ is placed on $x - y$ plane.

Another infinitely long line charge having uniform linear charge density $+\lambda_e \text{ C/m}$ is placed at $z = 4 \text{ m}$ plane and parallel to y -axis. If the magnitude values $|\sigma_s| = 2 |\lambda_e|$ then at point $(0, 0, 2)$, the ratio of magnitudes of electric field values due to sheet charge to that of line charge is $\pi\sqrt{n} : 1$. The value of n is _____.

Q294. JEE Main 2023 (06 Apr Shift 2)

A dipole comprises of two charged particles of identical magnitude q and opposite in nature. The mass m of the positive charged particle is half of the mass of the negative charged particle. The two charges are separated by a distance l . If the dipole is placed in a uniform electric field \vec{E} ; in such a way that dipole axis makes a very small angle with the electric field, \vec{E} . The angular frequency of the oscillations of the dipole when released is given by:

- | | |
|------------------------------|------------------------------|
| (1) $\sqrt{\frac{3qE}{2ml}}$ | (2) $\sqrt{\frac{8qE}{ml}}$ |
| (3) $\sqrt{\frac{4qE}{ml}}$ | (4) $\sqrt{\frac{8qE}{3ml}}$ |

Q295. JEE Main 2022 (29 Jun Shift 2)

If the electric potential at any point (x, y, z) m in space is given by $V = 3x^2$ volt. The electric field at the point

$(1, 0, 3) \text{ m}$ will be :

- (1) 3 Vm^{-1} , directed along positive x -axis.
- (2) 3 Vm^{-1} , directed along negative x -axis.
- (3) 6 Vm^{-1} , directed along negative x -axis.
- (4) 6 Vm^{-1} , directed along positive x -axis.

Q296. JEE Main 2022 (27 Jun Shift 2)

If a charge q is placed at the centre of a closed hemispherical non-conducting surface, the total flux passing through the flat surface would be



- (1) $\frac{q}{\epsilon_0}$ (2) $\frac{q}{2\epsilon_0}$
 (3) $\frac{q}{4\epsilon_0}$ (4) $\frac{q}{2\pi\epsilon_0}$

Q297. JEE Main 2022 (27 Jul Shift 1)

Two identical positive charges Q each are fixed at a distance of $2a$ apart from each other. Another point charge q_0 with mass m is placed at midpoint between two fixed charges. For a small displacement along the line joining the fixed charges, the charge q_0 executes SHM. The time period of oscillation of charge q_0 will be

- (1) $\sqrt{\frac{4\pi^3\epsilon_0 ma^3}{q_0 Q}}$ (2) $\sqrt{\frac{q_0 Q}{4\pi^3\epsilon_0 ma^3}}$
 (3) $\sqrt{\frac{2\pi^2\epsilon_0 ma^3}{q_0 Q}}$ (4) $\sqrt{\frac{8\pi^3\epsilon_0 ma^3}{q_0 Q}}$

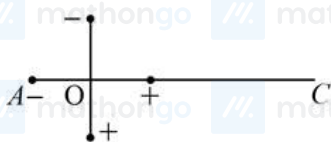
Q298. JEE Main 2022 (24 Jun Shift 2)

A long cylindrical volume contains a uniformly distributed charge of density ρ . The radius of cylindrical volume is R . A charge particle (q) revolves around the cylinder in a circular path. The kinetic energy of the particle is :

- (1) $\frac{\rho q R^2}{4\epsilon_0}$ (2) $\frac{\rho q R^2}{2\epsilon_0}$ (3) $\frac{q\rho}{4\epsilon_0 R^2}$ (4) $\frac{4\epsilon_0 R^2}{q\rho}$

Q299. JEE Main 2021 (25 Jul Shift 2)

Two ideal electric dipoles A and B , having their dipole moment p_1 and p_2 respectively are placed on a plane with their centres at O as shown in the figure. At point C on the axis of dipole A , the resultant electric field is making an angle of 37° with the axis. The ratio of the dipole moment of A and B , $\frac{p_1}{p_2}$ is: (take $\sin 37^\circ = \frac{3}{5}$)



- (1) $\frac{3}{8}$ (2) $\frac{3}{2}$ (3) $\frac{2}{3}$ (4) $\frac{4}{3}$

Q300. JEE Main 2021 (25 Feb Shift 2)

Two identical conducting spheres with negligible volume have 2.1 nC and -0.1 nC charges, respectively. They are brought into contact and then separated by a distance of 0.5 m . The electrostatic force acting between the spheres is $___ \times 10^{-9} \text{ N}$. [Given: $4\pi\epsilon_0 = \frac{1}{9 \times 10^9} \text{ SI unit}$]

Text & Video Solutions of these questions are available inside MARKS App.

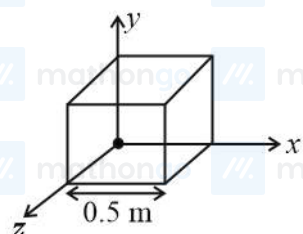
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Q301. JEE Main 2021 (25 Feb Shift 1)

The electric field in a region is given by $\vec{E} = \left(\frac{3}{5}E_0\hat{i} + \frac{4}{5}E_0\hat{j}\right) \text{ N C}^{-1}$. The ratio of flux of reported field through the rectangular surface of area 0.2 m^2 (parallel to $y - z$ plane) to that of the surface of area 0.3 m^2 (parallel to $x - z$ plane) is $a : b = a : 2$, where $a = ?$ [Here \hat{i} , \hat{j} and \hat{k} are unit vectors along x , y and z -axes respectively]

Q302. JEE Main 2021 (01 Sep Shift 2)

A cube is placed inside an electric field, $\vec{E} = 150y^2\hat{j}$. The side of the cube is 0.5 m and is placed in the field as shown in the given figure. The charge inside the cube is:

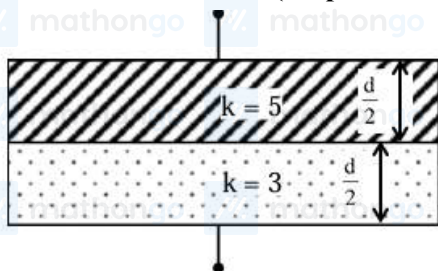


- (1) $8.3 \times 10^{-11} \text{ C}$ (2) $3.8 \times 10^{-11} \text{ C}$
 (3) $3.8 \times 10^{-12} \text{ C}$ (4) $8.3 \times 10^{-12} \text{ C}$

Q303. JEE Main 2020 (08 Jan Shift 1)

In finding the electric field using Gauss law the formula $|\vec{E}| = \frac{q_{\text{enc}}}{\epsilon_0 A}$ is applicable. In the formula ϵ_0 is permittivity of free space, A is the area of Gaussian surface and q_{enc} is charge enclosed by the Gaussian surface. This equation can be used in which of the following situation?

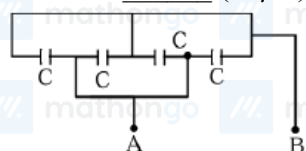
- (1) Only when the Gaussian surface is an equipotential surface
 (2) Only when the Gaussian surface is an equipotential surface and $|\vec{E}|$ is constant on the surface.
 (3) Only when $|\vec{E}| = \text{constant}$ on the surface.
 (4) For any choice of Gaussian surface.

Chapter: Capacitance**Q304. JEE Main 2025 (8 April Shift 2)**

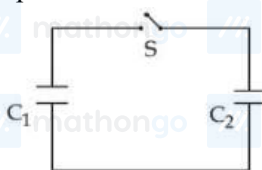
Space between the plates of a parallel plate capacitor of plate area 4 cm^2 and separation of (d) 1.77 mm , is filled with uniform dielectric materials with dielectric constants $(3 \text{ and } 5)$ as shown in figure. Another capacitor of capacitance 7.5 pF is connected in parallel with it. The effective capacitance of this combination is _____ pF . (Given $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$)

Q305. JEE Main 2025 (4 April Shift 1)

Four capacitor each of capacitance $16 \mu\text{F}$ are connected as shown in the figure. The capacitance between points A and B is : _____ (in μF).

**Q306. JEE Main 2025 (29 Jan Shift 2)**

A capacitor, $C_1 = 6 \mu\text{F}$ is charged to a potential difference of $V_0 = 5 \text{ V}$ using a 5 V battery. The battery is removed and another capacitor, $C_2 = 12 \mu\text{F}$ is inserted in place of the battery. When the switch 'S' is closed, the charge flows between the capacitors for some time until equilibrium condition is reached. What are the charges (q_1 and q_2) on the capacitors C_1 and C_2 when equilibrium condition is reached.



- (1) $q_1 = 10 \mu\text{C}, q_2 = 20 \mu\text{C}$
- (2) $q_1 = 30 \mu\text{C}, q_2 = 15 \mu\text{C}$
- (3) $q_1 = 20 \mu\text{C}, q_2 = 10 \mu\text{C}$
- (4) $q_1 = 15 \mu\text{C}, q_2 = 30 \mu\text{C}$

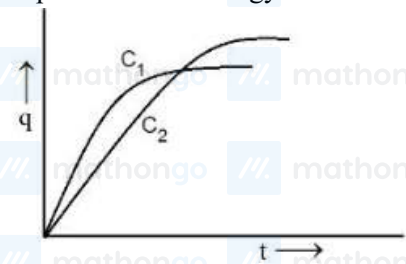
Q307. JEE Main 2025 (28 Jan Shift 2)

A parallel plate capacitor of capacitance $1\mu\text{ F}$ is charged to a potential difference of 20 V . The distance between plates is $1\mu\text{ m}$. The energy density between plates of capacitor is.

- (1) $2 \times 10^{-4}\text{ J/m}^3$ (2) $1.8 \times 10^5\text{ J/m}^3$
(3) $1.8 \times 10^3\text{ J/m}^3$ (4) $2 \times 10^2\text{ J/m}^3$

Q308. JEE Main 2025 (28 Jan Shift 1)

Two capacitors C_1 and C_2 are connected in parallel to a battery. Charge-time graph is shown below for the two capacitors. The energy stored with them are U_1 and U_2 , respectively. Which of the given statements is true?



- (1) $C_2 > C_1, U_2 < U_1$ (2) $C_1 > C_2, U_1 > U_2$
(3) $C_1 > C_2, U_1 < U_2$ (4) $C_2 > C_1, U_2 > U_1$

Q309. JEE Main 2025 (24 Jan Shift 1)

A parallel plate capacitor was made with two rectangular plates, each with a length of $l = 3\text{ cm}$ and breadth of $b = 1\text{ cm}$. The distance between the plates is $3\mu\text{ m}$. Out of the following, which are the ways to increase the capacitance by a factor of 10 ?

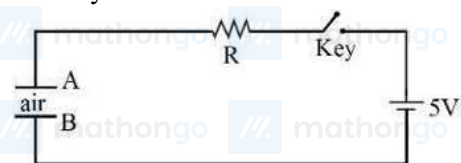
- A. $l = 30\text{ cm}$, $b = 1\text{ cm}$, $d = 1\mu\text{ m}$
B. $l = 3\text{ cm}$, $b = 1\text{ cm}$, $d = 30\mu\text{ m}$
C. $l = 6\text{ cm}$, $b = 5\text{ cm}$, $d = 3\mu\text{ m}$
D. $l = 1\text{ cm}$, $b = 1\text{ cm}$, $d = 10\mu\text{ m}$
E. $l = 5\text{ cm}$, $b = 2\text{ cm}$, $d = 1\mu\text{ m}$

Choose the correct answer from the options given below:

- (1) A only (2) C only
(3) B and D only (4) C and E only

Q310. JEE Main 2025 (23 Jan Shift 1)

Identify the valid statements relevant to the given circuit at the instant when the key is closed.



- A. There will be no current through resistor R .
- B. There will be maximum current in the connecting wires.
- C. Potential difference between the capacitor plates A and B is minimum.
- D. Charge on the capacitor plates is minimum.

Choose the correct answer from the options given below:

- (1) A, C Only
- (2) A, B, D Only
- (3) C, D Only
- (4) B, C, D Only

Q311. JEE Main 2025 (22 Jan Shift 1)

A parallel-plate capacitor of capacitance $40\mu\text{F}$ is connected to a 100V power supply. Now the intermediate space between the plates is filled with a dielectric material of dielectric constant $K = 2$. Due to the introduction of dielectric material, the extra charge and the change in the electrostatic energy in the capacitor, respectively, are

- (1) 4 mC and 0.2 J
- (2) 8 mC and 2.0 J
- (3) 2 mC and 0.4 J
- (4) 2 mC and 0.2 J

Q312. JEE Main 2024 (29 Jan Shift 1)

A 16Ω wire is bent to form a square loop. A 9V battery with internal resistance 1Ω is connected across one of its sides. If a $4\mu\text{F}$ capacitor is connected across one of its diagonals, the energy stored by the capacitor will be $\frac{x}{2}\mu\text{J}$, where $x = \underline{\hspace{2cm}}$.

Q313. JEE Main 2024 (05 Apr Shift 1)

The electric field between the two parallel plates of a capacitor of $1.5\mu\text{F}$ capacitance drops to one third of its initial value in $6.6\mu\text{s}$ when the plates are connected by a thin wire.

The resistance of this wire is $\underline{\hspace{2cm}}\Omega$.

(Given, $\log 3 = 1.1$)

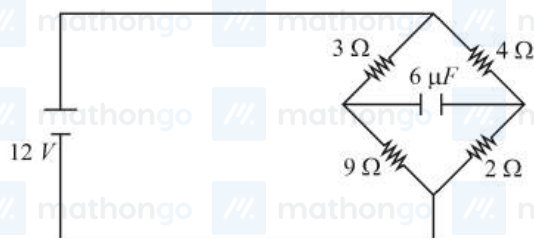
Q314. JEE Main 2024 (04 Apr Shift 2)

A parallel plate capacitor of capacitance 12.5pF is charged by a battery connected between its plates to potential difference of 12.0V . The battery is now disconnected and a dielectric slab ($\epsilon_r = 6$) is inserted between the plates.

The change in its potential energy after inserting the dielectric slab is $\underline{\hspace{2cm}}10^{-12}\text{J}$.

Q315. JEE Main 2023 (13 Apr Shift 2)

In the circuit shown, the energy stored in the capacitor is $n \mu\text{J}$. The value of n is _____.



Q316. JEE Main 2022 (28 Jul Shift 1)

Two capacitors, each having capacitance $40\mu\text{F}$ are connected in series. The space between one of the capacitors is filled with dielectric material of dielectric constant K such that the equivalence capacitance of the system became $24\mu\text{F}$. The value of K will be :

- (1) 1.5 (2) 2.5
(3) 1.2 (4) 3

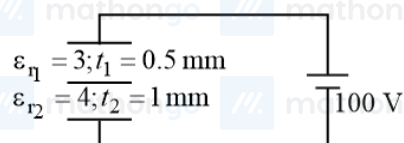
Q317. JEE Main 2022 (27 Jun Shift 1)

A force of 10 N acts on a charged particle placed between two plates of a charged capacitor. If one plate of capacitor is removed, then the force acting on that particle will be.

- (1) 5 N (2) 10 N
(3) 20 N (4) Zero

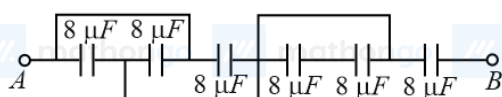
Q318. JEE Main 2022 (26 Jul Shift 1)

A composite parallel plate capacitor is made up of two different dielectric materials with different thickness (t_1 and t_2) as shown in figure. The two different dielectric material are separated by a conducting foil F . The voltage of the conducting foil is _____ V.



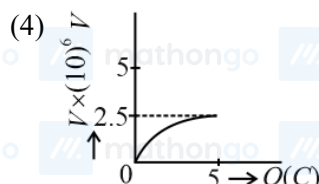
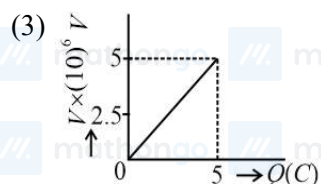
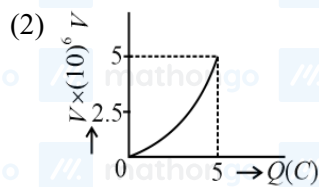
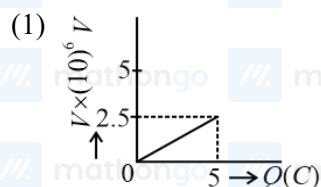
Q319. JEE Main 2022 (25 Jun Shift 1)

The equivalent capacitance between points A and B in below shown figure will be _____ μF .

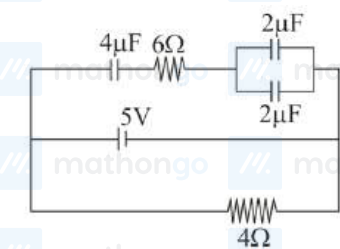


Q320. JEE Main 2022 (25 Jul Shift 1)

A condenser of $2 \mu\text{F}$ capacitance is charged steadily from 0 to 5 C. Which of the following graph represents correctly the variation of potential difference (V) across its plates with respect to the charge (Q) on the condenser?


Q321. JEE Main 2021 (27 Aug Shift 1)

Calculate the amount of charge on capacitor of $4 \mu\text{F}$. The internal resistance of battery is 1Ω :



(1) $4 \mu\text{C}$

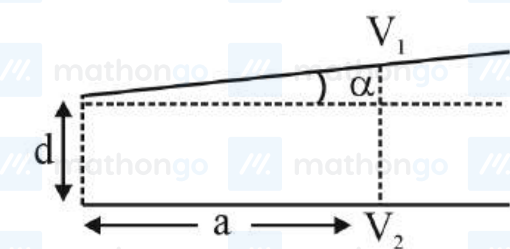
(2) $8 \mu\text{C}$

(3) $16 \mu\text{C}$

(4) zero

Q322. JEE Main 2020 (08 Jan Shift 2)

A capacitor is made of two square plates each of side ' a ' making a very small angle α between them, as shown in figure. The capacitance will be close to:



(1) $\frac{\epsilon_0 a^2}{d} \left(1 - \frac{\alpha a}{2d}\right)$

(2) $\frac{\epsilon_0 a^2}{d} \left(1 - \frac{\alpha a}{4d}\right)$

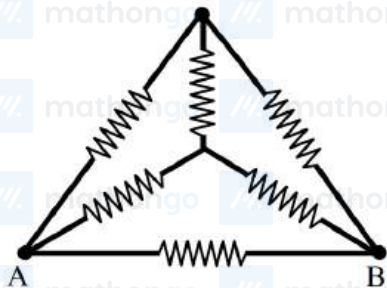
(3) $\frac{\epsilon_0 a^2}{d} \left(1 + \frac{\alpha a}{d}\right)$

(4) $\frac{\epsilon_0 a^2}{d} \left(1 - \frac{3\alpha a}{2d}\right)$

Chapter: Current Electricity**Q323. JEE Main 2025 (7 April Shift 1)**

A wire of resistance R is bent into a triangular pyramid as shown in figure with each segment having same length.

The resistance between points A and B is R/n . The value of n is :



- (1) 16 (2) 14
(3) 10 (4) 12

Q324. JEE Main 2025 (4 April Shift 2)

There are ' n ' number of identical electric bulbs, each is designed to draw a power p independently from the mains supply. They are now joined in series across the main supply. The total power drawn by the combination is :

- (1) np (2) $\frac{p}{n^2}$
(3) $\frac{p}{n}$ (4) p

Q325. JEE Main 2025 (3 April Shift 2)

Two cells of emf 1 V and 2 V and internal resistance 2Ω and 1Ω , respectively, are connected in series with an external resistance of 6Ω . The total current in the circuit is I_1 . Now the same two cells in parallel configuration are connected to same external resistance. In this case, the total current drawn is I_2 . The value of $\left(\frac{I_1}{I_2}\right)$ is $\frac{x}{3}$. The value of x is _____.

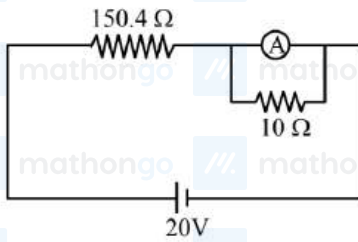
Q326. JEE Main 2025 (3 April Shift 1)

A wire of length 25 m and cross-sectional area 5 mm^2 having resistivity of $2 \times 10^{-6} \Omega \text{ m}$ is bent into a complete circle. The resistance between diametrically opposite points will be

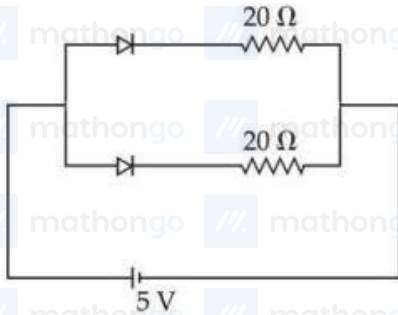
- (1) 12.5Ω (2) 50Ω
(3) 100Ω (4) 25Ω

Q327. JEE Main 2025 (3 April Shift 1)

In the figure shown below, a resistance of 150.4Ω is connected in series to an ammeter A of resistance 240Ω . A shunt resistance of 10Ω is connected in parallel with the ammeter. The reading of the ammeter is _____ mA.

**Q328. JEE Main 2025 (23 Jan Shift 2)**

What is the current through the battery in the circuit shown below



- (1) 1.5 A (2) 0.5 A
(3) 0.25 A (4) 1.0 A

Q329. JEE Main 2025 (23 Jan Shift 2)

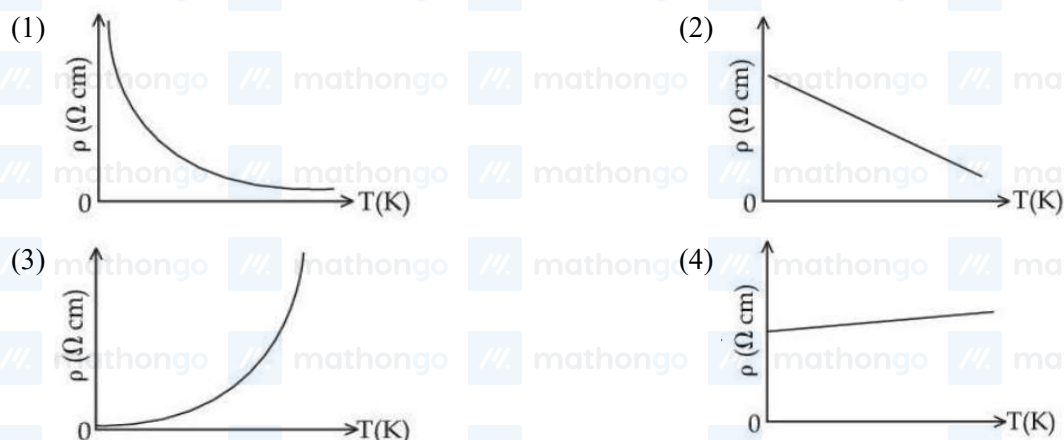
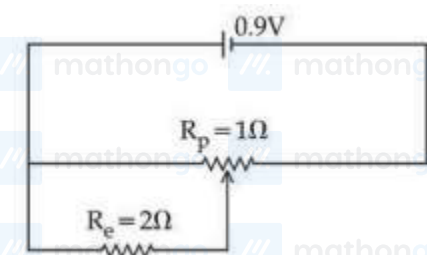
A galvanometer having a coil of resistance 30Ω need 20 mA of current for full-scale deflection. If a maximum current of 3 A is to be measured using this galvanometer, the resistance of the shunt to be added to the galvanometer should be $\frac{30}{X}\Omega$, where X is

Options

- (1) 596 (2) 149
(3) 298 (4) 447

Q330. JEE Main 2025 (22 Jan Shift 1)

Which of the following resistivity (ρ) v/s temperature (T) curves is most suitable to be used in wire bound standard resistors?

**Q331. JEE Main 2025 (22 Jan Shift 1)**

Sliding contact of a potentiometer is in the middle of the potentiometer wire having resistance $R_p = 1\Omega$ as shown in the figure. An external resistance of $R_e = 2\Omega$ is connected via the sliding contact. The electric current in the circuit is :

- (1) 0.9 A (2) 1.35 A
(3) 0.3 A (4) 1.0 A

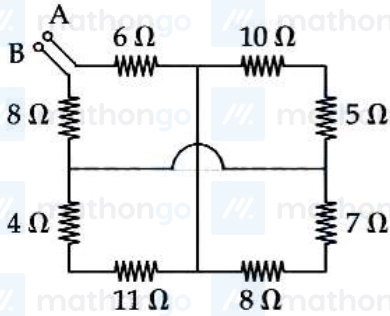
Q332. JEE Main 2025 (2 April Shift 1)

The battery of a mobile phone is rated as 4.2 V , 5800 mAh. How much energy is stored in it when fully charged ?

- (1) 43.8 kJ (2) 48.7 kJ
(3) 87.7 kJ (4) 24.4 kJ

Q333. JEE Main 2024 (09 Apr Shift 1)

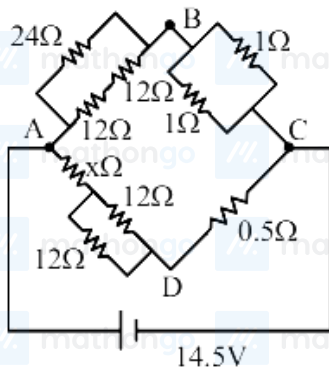
The equivalent resistance between A and B is:



- (1) 18Ω (2) 19Ω
 (3) 25Ω (4) 27Ω

Q334. JEE Main 2024 (06 Apr Shift 1)

The value of unknown resistance (x) for which the potential difference between B and D will be zero in the arrangement shown, is:



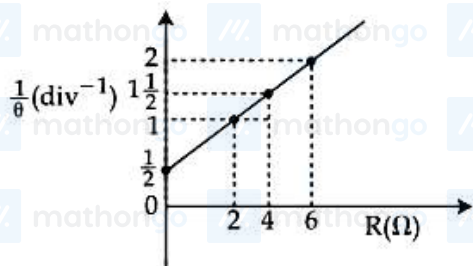
- (1) 3Ω (2) 42Ω
 (3) 9Ω (4) 6Ω

Q335. JEE Main 2024 (05 Apr Shift 2)

A wire of resistance 20Ω is divided into 10 equal parts, resulting pairs. A combination of two parts are connected in parallel and so on. Now resulting pairs of parallel combination are connected in series. The equivalent resistance of final combination is _____ Ω .

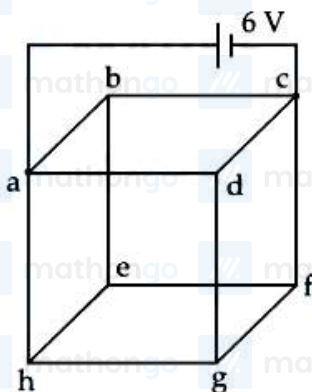
Q336. JEE Main 2024 (05 Apr Shift 1)

In the experiment to determine the galvanometer resistance by half-deflection method, the plot of $1/\theta$ vs the resistance (R) of the resistance box is shown in the figure. The figure of merit of the galvanometer is $\times 10^{-1}$ A/division. [The source has emf 2V]



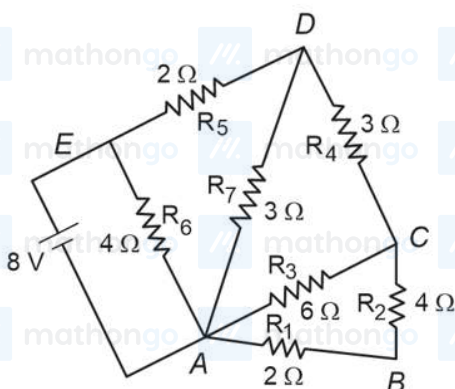
Q337. JEE Main 2024 (04 Apr Shift 1)

Twelve wires each having resistance 2Ω are joined to form a cube. A battery of 6 V emf is joined across point a and c . The voltage difference between e and f is V .



Q338. JEE Main 2023 (11 Apr Shift 2)

The current flowing through R_2 is:



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

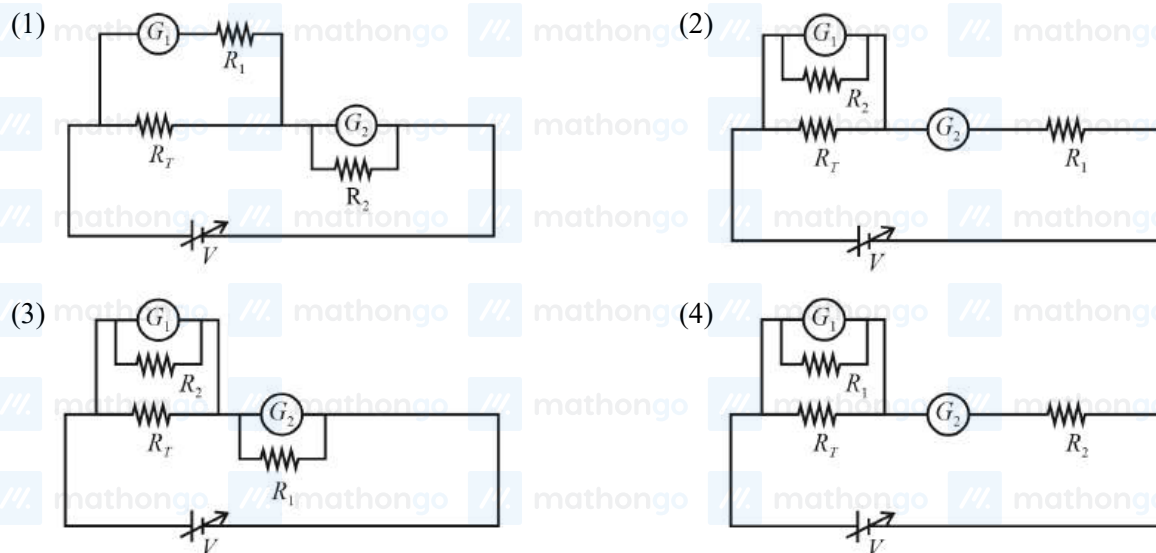
- (2) $\frac{1}{2}$ A
(4) $\frac{1}{4}$ A

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Q339. JEE Main 2023 (06 Apr Shift 2)

A student is provided with a variable voltage source V , a test resistor $R_T = 10\Omega$, two identical galvanometers G_1 and G_2 and two additional resistors, $R_1 = 10M\Omega$ and $R_2 = 0.001\Omega$. For conducting an experiment to verify ohm's law, the most suitable circuit is:

**Q340. JEE Main 2022 (27 Jun Shift 1)**

The current density in a cylindrical wire of radius 4 mm is $4 \times 10^6 \text{ A m}^{-2}$. The current through the outer portion of the wire between radial distances $\frac{R}{2}$ and R is _____ $\pi \text{ A}$.

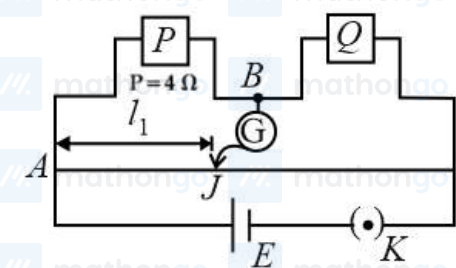
Q341. JEE Main 2022 (26 Jun Shift 1)

An aluminium wire is stretched to make its length, 0.4% larger. The percentage change in resistance is

- (1) 0.4% (2) 0.2%
(3) 0.8% (4) 0.6%

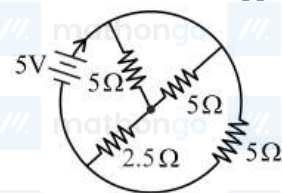
Q342. JEE Main 2022 (26 Jul Shift 1)

Resistance are connected in a meter bridge circuit as shown in the figure. The balancing length l_1 is 40 cm. Now an unknown resistance x is connected in series with P and new balancing length is found to be 80 cm measured from the same end. Then the value of x will be _____ Ω .



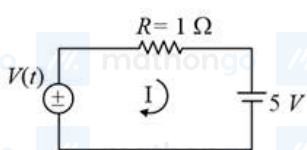
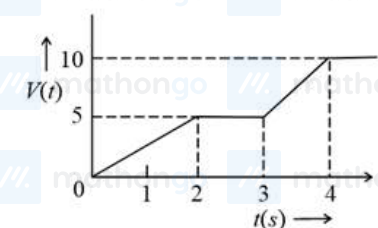
Q343. JEE Main 2022 (25 Jun Shift 1)

The total current supplied to the circuit as shown in figure by the 5 V battery is _____ A.



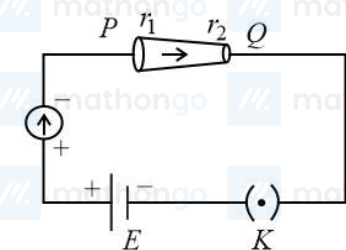
Q344. JEE Main 2021 (27 Jul Shift 2)

For the circuit shown, the value of current at time $t = 3.2$ s will be _____ A. [Voltage distribution $V(t)$ is shown by Fig. (1) and the circuit is shown in Fig. (2)]



Q345. JEE Main 2021 (27 Jul Shift 1)

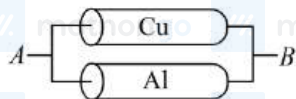
In the given figure, a battery of emf E is connected across a conductor PQ of length l and different area of cross-sections having radii r_1 and r_2 ($r_2 < r_1$). Choose the correct option as one moves from P to Q .



- (1) Drift velocity of electron increases.
- (2) Electric field decreases.
- (3) Electron current decreases.
- (4) All of these

Q346. JEE Main 2021 (22 Jul Shift 1)

A Copper (Cu) rod of length 25 cm and cross-sectional area 3 mm^2 is joined with a similar Aluminium (Al) rod as shown in figure. Find the resistance of the combination between the ends A and B . (Take resistivity of Copper $= 1.7 \times 10^{-8} \Omega\text{m}$, Resistivity of aluminium $= 2.6 \times 10^{-8} \Omega\text{m}$)



- (1) 2.170 m Ω (2) 1.420 m Ω
 (3) 0.0858 m Ω (4) 0.858 m Ω

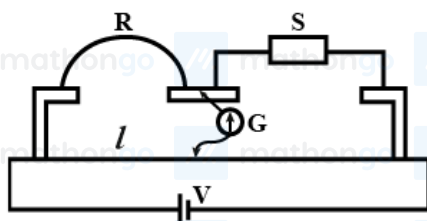
Q347. JEE Main 2021 (18 Mar Shift 1)

In the experiment of Ohm's law, a potential difference of 5.0 V is applied across the end of a conductor of length 10.0 cm and diameter of 5.00 mm. The measured current in the conductor is 2.00 A. The maximum permissible percentage error in the resistivity of the conductor is :-

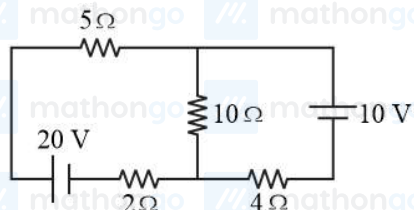
- (1) 3.9 (2) 8.4
 (3) 7.5 (4) 3.0

Q348. JEE Main 2020 (09 Jan Shift 2)

In a meter bridge experiment S is a standard resistance. R is a resistance wire. It is found that balancing length is $l = 25\text{cm}$. If R is replaced by a wire of half length and half diameter that of R of same material, then the balancing distance l' (in cm) will now be _____.

**Q349. JEE Main 2020 (06 Sep Shift 2)**

In the figure shown, the current in the 10 V battery is close to:



- (1) 0.71 A from positive to negative terminal (2) 0.42 A from positive to negative terminal
 (3) 0.21 A from positive to negative terminal (4) 0.36 A from negative to positive terminal

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Chapter: Magnetic Properties of Matter**Q350. JEE Main 2025 (7 April Shift 2)**

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

Assertion (A) : Magnetic monopoles do not exist.

Reason (R) : Magnetic field lines are continuous and form closed loops.

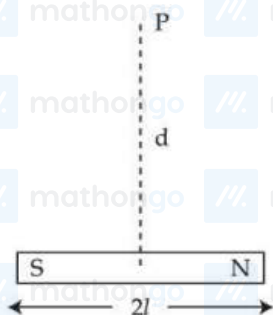
In the light of the above statements, choose the most appropriate answer from the options given below :

- (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (2) (A) is correct but (R) is not correct
- (3) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (4) (A) is not correct but (R) is correct

Q351. JEE Main 2025 (7 April Shift 1)

The percentage increase in magnetic field (B) when space within a current carrying solenoid is filled with magnesium (magnetic susceptibility $\chi_{\text{mg}} = 1.2 \times 10^{-5}$) is :

- (1) $\frac{6}{5} \times 10^{-3}\%$
- (2) $\frac{5}{6} \times 10^{-5}\%$
- (3) $\frac{5}{6} \times 10^{-4}\%$
- (4) $\frac{5}{3} \times 10^{-5}\%$

Q352. JEE Main 2025 (28 Jan Shift 2)

A bar magnet has total length $2l = 20$ units and the field point P is at a distance $d = 10$ units from the centre of the magnet. If the relative uncertainty of length measurement is 1%, then uncertainty of the magnetic field at point P is :

- (1) 4%
- (2) 15%
- (3) 5%
- (4) 10%

Q353. JEE Main 2025 (2 April Shift 2)

A solenoid having area A and length ' l ' is filled with a material having relative permeability 2. The magnetic energy stored in the solenoid is :

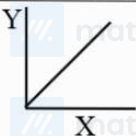
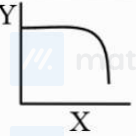
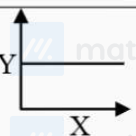
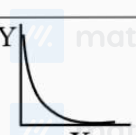
- (1) $\frac{B^2 Al}{\mu_0}$
- (2) $\frac{B^2 Al}{2\mu_0}$
- (3) $B^2 Al$
- (4) $\frac{B^2 Al}{4\mu_0}$

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Q354. JEE Main 2024 (06 Apr Shift 2)

Match List-I with List-II :

List-I (Y vs X)		List-II (Shape of Graph)	
(A)	Y = magnetic susceptibility X = magnetising field	(I)	
(B)	Y = magnetic field X = distance from centre of a current carrying wire for $x < a$ (where a = radius of wire)	(II)	
(C)	Y = magnetic field X = distance from centre of a current carrying wire for $x > a$ (where a = radius of wire)	(III)	
(D)	Y = magnetic field inside solenoid X = distance from center	(IV)	

Choose the correct answer from the options given below :

- (1) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
 (2) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
 (3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
 (4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Q355. JEE Main 2023 (10 Apr Shift 2)

Given below are two statements:

Statement I: For diamagnetic substance $-1 \leq \chi < 0$, where χ is the magnetic susceptibility.

Statement II: Diamagnetic substance when placed in an external magnetic field, tend to move from stronger to weaker part of the field.

In the light of the above statements, choose the correct answer from the options give below.

- (1) Both **Statement I** and **Statement II** are False
- (2) **Statement I** is correct but **Statement II** is false
- (3) **Statement I** is incorrect but **Statement II** is true
- (4) Both **Statement I** and **Statement II** are true

Q356. JEE Main 2023 (10 Apr Shift 1)

The current required to be passed through a solenoid of 15 cm length and 60 turns in order to demagnetise a bar magnet of magnetic intensity $2.4 \times 10^3 \text{ A m}^{-1}$ is _____ A.

Q357. JEE Main 2021 (18 Mar Shift 2)

Which of the following statements are correct?

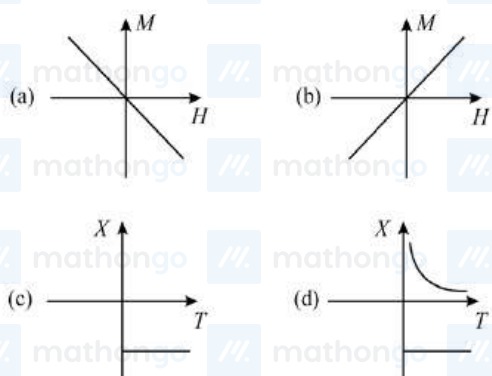
- (A) Electric monopoles do not exist whereas magnetic monopoles exist.
- (B) Magnetic field lines due to a solenoid at its ends and outside cannot be completely straight and confined.
- (C) Magnetic field lines are completely confined within a toroid.
- (D) Magnetic field lines inside a bar magnet are not parallel.
- (E) $\chi = -1$ is the condition for a perfect diamagnetic material, where χ is its magnetic susceptibility.

Choose the correct answer from the options given below :

- (1) (C) and (E) only
- (2) (B) and (D) only
- (3) (A) and (B) only
- (4) (B) and (C) only

Q358. JEE Main 2021 (01 Sep Shift 2)

Following plots show Magnetization (M) vs Magnetising field (H) and Magnetic susceptibility (χ) vs Temperature (T) graph :



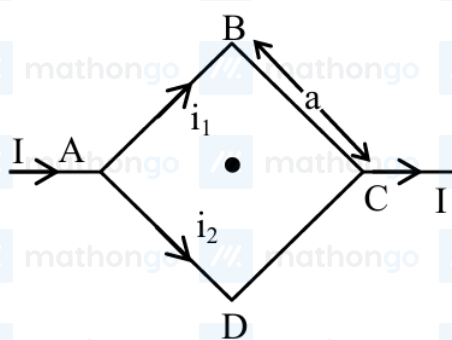
Which of the following combination will be represented by a diamagnetic material?

- (1) (b), (c) (2) (b), (d)
(3) (a), (d) (4) (a), (c)

Chapter: Magnetic Effects of Current

Q359. JEE Main 2025 (8 April Shift 2)

Figure shows a current carrying square loop ABCD of edge length is ' a ' lying in a plane. If the resistance of the ABC part is r and that of ADC part is $2r$, then the magnitude of the resultant magnetic field at centre of the square loop is



- (1) $\frac{3\pi\mu_0 I}{\sqrt{2}a}$ (2) $\frac{\mu_0 I}{2\pi a}$ (3) $\frac{\sqrt{2}\mu_0 I}{3\pi a}$ (4) $\frac{2\mu_0 I}{3\pi a}$

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Q360. JEE Main 2025 (7 April Shift 1)

A particle of charge q , mass m and kinetic energy E enters in magnetic field perpendicular to its velocity and undergoes a circular arc of radius(r). Which of the following curves represents the variation of r with E ?

**Q361. JEE Main 2025 (3 April Shift 2)**

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

Assertion A: If oxygen ion (O^{-2}) and Hydrogen ion (H^{+}) enter normal to the magnetic field with equal momentum, then the path of O^{-2} ion has a smaller curvature than that of H^{+} .

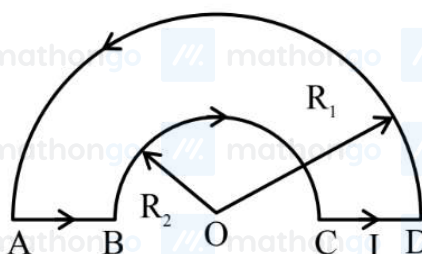
Reason R : A proton with same linear momentum as an electron will form a path of smaller radius of curvature on entering a uniform magnetic field perpendicularly.

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

- (1) A is true but R is false.
- (2) Both A and R are true but R is NOT the correct explanation of A.
- (3) A is false but R is true.
- (4) Both A and R are true and R is the correct explanation of A.

Q362. JEE Main 2025 (3 April Shift 1)

A loop ABCDA, carrying current $I = 12$ A, is placed in a plane, consists of two semi-circular segments of radius $R_1 = 6\pi$ m and $R_2 = 4\pi$ m. The magnitude of the resultant magnetic field at center O is $k \times 10^{-7}$ T. The value of k is _____ (Given $\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$)

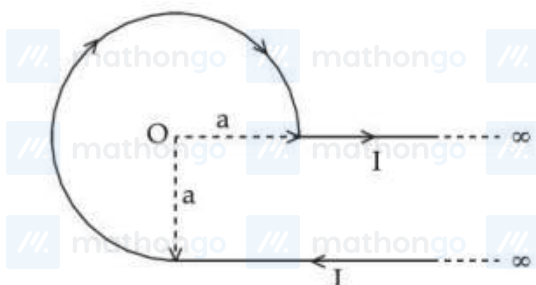


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Q363. JEE Main 2025 (29 Jan Shift 2)

The magnetic field inside a 200 turns solenoid of radius 10 cm is 2.9×10^{-4} Tesla. If the solenoid carries a current of 0.29 A, then the length of the solenoid is _____ π cm.

Q364. JEE Main 2025 (28 Jan Shift 2)

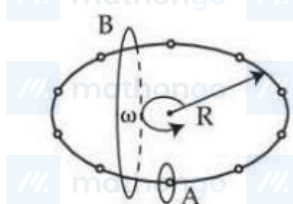
An infinite wire has a circular bend of radius a , and carrying a current I as shown in figure. The magnitude of magnetic field at the origin O of the arc is given by :

- (1) $\frac{\mu_0}{4\pi} \frac{I}{a} \left[\frac{\pi}{2} + 1 \right]$ (2) $\frac{\mu_0}{4\pi} \frac{I}{a} \left[\frac{3\pi}{2} + 2 \right]$
 (3) $\frac{\mu_0}{2\pi} \frac{I}{a} \left[\frac{\pi}{2} + 2 \right]$ (4) $\frac{\mu_0}{4\pi} \frac{I}{a} \left[\frac{3\pi}{2} + 1 \right]$

Q365. JEE Main 2025 (28 Jan Shift 1)

Consider a long thin conducting wire carrying a uniform current I . A particle having mass " M " and charge " q " is released at a distance " a " from the wire with a speed v_0 along the direction of current in the wire. The particle gets attracted to the wire due to magnetic force. The particle turns round when it is at distance x from the wire. The value of x is [μ_0 is vacuum permeability]

- (1) $ae^{-\frac{4\pi m v_0}{q \mu_0 I}}$ (2) $a \left[1 - \frac{m v_0}{2q \mu_0 I} \right]$
 (3) $a \left[1 - \frac{m v}{q \mu_0 I} \right]$ (4) $\frac{a}{2}$

Q366. JEE Main 2025 (24 Jan Shift 2)

N equally spaced charges each of value q , are placed on a circle of radius R . The circle rotates about its axis with an angular velocity ω as shown in the figure. A bigger Amperian loop B encloses the whole circle where as a smaller Amperian loop A encloses a small segment. The difference between enclosed currents, $I_A - I_B$, for the given Amperian loops is

- (1) $\frac{2\pi}{N} q \omega$ (2) $\frac{N^2}{2\pi} q \omega$
 (3) $\frac{N}{\pi} q \omega$ (4) $\frac{N}{2\pi} q \omega$

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Q367. JEE Main 2025 (23 Jan Shift 1)

Consider a moving coil galvanometer (MCG):

- A. The torsional constant in moving coil galvanometer has dimensions $[ML^2 T^{-2}]$
- B. Increasing the current sensitivity may not necessarily increase the voltage sensitivity.
- C. If we increase number of turns (N) to its double ($2N$), then the voltage sensitivity doubles.
- D. MCG can be converted into an ammeter by introducing a shunt resistance of large value in parallel with galvanometer.
- E. Current sensitivity of MCG depends inversely on number of turns of coil.

Choose the correct answer from the options given below:

- (1) A, D Only
- (2) A, B, E Only
- (3) B, D, E Only
- (4) A, B Only

Q368. JEE Main 2025 (22 Jan Shift 2)

A proton is moving undeflected in a region of crossed electric and magnetic fields at a constant speed of $2 \times 10^5 \text{ ms}^{-1}$. When the electric field is switched off, the proton moves along a circular path of radius 2 cm. The magnitude of electric field is $x \times 10^4 \text{ N/C}$. The value of x is _____. Take the mass of the proton $= 1.6 \times 10^{-27} \text{ kg}$.

Q369. JEE Main 2025 (2 April Shift 2)

In a moving coil galvanometer, two moving coils M_1 and M_2 have the following particulars :

$$R_1 = 5\Omega, N_1 = 15, A_1 = 3.6 \times 10^{-3} \text{ m}^2, B_1 = 0.25 \text{ T}$$

$$R_2 = 7\Omega, N_2 = 21, A_2 = 1.8 \times 10^{-3} \text{ m}^2, B_2 = 0.50 \text{ T}$$

Assuming that torsional constant of the springs are same for both coils, what will be the ratio of voltage sensitivity of M_1 and M_2 ?

- (1) 1 : 1
- (2) 1 : 4
- (3) 1 : 3
- (4) 1 : 2

Q370. JEE Main 2024 (27 Jan Shift 1)

A proton moving with a constant velocity passes through a region of space without any change in its velocity. If \vec{E} and \vec{B} represent the electric and magnetic fields respectively, then the region of space may have :

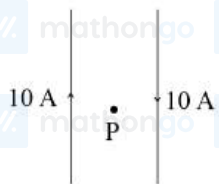
- (A) $E = 0, B = 0$;
- (B) $E = 0, B \neq 0$;
- (C) $E \neq 0, B = 0$;
- (D) $E \neq 0, B \neq 0$

Choose the most appropriate answer from the options given below :

- (1) (A), (B) and (C) only
- (2) (A), (C) and (D) only
- (3) (A), (B) and (D) only
- (4) (B), (C) and (D) only

Q371. JEE Main 2024 (27 Jan Shift 1)

Two long, straight wires carry equal currents in opposite directions as shown in figure. The separation between the wires is 5.0 cm. The magnitude of the magnetic field at a point P midway between the wires is _____ μT . (Given: $\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$)

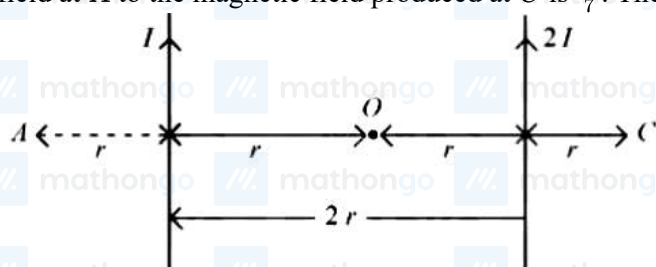


Q372. JEE Main 2024 (05 Apr Shift 2)

A solenoid of length 0.5 m has a radius of 1 cm and is made up of 'm' number of turns. It carries a current of 5 A. If the magnitude of the magnetic field inside the solenoid is $6.28 \times 10^{-3} \text{ T}$ then the value of m is _____.

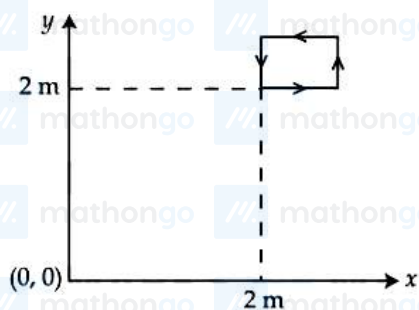
Q373. JEE Main 2024 (04 Apr Shift 2)

Two parallel long current carrying wire separated by a distance $2r$ are shown in the figure. The ratio of magnetic field at A to the magnetic field produced at C is $\frac{x}{7}$. The value of x is _____.



Q374. JEE Main 2024 (04 Apr Shift 1)

The magnetic field existing in a region is given by $\vec{B} = 0.2(1 + 2x)\hat{k} \text{ T}$. A square loop of edge 50 cm carrying 0.5 A current is placed in $x - y$ plane with its edges parallel to the $x - y$ axes, as shown in figure. The magnitude of the net magnetic force experienced by the loop is _____ mN.



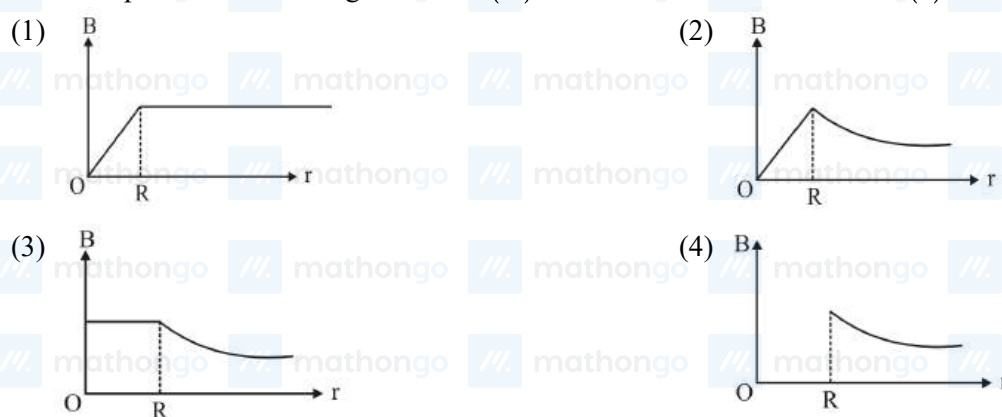
Q375. JEE Main 2023 (06 Apr Shift 1)

A long straight wire of circular cross-section (radius a) is carrying steady current I . The current I is uniformly distributed across this cross-section. The magnetic field is

- (1) inversely proportional to r in the region $r < a$ and uniform throughout in the region $r > a$
- (2) directly proportional to r in the region $r < a$ and inversely proportional to r in the region $r > a$
- (3) Zero in the region $r < a$ and inversely proportional to r in the region $r > a$
- (4) uniform in the region $r < a$ and inversely proportional to distance r from the axis, in the region $r > a$

Q376. JEE Main 2022 (28 Jun Shift 1)

An infinitely long hollow conducting cylinder with radius R carries a uniform current along its surface. Choose the correct representation of magnetic field (B) as a function of radial distance (r) from the axis of cylinder.

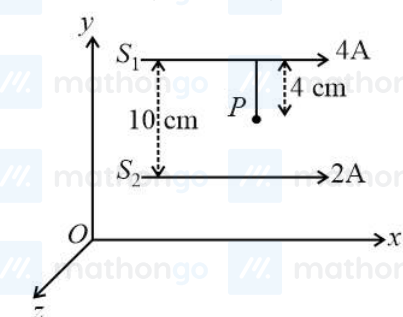


Q377. JEE Main 2022 (27 Jun Shift 2)

Two long parallel conductors S_1 and S_2 are separated by a distance 10 cm and carrying currents of 4 A and 2 A respectively. The conductors are placed along x -axis in $X - Y$ plane. There is a point P located between the conductors (as shown in figure).

A charge particle of 3π coulomb is passing through the point P with velocity $\vec{v} = (2\hat{i} + 3\hat{j}) \text{ m s}^{-1}$; where \hat{i} & \hat{j} represents unit vector along x & y axis respectively. The force acting on the charge particle is

$4\pi \times 10^{-5}(-x\hat{i} + 2\hat{j}) \text{ N}$. The value of x is



- (1) 2
- (2) 1
- (3) 3
- (4) -3

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Q378. JEE Main 2022 (27 Jun Shift 2)

A deuteron and a proton moving with equal kinetic energy enter into to a uniform magnetic field at right angle to the field. If r_d and r_p are the radii of their circular paths respectively, then the ratio $\frac{r_d}{r_p}$ will be $\sqrt{x} : 1$ where x is 4.

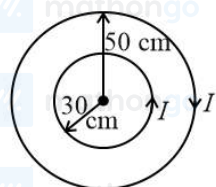
Q379. JEE Main 2022 (26 Jun Shift 1)

A proton and an alpha particle of the same velocity enter in a uniform magnetic field which is acting perpendicular to their direction of motion. The ratio of the radii of the circular paths described by the alpha particle and proton is

- (1) 4 : 1 (2) 2 : 1
(3) 1 : 2 (4) 1 : 4

Q380. JEE Main 2022 (26 Jul Shift 2)

Two concentric circular loops of radii $r_1 = 30$ cm and $r_2 = 50$ cm are placed in $X - Y$ plane as shown in the figure. A current $I = 7$ A is flowing through them in the direction as shown in figure. The net magnetic moment of this system of two circular loops is approximately



- (1) $\frac{7}{2}\hat{k} \text{ A m}^2$ (2) $-\frac{7}{2}\hat{k} \text{ A m}^2$
 (3) $7\hat{k} \text{ A m}^2$ (4) $-7\hat{k} \text{ A m}^2$

Q381. JEE Main 2021 (31 Aug Shift 2)

A long solenoid with $1000 \text{ turns m}^{-1}$ has a core material with relative permeability 500 and volume 10^3 cm^3 . If the core material is replaced by another material having relative permeability of 750 with same volume maintaining same current of 0.75 A in the solenoid, the fractional change in the magnetic moment of the core would be approximately $\left(\frac{x}{499}\right)$. Find the value of x .

Q382. JEE Main 2021 (31 Aug Shift 1)

A coil having N turns is wound tightly in the form of a spiral with inner and outer radii a and b respectively. Find the magnetic field at centre, when a current I passes through coil :

- $$(1) \frac{\mu_0 I}{8} \left[\frac{a+b}{a-b} \right] \quad (2) \frac{\mu_0 I}{4(a-b)} \left[\frac{1}{a} - \frac{1}{b} \right] \quad (3) \frac{\mu_0 I}{8} \left(\frac{a-b}{a+b} \right) \quad (4) \frac{\mu_0 I N}{2(b-a)} \log_e \left(\frac{b}{a} \right)$$

Q383. JEE Main 2021 (26 Aug Shift 1)

The fractional change in the magnetic field intensity at a distance r from centre on the axis of current carrying coil of radius a to the magnetic field intensity at the centre of the same coil is: (Take $r < a$)

- $$(1) \frac{2}{3} \frac{a^2}{r^2} \qquad (2) \frac{3}{2} \frac{a^2}{r^2} \qquad (3) \frac{3}{2} \frac{r^2}{a^2} \qquad (4) \frac{2}{3} \frac{r^2}{a^2}$$

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Q384. JEE Main 2020 (02 Sep Shift 1)

A beam of protons with speed $4 \times 10^5 \text{ m s}^{-1}$ enters a uniform magnetic field of 0.3 T at an angle 60° to the magnetic field, the pitch of the resulting helical path of protons is close to :

(Mass of the proton = $1.67 \times 10^{-27} \text{ kg}$,

charge of the proton = $1.69 \times 10^{-19} \text{ C}$)

(1) 2 cm

(2) 5 cm

(3) 12 cm

(4) 4 cm

Chapter: Electromagnetic Induction**Q385. JEE Main 2025 (29 Jan Shift 1)**

Consider I_1 and I_2 are the currents flowing simultaneously in two nearby coils 1 & 2, respectively. If L_1 = self inductance of coil 1, M_{12} = mutual inductance of coil 1 with respect to coil 2, then the value of induced emf in coil 1 will be

Options

(1) $\varepsilon_1 = -L_1 \frac{dI_2}{dt} - M_{12} \frac{dI_1}{dt}$

(2) $\varepsilon_1 = -L_1 \frac{dI_1}{dt} - M_{12} \frac{dI_2}{dt}$

(3) $\varepsilon_1 = -L_1 \frac{dI_1}{dt} - M_{12} \frac{dI_1}{dt}$

(4) $\varepsilon_1 = -L_1 \frac{dI_1}{dt} + M_{12} \frac{dI_2}{dt}$

Q386. JEE Main 2025 (28 Jan Shift 2)

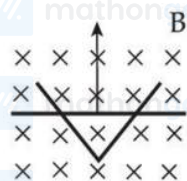
A uniform magnetic field of 0.4 T acts perpendicular to a circular copper disc 20 cm in radius. The disc is having a uniform angular velocity of $10\pi \text{ rad s}^{-1}$ about an axis through its centre and perpendicular to the disc. What is the potential difference developed between the axis of the disc and the rim ? ($\pi = 3.14$)

(1) 0.5024 V

(2) V

(3) 0.2512 V

(4) 0.1256 V

Q387. JEE Main 2025 (28 Jan Shift 2)

A conducting bar moves on two conducting rails as shown in the figure. A constant magnetic field B exists into the page. The bar starts to move from the vertex at time $t = 0$ with a constant velocity. If the induced EMF is $E \propto t^n$, then value of n is _.

Q388. JEE Main 2025 (23 Jan Shift 1)

Regarding self-inductance:

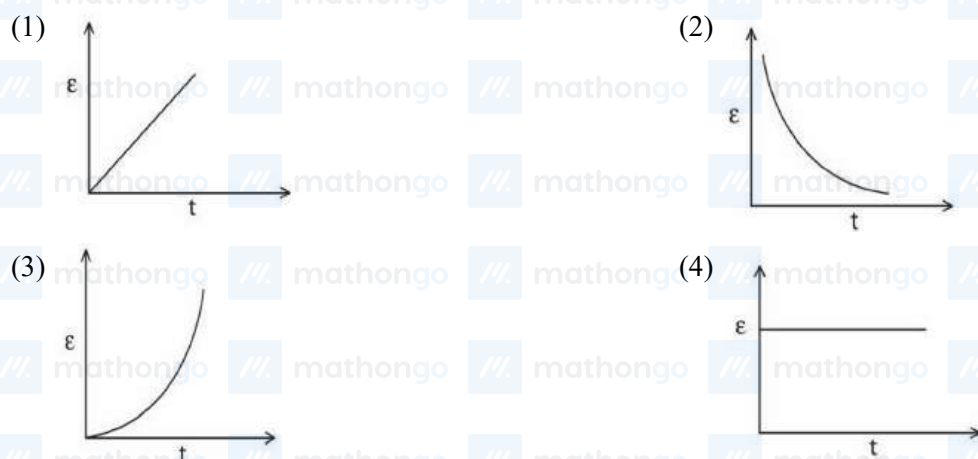
- A. The self-inductance of the coil depends on its geometry.
- B. Self-inductance does not depend on the permeability of the medium.
- C. Self-induced e.m.f. opposes any change in the current in a circuit.
- D. Self-inductance is electromagnetic analogue of mass in mechanics.
- E. Work needs to be done against self-induced e.m.f. in establishing the current.

Choose the correct answer from the options given below:

- (1) A, B, C, E only
- (2) B, C, D, E only
- (3) A, C, D, E only
- (4) A, B, C, D only

Q389. JEE Main 2025 (22 Jan Shift 2)

A rectangular metallic loop is moving out of a uniform magnetic field region to a field free region with a constant speed. When the loop is partially inside the magnetic field, the plot of magnitude of induced emf (ε) with time (t) is given by

**Q390. JEE Main 2024 (29 Jan Shift 1)**

A square loop of side 10 cm and resistance 0.7Ω is placed vertically in the east-west plane. A uniform magnetic field of 0.20 T is set up across the plane in the north-east direction. The magnetic field is decreased to zero in 1 s at a steady rate. Then, the magnitude of induced emf is $\sqrt{x} \times 10^{-3}$ V. The value of x is _____.

Q391. JEE Main 2024 (27 Jan Shift 1)

Two coils have mutual inductance 0.002 H. The current changes in the first coil according to the relation

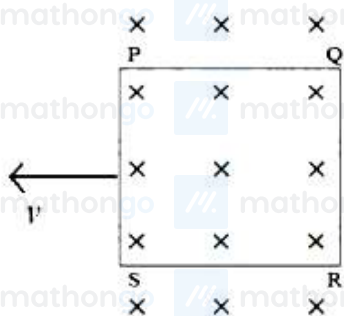
$i = i_0 \sin \omega t$, where $i_0 = 5$ A and $\omega = 50\pi$ rad s^{-1} . The maximum value of emf in the second coil is $\frac{\pi}{\alpha}$ V. The value of α is

Q392. JEE Main 2024 (09 Apr Shift 1)

When a coil is connected across a 20 V dc supply, it draws a current of 5 A. When it is connected across 20 V, 50 Hz ac supply, it draws a current of 4 A. The self inductance of the coil is _____ mH. (Take $\pi = 3$)

Q393. JEE Main 2024 (08 Apr Shift 1)

A square loop PQRS having 10 turns, area $3.6 \times 10^{-3} \text{ m}^2$ and resistance 100Ω is slowly and uniformly being pulled out of a uniform magnetic field of magnitude $B = 0.5 \text{ T}$ as shown. Work done in pulling the loop out of the field in 1.0 s is _____ $\times 10^{-6} \text{ J}$.

**Q394. JEE Main 2024 (04 Apr Shift 2)**

A rod of length 60 cm rotates with a uniform angular velocity 20 rad s^{-1} about its perpendicular bisector, in a uniform magnetic field 0.5 T . The direction of magnetic field is parallel to the axis of rotation. The potential difference between the two ends of the rod is _____ V.

Q395. JEE Main 2024 (01 Feb Shift 1)

A rectangular loop of sides 12 cm and 5 cm, with its sides parallel to the x -axis and y -axis respectively moves with a velocity of 5 cm s^{-1} in the positive x axis direction, in a space containing a variable magnetic field in the positive z direction. The field has a gradient of $10^{-3} \text{ T cm}^{-1}$ along the negative x direction and it is decreasing with time at the rate of 10^{-3} T s^{-1} . If the resistance of the loop is $6 \text{ m}\Omega$, the power dissipated by the loop as heat is _____ $\times 10^{-9} \text{ W}$.

Q396. JEE Main 2023 (10 Apr Shift 1)

A 1 m long metal rod XY completes the circuit as shown in figure. The plane of the circuit is perpendicular to the magnetic field of flux density 0.15 T . If the resistance of the circuit is 5Ω , the force needed to move the rod in direction, as indicated, with a constant speed of 4 m s^{-1} will be _____ 10^{-3} N .



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Q397. JEE Main 2022 (26 Jun Shift 2)

A metallic conductor of length 1 m rotates in a vertical plane parallel to east-west direction about one of its end with angular velocity 5 rad s^{-1} . If the horizontal component of earth's magnetic field is $0.2 \times 10^{-4} \text{ T}$, then emf induced between the two ends of the conductor is

- (1) $5 \mu\text{V}$ (2) $50 \mu\text{V}$
 (3) 5 mV (4) 50 mV

Q398. JEE Main 2022 (26 Jun Shift 2)

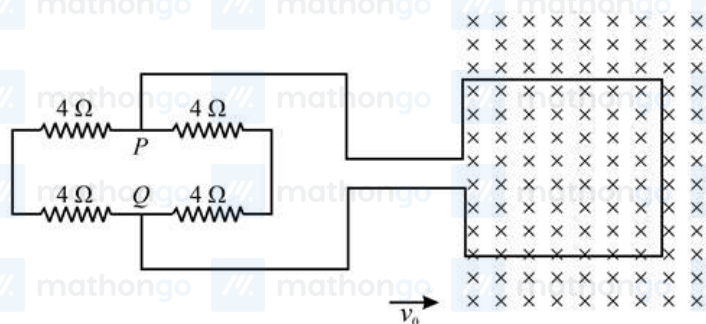
Two coils of self inductance L_1 and L_2 are connected in series combination having mutual inductance of the coils as M . The equivalent self inductance of the combination will be



- (1) $\frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{M}$ (2) $L_1 + L_2 - 2M$
 (3) $L_1 + L_2 + M$ (4) $L_1 + L_2 + 2M$

Q399. JEE Main 2021 (01 Sep Shift 2)

A square loop of side 20 cm and resistance 1Ω is moved towards right with a constant speed v_0 . The right arm of the loop is in a uniform magnetic field of 5 T. The field is perpendicular to the plane of the loop and is going into it. The loop is connected to a network of resistors each of value 4Ω . What should be the value of v_0 so that a steady current of 2 mA flows in the loop?



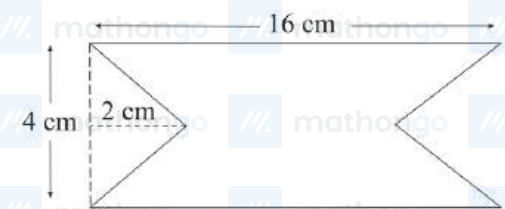
- (1) $10^{-2} \text{ cm s}^{-1}$ (2) 1 m s^{-1}
 (3) 1 cm s^{-1} (4) 10^2 m s^{-1}

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Q400. JEE Main 2020 (08 Jan Shift 1)

At time $t = 0$ magnetic field of 1000 Gauss is passing perpendicularly through the area defined by the closed loop shown in the figure. If the magnetic field reduces linearly to 500 Gauss, in the next 5s, then induced EMF in the loop is:



- (1) $56\mu\text{V}$ (2) $28\mu\text{V}$
(3) $48\mu\text{V}$ (4) $36\mu\text{V}$

Q401. JEE Main 2020 (07 Jan Shift 1)

A loop ABCDEFA of straight edges has six corner points $A(0, 0, 0)$, $B(5, 0, 0)$, $C(5, 5, 0)$, $D(0, 5, 0)$, $E(0, 5, 5)$ and $F(0, 0, 5)$. The magnetic field in this region is $\vec{B} = (3\hat{i} + 4\hat{k})T$. The quantity of flux through the loop ABCDEFA (in Wb) is _____.

Chapter: Alternating Current**Q402. JEE Main 2025 (7 April Shift 2)**

An inductor of reactance 100Ω , a capacitor of reactance 50Ω , and a resistor of resistance 50Ω are connected in series with an AC source of 10 V, 50 Hz. Average power dissipated by the circuit is _____ W.

Q403. JEE Main 2025 (4 April Shift 2)

An inductor of self inductance 1 H connected in series with a resistor of $100\pi\Omega$ and an ac supply of 100π volt, 50 Hz. Maximum current flowing in the circuit is _____ A.

Q404. JEE Main 2025 (3 April Shift 2)

An electric bulb rated as 100 W – 220 V is connected to an ac source of rms voltage 220 V. The peak value of current through the bulb is :

- (1) 0.64 A (2) 0.45 A
(3) 2.2 A (4) 0.32 A

Q405. JEE Main 2025 (29 Jan Shift 1)

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

Assertion (A) : Choke coil is simply a coil having a large inductance but a small resistance. Choke coils are used with fluorescent mercury-tube fittings. If household electric power is directly connected to a mercury tube, the tube will be damaged.

Reason (R): By using the choke coil, the voltage across the tube is reduced by a factor $\left(\frac{R}{\sqrt{R^2 + \omega^2 L^2}} \right)$, where ω is frequency of the supply across resistor R and inductor L . If the choke coil were not used, the voltage across the resistor would be the same as the applied voltage.

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

- (1) (A) is true but (R) is false
- (2) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (3) (A) is false but (R) is true
- (4) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Q406. JEE Main 2025 (23 Jan Shift 2)

In a series LCR circuit, a resistor of 300Ω , a capacitor of 25 nF and an inductor of 100 mH are used. For maximum current in the circuit, the angular frequency of the ac source is $\underline{\hspace{1cm}} \times 10^4\text{ radians s}^{-1}$.

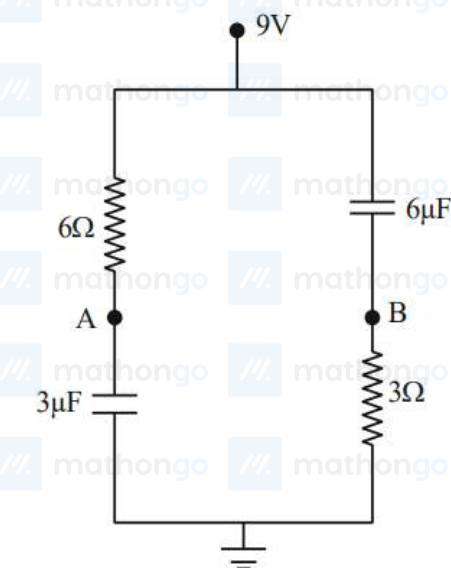
Q407. JEE Main 2025 (22 Jan Shift 2)

A series LCR circuit is connected to an alternating source of emf E . The current amplitude at resonant frequency is I_0 . If the value of resistance R becomes twice of its initial value then amplitude of current at resonance will be

- (1) $2I_0$
- (2) I_0
- (3) $\frac{I_0}{2}$
- (4) $\frac{I_0}{\sqrt{2}}$

Q408. JEE Main 2024 (29 Jan Shift 2)

In the given figure, the charge stored in $6\mu\text{F}$ capacitor, when points A and B are joined by a connecting wire is $\underline{\hspace{1cm}}\mu\text{C}$.



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Q409. JEE Main 2024 (27 Jan Shift 2)

The primary side of a transformer is connected to 230 V, 50 Hz supply. The turn ratio of primary to secondary winding is 10 : 1. Load resistance connected to the secondary side is $46\ \Omega$. The power consumed in it is:

- (1) 12.5 W (2) 10.0 W
(3) 11.5 W (4) 12.0 W

Q410. JEE Main 2024 (06 Apr Shift 1)

When a *dc* voltage of 100 V is applied to an inductor, a *dc* current of 5 A flows through it. When an ac voltage of 200 V peak value is connected to inductor, its inductive reactance is found to be $20\sqrt{3}\ \Omega$. The power dissipated in the circuit is _____ W.

Q411. JEE Main 2023 (30 Jan Shift 1)

In a series *LR* circuit with $X_L = R$, power factor is P_1 . If a capacitor of capacitance C with $X_C = X_L$ is added to the circuit the power factor becomes P_2 . The ratio of P_1 to P_2 will be :

- (1) 1 : 3 (2) $1 : \sqrt{2}$
(3) 1 : 1 (4) 1 : 2

Q412. JEE Main 2023 (01 Feb Shift 1)

A series LCR circuit is connected to an ac source of 220 V, 50 Hz. The circuit contain a resistance $R = 100\ \Omega$ and an inductor of inductive reactance $X_L = 79.6\ \Omega$. The capacitance of the capacitor needed to maximize the average rate at which energy is supplied will be _____ μF .

Q413. JEE Main 2022 (28 Jun Shift 1)

A telegraph line of length 100 km has a capacity of $0.01\ \mu\text{F km}^{-1}$ and it carries an alternating current at 0.5 kilo cycle per second. If minimum impedance is required, then the value of the inductance that needs to be introduced in series is _____ mH. (If $\pi = \sqrt{10}$)

Q414. JEE Main 2022 (27 Jul Shift 2)

A series LCR circuit has $L = 0.01\ \text{H}$, $R = 10\ \Omega$ and $C = 1\ \mu\text{F}$ and it is connected to ac voltage of amplitude (V_m) 50 V. At frequency 60% lower than resonant frequency, the amplitude of current will be approximately

- (1) 466 mA (2) 312 mA
(3) 238 mA (4) 196 mA

Q415. JEE Main 2022 (25 Jun Shift 1)

Match List - I with List - II.

List-I**List-II**

- (A) AC generator (I) Detects the presence of current in the circuit
 (B) Galvanometer (II) Converts mechanical energy into electrical energy
 (C) Transformer (III) Works on the principle of resonance in AC circuit
 (D) Metal detector (IV) Changes an alternating voltage for smaller or greater value

(1) (A) – (II), (B) – (I), (C) – (IV), (D) – (III)

(2) (A) – (II), (B) – (I), (C) – (III), (D) – (IV)

(3) (A) – (III), (B) – (IV), (C) – (II), (D) – (I)

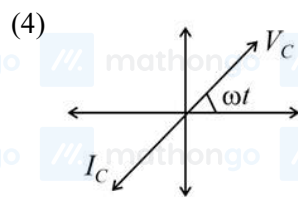
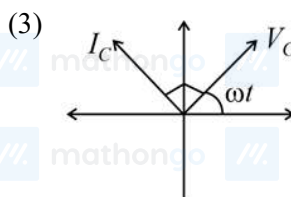
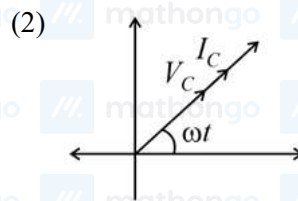
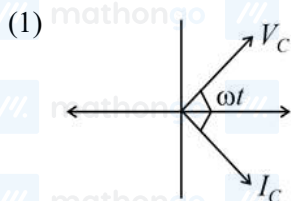
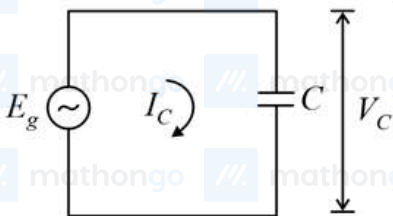
(4) (A) – (III), (B) – (I), (C) – (II), (D) – (IV)

Q416. JEE Main 2021 (26 Aug Shift 1)

A series LCR circuit driven by 300 V at a frequency of 50 Hz contains a resistance $R = 3 \text{ k}\Omega$, an inductor of inductive reactance $X_L = 250\pi \Omega$ and an unknown capacitor. The value of capacitance to maximise the average power should be _____ (take $\pi^2 = 10$)

(1) $400 \mu\text{F}$ (2) $4 \mu\text{F}$ (3) $40 \mu\text{F}$ (4) $25 \mu\text{F}$ **Q417. JEE Main 2021 (22 Jul Shift 1)**

In a circuit consisting of a capacitance and a generator with alternating emf, $E_g = E_0 \sin \omega t$, V_C and I_C are the voltage and current. Correct phasor diagram for such circuit is



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Q418. JEE Main 2020 (07 Jan Shift 1)

A LCR circuit behaves like a clamped harmonic oscillator. Comparing it with a physical spring-mass damped oscillator having damping constant ' b ', the correct equivalence would be:

- (1) $L \leftrightarrow m, C \leftrightarrow k, R \leftrightarrow b$
- (2) $L \leftrightarrow \frac{1}{b}, C \leftrightarrow \frac{1}{m}, R \leftrightarrow \frac{1}{k}$
- (3) $L \leftrightarrow k, C \leftrightarrow b, R \leftrightarrow m$
- (4) $L \leftrightarrow m, C \leftrightarrow \frac{1}{k}, R \leftrightarrow b$

Chapter: Ray Optics**Q419. JEE Main 2025 (8 April Shift 2)**

A concave-convex lens of refractive index 1.5 and the radii of curvature of its surfaces are 30 cm and 20 cm, respectively. The concave surface is upwards and is filled with a liquid of refractive index 1.3. The focal length of the liquid-glass combination will be

- (1) $\frac{500}{11}$ cm
- (2) $\frac{800}{11}$ cm
- (3) $\frac{700}{11}$ cm
- (4) $\frac{600}{11}$ cm

Q420. JEE Main 2025 (7 April Shift 2)

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

Assertion (A) : Refractive index of glass is higher than that of air.

Reason (R) : Optical density of a medium is directly proportionate to its mass density which results in a proportionate refractive index.

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

- (1) (A) is not correct but (R) is correct
- (2) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (3) (A) is correct but (R) is not correct
- (4) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

Q421. JEE Main 2025 (7 April Shift 1)

Two thin convex lenses of focal length 30 cm and 10 cm are placed coaxially, 10 cm apart. The power of this combination is :

- (1) 5 D
- (2) 1 D
- (3) 20 D
- (4) 10 D

Q422. JEE Main 2025 (4 April Shift 1)

When an object is placed 40 cm away from a spherical mirror an image of magnification $\frac{1}{2}$ is produced. To obtain an image with magnification of $\frac{1}{3}$, the object is to be moved :

- (1) 40 cm away from the mirror.
- (2) 80 cm away from the mirror.
- (3) 20 cm towards the mirror.
- (4) 20 cm away from the mirror.

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Q423. JEE Main 2025 (3 April Shift 2)

Light from a point source in air falls on a spherical glass surface (refractive index, $\mu = 1.5$ and radius of curvature $= 50$ cm). The image is formed at a distance of 200 cm from the glass surface inside the glass. The magnitude of distance of the light source from the glass surface is ____ m.

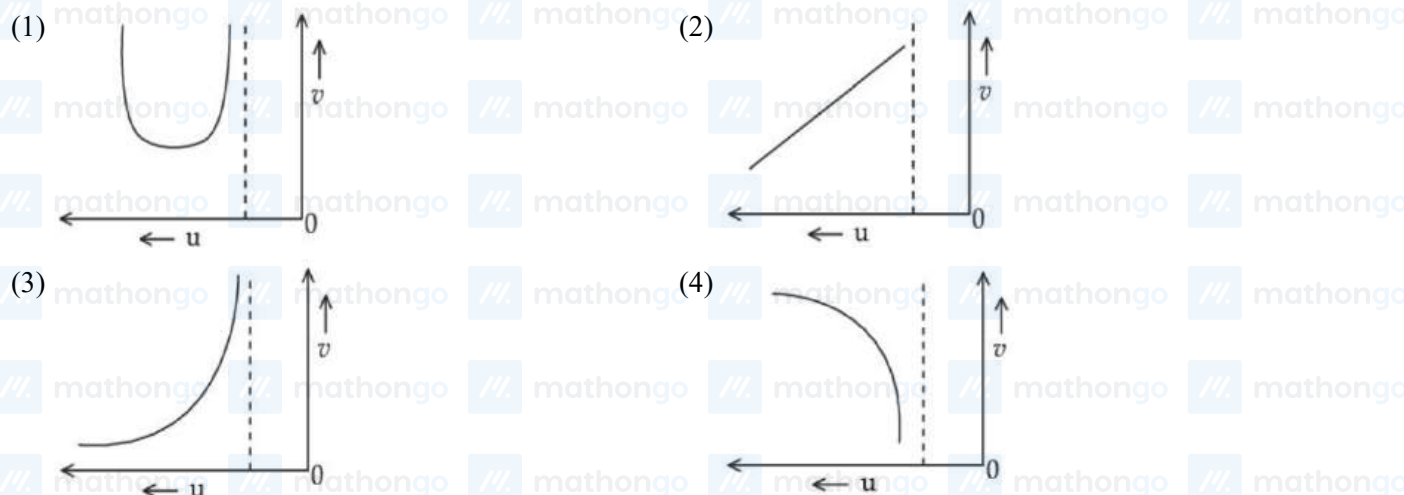
Q424. JEE Main 2025 (29 Jan Shift 2)

A convex lens made of glass (refractive index $= 1.5$) has focal length 24 cm in air. When it is totally immersed in water (refractive index $= 1.33$), its focal length changes to

- (1) 24 cm (2) 96 cm
(3) 48 cm (4) 72 cm

Q425. JEE Main 2025 (29 Jan Shift 1)

Let u and v be the distances of the object and the image from a lens of focal length f . The correct graphical representation of u and v for a convex lens when $|u| > f$, is

**Q426. JEE Main 2025 (28 Jan Shift 2)**

In a long glass tube, mixture of two liquids A and B with refractive indices 1.3 and 1.4 respectively, forms a convex refractive meniscus towards A. If an object placed at 13 cm from the vertex of the meniscus in A forms an image with a magnification of -2 then the radius of curvature of meniscus is :

- (1) $\frac{1}{3}$ cm (2) $\frac{4}{3}$ cm
(3) 1 cm (4) $\frac{2}{3}$ cm

Q427. JEE Main 2025 (24 Jan Shift 1)

A thin plano convex lens made of glass of refractive index 1.5 is immersed in a liquid of refractive index 1.2. When the plane side of the lens is silver coated for complete reflection, the lens immersed in the liquid behaves like a concave mirror of focal length 0.2 m. The radius of curvature of the curved surface of the lens is

- (1) 0.20 m (2) 0.25 m
(3) 0.15 m (4) 0.10 m

Q428. JEE Main 2025 (23 Jan Shift 2)

A concave mirror of focal length f in air is dipped in a liquid of refractive index μ . Its focal length in the liquid will be:

- (1) μf (2) $\frac{f}{\mu}$
(3) $\frac{f}{(\mu-1)}$ (4) $\frac{f}{\mu}$

Q429. JEE Main 2025 (23 Jan Shift 2)

5 The refractive index of the material of a glass prism is $\sqrt{3}$. The angle of minimum deviation is equal to the angle of the prism. What is the angle of the prism?

- (1) 60° (2) 58° (3) 48° (4) 50°

Q430. JEE Main 2025 (23 Jan Shift 1)

What is the lateral shift of a ray refracted through a parallel-sided glass slab of thickness ' h ' in terms of the angle of incidence ' i ' and angle of refraction ' r ', if the glass slab is placed in air medium?

- (1) $\frac{h \tan(i-r)}{\tan r}$ (2) $\frac{h \sin(i-r)}{\cos r}$
(3) h (4) $\frac{h \cos(i-r)}{\sin r}$

Q431. JEE Main 2025 (22 Jan Shift 2)

A transparent film of refractive index, 2.0 is coated on a glass slab of refractive index, 1.45. What is the minimum thickness of transparent film to be coated for the maximum transmission of Green light of wavelength 550 nm.

[Assume that the light is incident nearly perpendicular to the glass surface.]

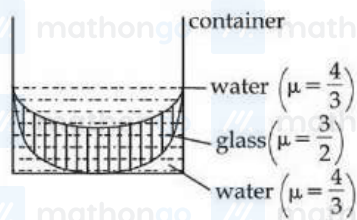
- (1) 137.5 nm (2) 275 nm
(3) 94.8 nm (4) 68.7 nm

Q432. JEE Main 2025 (22 Jan Shift 1)

The driver sitting inside a parked car is watching vehicles approaching from behind with the help of his side view mirror, which is a convex mirror with radius of curvature $R = 2$ m. Another car approaches him from behind with a uniform speed of 90 km/hr. When the car is at a distance of 24 m from him, the magnitude of the acceleration of the image of the car in the side view mirror is ' a '. The value of $100a$ is _____ m/s^2 .

Q433. JEE Main 2025 (22 Jan Shift 1)

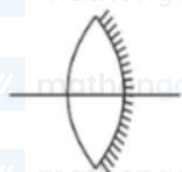
In the diagram given below, there are three lenses formed. Considering negligible thickness of each of them as compared to $|R_1|$ and $|R_2|$, i.e., the radii of curvature for upper and lower surfaces of the glass lens, the power of the combination is



- (1) $\frac{1}{6} \left(\frac{1}{|R_1|} - \frac{1}{|R_2|} \right)$ (2) $-\frac{1}{6} \left(\frac{1}{|R_1|} + \frac{1}{|R_2|} \right)$
 (3) $\frac{1}{6} \left(\frac{1}{|R_1|} + \frac{1}{|R_2|} \right)$ (4) $-\frac{1}{6} \left(\frac{1}{|R_1|} - \frac{1}{|R_2|} \right)$

Q434. JEE Main 2025 (22 Jan Shift 1)

Given is a thin convex lens of glass (refractive index μ) and each side having radius of curvature R . One side is polished for complete reflection. At what distance from the lens, an object be placed on the optic axis so that the image gets formed on the object itself?



- (1) R/μ (2) $R/(2\mu - 3)$
 (3) μR (4) $R/(2\mu - 1)$

Q435. JEE Main 2025 (2 April Shift 2)

A ray of light suffers minimum deviation when incident on a prism having angle of the prism equal to 60° . The refractive index of the prism material is $\sqrt{2}$. The angle of incidence (in degrees) is _____.

Q436. JEE Main 2025 (2 April Shift 2)

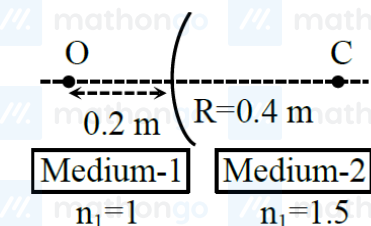
Two identical objects are placed in front of convex mirror and concave mirror having same radii of curvature of 12 cm, at same distance of 18 cm from the respective mirrors. The ratio of sizes of the images formed by convex mirror and by concave mirror is :

- (1) $1/2$ (2) 2
 (3) 3 (4) $1/3$

Q437. JEE Main 2025 (2 April Shift 2)

A bi-convex lens has radius of curvature of both the surfaces same as $\frac{1}{6}$ cm. If this lens is required to be replaced by another convex lens having different radii of curvatures on both sides ($R_1 \neq R_2$), without any change in lens power then possible combination of R_1 and R_2 is :

- (1) $\frac{1}{3}$ cm and $\frac{1}{3}$ cm (2) $\frac{1}{5}$ cm and $\frac{1}{7}$ cm
 (3) $\frac{1}{3}$ cm and $\frac{1}{7}$ cm (4) $\frac{1}{6}$ cm and $\frac{1}{9}$ cm

Q438. JEE Main 2025 (2 April Shift 1)

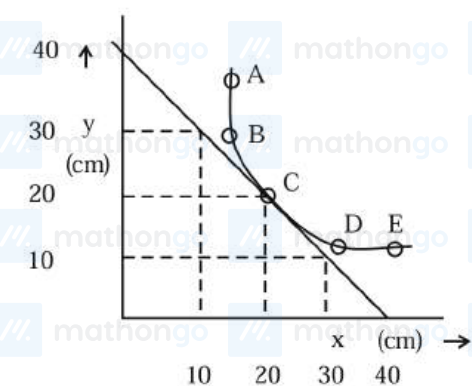
A spherical surface separates two media of refractive indices 1 and 1.5 as shown in figure. Distance of the image of an object 'O', is :

(C is the center of curvature of the spherical surface and R is the radius of curvature)

- (1) 0.24 m right to the spherical surface (2) 0.4 m left to the spherical surface
 (3) 0.24 m left to the spherical surface (4) 0.4 m right to the spherical surface

Q439. JEE Main 2024 (30 Jan Shift 2)

In an experiment to measure the focal length (f) of a convex lens, the magnitude of object distance (x) and the image distance (y) are measured with reference to the focal point of the lens. The $y - x$ plot is shown in figure. The focal length of the lens is _____ cm.

**Q440. JEE Main 2024 (29 Jan Shift 1)**

A biconvex lens of refractive index 1.5 has a focal length of 20 cm in air. Its focal length when immersed in a liquid of refractive index 1.6 will be:

- (1) -16 cm (2) -160 cm
 (3) +160 cm (4) +16 cm

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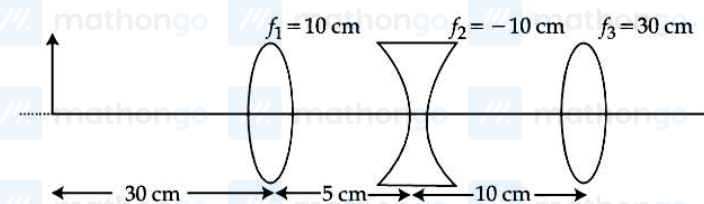
Q441. JEE Main 2024 (27 Jan Shift 1)

If the refractive index of the material of a prism is $\cot\left(\frac{A}{2}\right)$, where A is the angle of prism then the angle of minimum deviation will be

- (1) $\pi - 2A$ (2) $\frac{\pi}{2} - 2A$
 (3) $\pi - A$ (4) $\frac{\pi}{2} - A$

Q442. JEE Main 2024 (08 Apr Shift 2)

The position of the image formed by the combination of lenses is :



- (1) 15 cm (right of second lens) (2) 30 cm (left of third lens) (3) 15 cm (left of second lens) (4) 30 cm (right of third lens)

Q443. JEE Main 2024 (06 Apr Shift 2)

In finding out refractive index of glass slab the following observations were made through travelling microscope
 50 vernier scale division = 49MSD; 20 divisions on main scale in each cm

For mark on paper MSR = 8.45 cm, VC = 26

For mark on paper seen through slab MSR = 7.12 cm, VC = 41

For powder particle on the top surface of the glass slab MSR = 4.05 cm, VC = 1

(MSR = Main Scale Reading, VC = Vernier Coincidence)

Refractive index of the glass slab is :

- (1) 1.52 (2) 1.35 (3) 1.42 (4) 1.24

Q444. JEE Main 2024 (06 Apr Shift 1)

The refractive index of prism is $\mu = \sqrt{3}$ and the ratio of the angle of minimum deviation to the angle of prism is one. The value of angle of prism is _____.

Q445. JEE Main 2023 (06 Apr Shift 2)

A 2 meter long scale with least count of 0.2 cm is used to measure the locations of objects on an optical bench.

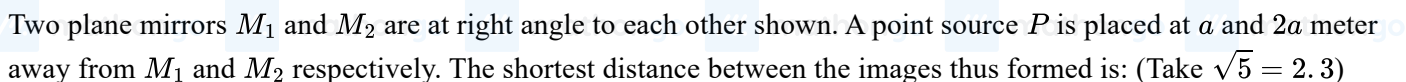
While measuring the focal length of a convex lens, the object pin and the convex lens are placed at 80 cm mark and 1 m mark, respectively. The image of the object pin on the other side of lens coincides with image pin that is kept at 180 cm mark. The % error in the estimation of focal length is:

- (1) 0.85 (2) 1.70 (3) 1.02 (4) 0.51

A convex lens has power P . It is cut into two halves along its principal axis. Further one piece (out of the two halves) is cut into two halves perpendicular to the principal axis (as shown in figures). Choose the incorrect option for the reported pieces.

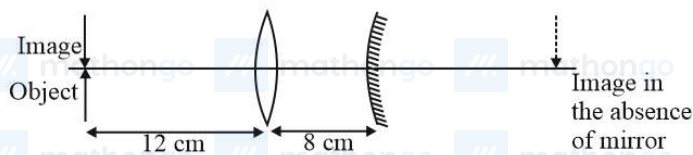


In the given figure, the face AC of the equilateral prism is immersed in a liquid of refractive index n . For incident angle 60° at the side AC , the refracted light beam just grazes along face AC . The refractive index of the liquid $n = \frac{\sqrt{x}}{4}$. The value of x is _____. (Given refractive index of glass = 1.5)



Q449. JEE Main 2021 (26 Aug Shift 2)

An object is placed at a distance of 12 cm from a convex lens. A convex mirror of focal length 15 cm is placed on another side of the lens at 8 cm as shown in the figure. The image of the object coincides with the object. When the convex mirror is removed, a real and inverted image is formed at a position. The distance of the image from the object will be ____ cm

**Q450. JEE Main 2021 (17 Mar Shift 2)**

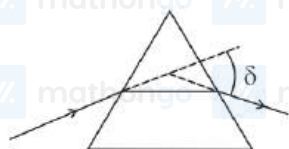
The image of an object placed in air formed by a convex refracting surface is at a distance of 10 m behind the surface. The image is real and is at $\frac{2^{rd}}{3}$ of the distance of the object from the surface. The wavelength of light inside the surface is $\frac{2}{3}$ times the wavelength in air. The radius of the curved surface is $\frac{x}{13}$ m, the value of x is _____.

Q451. JEE Main 2021 (16 Mar Shift 1)

The angle of deviation through a prism is minimum when

- (A) Incident ray and emergent ray are symmetric to the prism
- (B) The refracted ray inside the prism becomes parallel to its base
- (C) Angle of incidence is equal to that of the angle of emergence
- (D) When angle of emergence is double the angle of incidence

Choose the correct answer from the options given below :



- (1) Statements (A), (B) and (C) are true
- (2) Only statement (D) is true
- (3) Only statements (A) and (B) are true
- (4) Statements (B) and (C) are true

Q452. JEE Main 2020 (09 Jan Shift 1)

A vessel of depth $2h$ is half filled with a liquid of refractive index $2\sqrt{2}$ and the upper half with another liquid of refractive index $\sqrt{2}$. The liquids are immiscible. The apparent depth of the inner surface of the bottom of the vessel will be

- (1) $\frac{h}{\sqrt{2}}$
- (2) $\frac{h}{2(\sqrt{2}+1)}$
- (3) $\frac{h}{3\sqrt{2}}$
- (4) $\frac{3\sqrt{2}h}{4}$

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Chapter: Wave Optics**Q453. JEE Main 2025 (8 April Shift 2)**

In a Young's double slit experiment, the source is white light. One of the slits is covered by red filter and another by a green filter. In this case

- (1) There shall be an interference pattern for red distinct from that for green.
- (2) There shall be no interference fringes.
- (3) There shall be alternate interference fringes of red and green.
- (4) There shall be an interference pattern, where each fringe's pattern center is green and outer edges is red.

Q454. JEE Main 2025 (4 April Shift 2)

In a Young's double slit experiment, two slits are located 1.5 mm apart. The distance of screen from slits is 2 m and the wavelength of the source is 400 nm. If the 20 maxima of the double slit pattern are contained within the centre maximum of the single slit diffraction pattern, then the width of each slit is $x \times 10^{-3}$ cm, where x -value is

Q455. JEE Main 2025 (3 April Shift 2)

A monochromatic light of frequency 5×10^{14} Hz travelling through air, is incident on a medium of refractive index $\sqrt{2}$. Wavelength of the refracted light will be :

- (1) 300 nm
- (2) 600 nm
- (3) 400 nm
- (4) 500 nm

Q456. JEE Main 2025 (3 April Shift 2)

Width of one of the two slits in a Young's double slit interference experiment is half of the other slit. The ratio of the maximum to the minimum intensity in the interference pattern is :

- (1) $(2\sqrt{2} + 1) : (2\sqrt{2} - 1)$
- (2) $(3 + 2\sqrt{2}) : (3 - 2\sqrt{2})$
- (3) 9 : 1
- (4) 3 : 1

Q457. JEE Main 2025 (3 April Shift 1)

Two coherent monochromatic light beams of intensities $4I$ and $9I$ are superimposed. The difference between the maximum and minimum intensities in the resulting interference pattern is xI . The value of x is _____.

Q458. JEE Main 2025 (28 Jan Shift 2)

Which of the following phenomena can not be explained by wave theory of light?

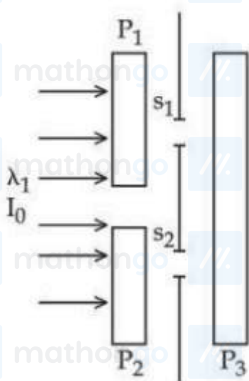
- (1) Compton effect
- (2) Refraction of light
- (3) Reflection of light
- (4) Diffraction of light

Q459. JEE Main 2025 (28 Jan Shift 1)

A double slit interference experiment performed with a light of wavelength 600 nm forms an interference fringe pattern on a screen with 10th bright fringe having its centre at a distance of 10 mm from the central maximum. Distance of the centre of the same 10th bright fringe from the central maximum when the source of light is replaced by another source of wavelength 660 nm would be _____ mm.

Q460. JEE Main 2025 (24 Jan Shift 2)

In a Young's double slit experiment, three polarizers are kept as shown in the figure. The transmission axes of P_1 and P_2 are orthogonal to each other. The polarizer P_3 covers both the slits with its transmission axis at 45° to those of P_1 and P_2 . An unpolarized light of wavelength λ and intensity I_0 is incident on P_1 and P_2 . The intensity at a point after P_3 where the path difference between the light waves from s_1 and s_2 is $\frac{\lambda}{3}$, is



- (1) $\frac{I_0}{2}$ (2) $\frac{I_0}{4}$
(3) $\frac{I_0}{3}$ (4) I_0

Q461. JEE Main 2025 (24 Jan Shift 1)

The Young's double slit interference experiment is performed using light consisting of 480 nm and 600 nm wavelengths to form interference patterns. The least number of the bright fringes of 480 nm light that are required for the first coincidence with the bright fringes formed by 600 nm light is

- (1) 5 (2) 4
(3) 6 (4) 8

Q462. JEE Main 2025 (22 Jan Shift 1)

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

Assertion-(A) : If Young's double slit experiment is performed in an optically denser medium than air, then the consecutive fringes come closer.

Reason-(R) : The speed of light reduces in an optically denser medium than air while its frequency does not change.

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

- (1) Both (A) and (R) are true but (R) is not the correct explanation of (A)
- (2) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (3) (A) is true but (R) is false
- (4) (A) is false but (R) is true

Q463. JEE Main 2023 (06 Apr Shift 2)

A beam of light consisting of two wavelengths 7000 \AA and 5500 \AA is used to obtain interference pattern in Young's double slit experiment. The distance between the slits is 2.5 mm and the distance between the plane of slits and the screen is 150 cm . The least distance from the central fringe, where the bright fringes due to both the wavelengths coincide, is $n \times 10^{-5} \text{ m}$. The value of n is _____.

Q464. JEE Main 2023 (01 Feb Shift 1)

' n ' polarizing sheets are arranged such that each makes an angle 45° with the proceeding sheet. An unpolarized light of intensity I is incident into this arrangement. The output intensity is found to be $\frac{I}{64}$. The value of n will be:

- (1) 3
- (2) 6
- (3) 5
- (4) 4

Q465. JEE Main 2022 (27 Jul Shift 2)

Two coherent sources of light interfere. The intensity ratio of two sources is $1 : 4$. For this interference pattern if the value of $\frac{I_{\max} + I_{\min}}{I_{\max} - I_{\min}}$ is equal to $\frac{2\alpha + 1}{\beta + 3}$, then $\frac{\alpha}{\beta}$ will be

- (1) 1.5
- (2) 2
- (3) 0.5
- (4) 1

Q466. JEE Main 2022 (24 Jun Shift 1)

Sodium light of wavelengths 650 nm and 655 nm is used to study diffraction at a single slit of aperture 0.5 mm .

The distance between the slit and the screen is 2.0 m . The separation between the positions of the first maxima of diffraction pattern obtained in the two cases is _____ $\times 10^{-5} \text{ m}$

Q467. JEE Main 2021 (25 Jul Shift 1)

In the Young's double slit experiment, the distance between the slits varies in time as $d(t) = d_0 + a_0 \sin \omega t$; where d_0 , ω and a_0 are constants. The difference between the largest fringe width and the smallest fringe width obtained over time is given as:

- (1) $\frac{2\lambda D(d_0)}{(d_0^2 - a_0^2)}$ (2) $\frac{2\lambda D a_0}{(d_0^2 - a_0^2)}$ (3) $\frac{\lambda D}{d_0^2} a_0$ (4) $\frac{\lambda D}{d_0 + a_0}$

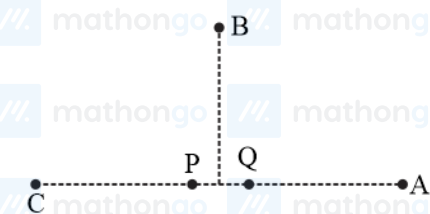
Q468. JEE Main 2020 (09 Jan Shift 1)

The aperture diameter of a telescope is 5m. The separation between the moon and the earth is 4×10^5 km. With light of wavelength of 5500 \AA , the minimum separation between objects on the surface of moon, so that they are just resolved, is close to:

- (1) 60m (2) 20m
(3) 200m (4) 600m

Q469. JEE Main 2020 (06 Sep Shift 1)

In the figure below, P and Q are two equally intense coherent sources emitting radiation of wavelength 20m . The separation between P and Q is 5m and the phase of P is ahead of that of Q by 90° . A , B and C are three distinct point of observation, each equidistant from the midpoint of PQ . The intensities of radiation at A , B , C will be in the ratio :



- (1) 0 : 1 : 4 (2) 2 : 1 : 0
(3) 0 : 1 : 2 (4) 4 : 1 : 0

Q470. JEE Main 2020 (04 Sep Shift 1)

A beam of plane polarized light of large cross-sectional area and uniform intensity of 3.3 W m^{-2} falls normally on a polarizer (cross-sectional area $3 \times 10^{-4} \text{ m}^2$), which rotates about its axis with an angular speed of 31.4 rad s^{-1} .

The energy of light passing through the polarizer per revolution, is close to:

- (1) $1.0 \times 10^{-5} \text{ J}$ (2) $1.0 \times 10^{-4} \text{ J}$
(3) $1.5 \times 10^{-4} \text{ J}$ (4) $5.0 \times 10^{-4} \text{ J}$

Chapter: Dual Nature of Matter**Q471. JEE Main 2025 (7 April Shift 2)**

A photo-emissive substance is illuminated with a radiation of wavelength λ_i so that it releases electrons with de-Broglie wavelength λ_e . The longest wavelength of radiation that can emit photoelectron is λ_0 . Expression for de-Broglie wavelength is given by :

(m : mass of the electron, h : Planck's constant and c : speed of light)

$$(1) \lambda_e = \sqrt{\frac{h}{2mc\left(\frac{1}{\lambda_i} - \frac{1}{\lambda_0}\right)}}$$

$$(2) \lambda_e = \sqrt{\frac{h\lambda_0}{2mc}}$$

$$(3) \lambda_e = \frac{h}{\sqrt{2mc\left(\frac{1}{\lambda_i} - \frac{1}{\lambda_0}\right)}}$$

$$(4) \lambda_e = \sqrt{\frac{h\lambda_i}{2mc}}$$

Q472. JEE Main 2025 (4 April Shift 1)

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

Assertion A: In photoelectric effect, on increasing the intensity of incident light the stopping potential increases.

Reason R : Increase in intensity of light increases the rate of photoelectrons emitted, provided the frequency of incident light is greater than threshold frequency.

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

(1) Both A and R are true but R is NOT the correct explanation of A

(2) A is false but R is true

(3) A is true but R is false

(4) Both A and R are true and R is the correct explanation of A

Q473. JEE Main 2025 (4 April Shift 1)

A small mirror of mass m is suspended by a massless thread of length l . Then the small angle through which the thread will be deflected when a short pulse of laser of energy E falls normal on the mirror (c = speed of light in vacuum and g = acceleration due to gravity)

$$(1) \theta = \frac{3E}{4mc\sqrt{gl}}$$

$$(2) \theta = \frac{E}{mc\sqrt{gl}}$$

$$(3) \theta = \frac{E}{2mc\sqrt{gl}}$$

$$(4) \theta = \frac{2E}{mc\sqrt{gl}}$$

Q474. JEE Main 2025 (3 April Shift 1)

The radiation pressure exerted by a 450 W light source on a perfectly reflecting surface placed at 2 m away from it, is :

$$(1) 1.5 \times 10^{-8} \text{ Pascals}$$

$$(2) 0$$

$$(3) 6 \times 10^{-8} \text{ Pascals}$$

$$(4) 3 \times 10^{-8} \text{ Pascals}$$

Q475. JEE Main 2025 (29 Jan Shift 2)

In an experiment with photoelectric effect, the stopping potential,

- (1) increases with increase in the intensity of the incident light
- (2) decreases with increase in the intensity of the incident light
- (3) increases with increase in the wavelength of the incident light
- (4) is $\left(\frac{1}{e}\right)$ times the maximum kinetic energy of the emitted photoelectrons

Q476. JEE Main 2025 (24 Jan Shift 2)

In photoelectric effect, the stopping potential (V_0)v/s frequency (ν) curve is plotted.

(h is the Planck's constant and ϕ_0 is work function of metal)

- (A) $V_0\nu/s\nu$ is linear.
- (B) The slope of $V_0\nu/s\nu$ curve = $\frac{\phi_0}{h}$
- (C) h constant is related to the slope of $V_0\nu/s\nu$ line.
- (D) The value of electric charge of electron is not required to determine h using the $V_0\nu/s\nu$ curve.
- (E) The work function can be estimated without knowing the value of h .

Choose the correct answer from the options given below :

- (1) (C) and (D) only
- (2) (A), (C) and (E) only
- (3) (A), (B) and (C) only
- (4) (D) and (E) only

Q477. JEE Main 2025 (23 Jan Shift 2)

In photoelectric effect an EM-wave is incident on a metal surface and electrons are ejected from the surface. If the work function of the metal is 2.14 eV and stopping potential is 2 V, what is the wavelength of the EM-wave ?

(Given $hc = 1242\text{eVnm}$ where h is the Planck's constant and c is the speed of light in vacuum.)

- (1) 300 nm
- (2) 400 nm
- (3) 600 nm
- (4) 200 nm

Q478. JEE Main 2025 (2 April Shift 1)

A monochromatic light is incident on a metallic plate having work function ϕ . An electron, emitted normally to the plate from a point A with maximum kinetic energy, enters a constant magnetic field, perpendicular to the initial velocity of electron. The electron passes through a curve and hits back the plate at a point B . The distance between A and B is :

(Given : The magnitude of charge of an electron is e and mass is m , h is Planck's constant and c is velocity of light.

Take the magnetic field exists throughout the path of electron)

- (1) $\sqrt{2m\left(\frac{hc}{\lambda} - \phi\right)}/eB$
- (2) $\sqrt{m\left(\frac{hc}{\lambda} - \phi\right)}/eB$
- (3) $\sqrt{8m\left(\frac{hc}{\lambda} - \phi\right)}/eB$
- (4) $2\sqrt{m\left(\frac{hc}{\lambda} - \phi\right)}/eB$

Q479. JEE Main 2024 (31 Jan Shift 2)

In a photoelectric effect experiment a light of frequency 1.5 times the threshold frequency is made to fall on the surface of photosensitive material. Now if the frequency is halved and intensity is doubled, the number of photoelectrons emitted will be:

- (1) Doubled (2) Quadrupled
(3) Zero (4) Halved

Q480. JEE Main 2024 (29 Jan Shift 1)

The de-Broglie wavelength of an electron is the same as that of a photon. If velocity of electron is 25% of the velocity of light, then the ratio of K.E. of electron and K.E. of photon will be:

- (1) $\frac{1}{1}$ (2) $\frac{1}{8}$
(3) $\frac{8}{1}$ (4) $\frac{1}{4}$

Q481. JEE Main 2024 (08 Apr Shift 1)

Average force exerted on a non-reflecting surface at normal incidence is 2.4×10^{-4} N. If 360 W/cm^2 is the light energy flux during span of 1 hour 30 minutes, Then the area of the surface is:

- (1) 0.2 m^2 (2) 20 m^2
(3) 0.1 m^2 (4) 0.02 m^2

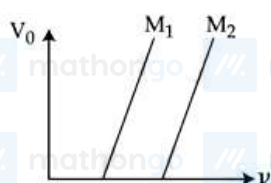
Q482. JEE Main 2024 (05 Apr Shift 1)

Given below are two statements:

Statement I: Figure shows the variation of stopping potential with frequency (ν) for the two photosensitive materials M_1 and M_2 . The slope gives value of $\frac{h}{e}$, where h is Planck's constant, e is the charge of electron.

Statement II: M_2 will emit photoelectrons of greater kinetic energy for the incident radiation having same frequency.

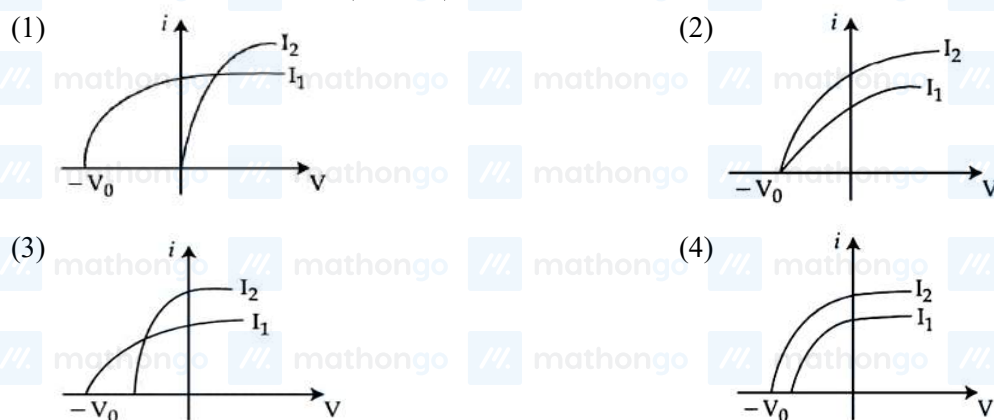
In the light of the above statements, choose the most appropriate answer from the options given below.



- (1) Both Statement I and Statement II are correct
(2) Statement I is incorrect but Statement II is correct
(3) Both Statement I and Statement II are incorrect
(4) Statement I is correct and Statement II is incorrect

Q483. JEE Main 2024 (04 Apr Shift 1)

Which figure shows the correct variation of applied potential difference (V) with photoelectric current (i) at two different intensities of light ($I_1 < I_2$) of same wavelengths :

**Q484. JEE Main 2022 (29 Jul Shift 2)**

An α particle and a proton are accelerated from rest through the same potential difference. The ratio of linear momenta acquired by above two particles will be :

- (1) $\sqrt{2} : 1$ (2) $2\sqrt{2} : 1$
 (3) $4\sqrt{2} : 1$ (4) $8 : 1$

Q485. JEE Main 2021 (17 Mar Shift 2)

Two identical photocathodes receive the light of frequencies f_1 and f_2 respectively. If the velocities of the photoelectrons coming out are v_1 and v_2 respectively, then

- (1) $v_1^2 - v_2^2 = \frac{2h}{m} [f_1 - f_2]$
 (2) $v_1^2 + v_2^2 = \frac{2h}{m} [f_1 + f_2]$
 (3) $v_1 + v_2 = \left[\frac{2h}{m} (f_1 + f_2) \right]^{\frac{1}{2}}$
 (4) $v_1 - v_2 = \left[\frac{2h}{m} (f_1 - f_2) \right]^{\frac{1}{2}}$

Q486. JEE Main 2020 (09 Jan Shift 2)

An electron of mass m and magnitude of charge e at rest, gets accelerated by a constant electric field E . The rate of change of de-Broglie wavelength of this electron at a time t is (ignore relativistic effects)

- (1) $\frac{d\lambda}{dt} = -\frac{h}{eEt}$ (2) $\frac{d\lambda}{dt} = -\frac{2h}{eEt}$
 (3) $\frac{d\lambda}{dt} = -\frac{2h}{eEt^2}$ (4) $\frac{d\lambda}{dt} = -\frac{h}{eEt^2}$

Chapter: Atomic Physics**Q487. JEE Main 2025 (7 April Shift 1)**

For a hydrogen atom, the ratio of the largest wavelength of Lyman series to that of the Balmer series is.

- (1) 5 : 36 (2) 5 : 27
(3) 3 : 4 (4) 27 : 5

Q488. JEE Main 2025 (4 April Shift 1)

Considering the Bohr model of hydrogen like atoms, the ratio of the ratio of the radius 5th orbit of the electron in Li^{2+} and He^{+} is

- (1) $\frac{3}{2}$ (2) $\frac{4}{9}$ (3) $\frac{9}{4}$ (4) $\frac{2}{3}$

Q489. JEE Main 2025 (3 April Shift 2)

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as

Reason R.

Assertion A: The Bohr model is applicable to hydrogen and hydrogen-like atoms only.

Reason R : The formulation of Bohr model does not include repulsive force between electrons.

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

- (1) Both A and R are true but R is NOT the correct explanation of A.
(2) A is false but R is true.
(3) Both A and R are true and R is the correct explanation of A.
(4) A is true but R is false.

Q490. JEE Main 2025 (24 Jan Shift 2)

Arrange the following in the ascending order of wavelength (λ) :

- (A) Microwaves (λ_1)
(B) Ultraviolet rays (λ_2)
(C) Infrared rays (λ_3)
(D) X-rays (λ_4)

Choose the most appropriate answer from the options given below :

- (1) $\lambda_4 < \lambda_3 < \lambda_2 < \lambda_1$ (2) $\lambda_3 < \lambda_4 < \lambda_2 < \lambda_1$
(3) $\lambda_4 < \lambda_3 < \lambda_1 < \lambda_2$ (4) $\lambda_4 < \lambda_2 < \lambda_3 < \lambda_1$

Q491. JEE Main 2025 (24 Jan Shift 1)

During the transition of electron from state A to state C of a Bohr atom, the wavelength of emitted radiation is 2000\AA and it becomes 6000\AA when the electron jumps from state B to state C. Then the wavelength of the radiation emitted during the transition of electrons from state A to state B is

- (1) 4000\AA (2) 2000\AA
(3) 3000\AA (4) 6000\AA

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Q492. JEE Main 2025 (2 April Shift 2)

Assuming the validity of Bohr's atomic model for hydrogen like ions the radius of Li^{++} ion in its ground state is given by $\frac{1}{X} a_0$, where $X = \underline{\hspace{2cm}}$. (Where a_0 is the first Bohr's radius.)

- (1) 2 (2) 1
(3) 3 (4) 9

Q493. JEE Main 2025 (2 April Shift 1)

Considering Bohr's atomic model for hydrogen atom :

- (A) the energy of H atom in ground state is same as energy of He^+ ion in its first excited state.
(B) the energy of H atom in ground state is same as that for Li^{++} ion in its second excited state.
(C) the energy of H atom in its ground state is same as that of He^+ ion for its ground state.
(D) the energy of He^+ ion in its first excited state is same as that for Li^{++} ion in its ground state

Choose the correct answer from the options given below :

- (1) (B), (D) only (2) (A), (B) only
(3) (A), (D) only (4) (A), (C) only

Q494. JEE Main 2024 (29 Jan Shift 2)

Hydrogen atom is bombarded with electrons accelerated through a potential different of V , which causes excitation of hydrogen atoms. If the experiment is being formed at $T = 0$ K. The minimum potential difference needed to observe any Balmer series lines in the emission spectra will be $\frac{\alpha}{10} V$, where $\alpha = \underline{\hspace{2cm}}$. (Write the value to the nearest integer)

Q495. JEE Main 2024 (06 Apr Shift 1)

The ratio of the shortest wavelength of Balmer series to the shortest wavelength of Lyman series for hydrogen atom is :

- (1) 4 : 1 (2) 1 : 4
(3) 2 : 1 (4) 1 : 2

Q496. JEE Main 2023 (01 Feb Shift 1)

A light of energy 12.75 eV is incident on a hydrogen atom in its ground state. The atom absorbs the radiation and reaches to one of its excited states. The angular momentum of the atom in the excited state is $\frac{x}{\pi} \times 10^{-17}$ eVs. The value of x is $\underline{\hspace{2cm}}$ (use $h = 4.14 \times 10^{-15}$ eVs, $c = 3 \times 10^8$ m s $^{-1}$)

Q497. JEE Main 2022 (29 Jul Shift 1)

Find the ratio of energies of photons produced due to transition of an electron of hydrogen atom from its (i) second permitted energy level to the first level, and (ii) the highest permitted energy level to the first permitted level.

- (1) 3 : 4 (2) 4 : 3
(3) 1 : 4 (4) 4 : 1

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Q498. JEE Main 2022 (27 Jun Shift 2)

Given below are two statements

Statement I: In hydrogen atom, the frequency of radiation emitted when an electron jumps from lower energy orbit (E_1) to higher energy orbit (E_2), is given as $hf = E_1 - E_2$

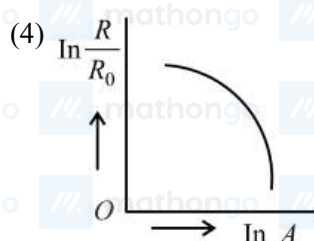
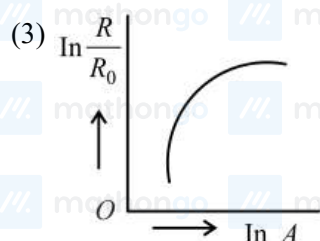
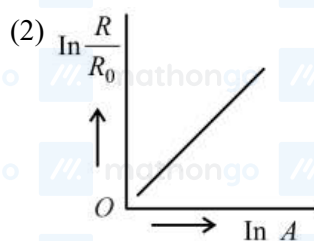
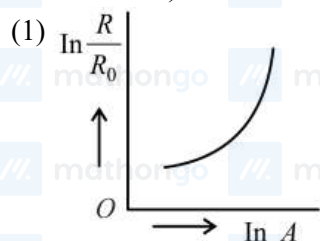
Statement II: The jumping of electron from higher energy orbit (E_2) to lower energy orbit (E_1) is associated with frequency of radiation given as $f = \frac{(E_2 - E_1)}{h}$. This condition is Bohr's frequency condition.

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

- (1) Both statement I and statement II are true.
- (2) Both statement I and statement II are false.
- (3) Statement I is correct but statement II is false.
- (4) Statement I is incorrect but statement II is true.

Q499. JEE Main 2022 (25 Jun Shift 2)

Which of the following figure represents the variation of $\ln\left(\frac{R}{R_0}\right)$ with $\ln A$ (if R = radius of a nucleus and A = its mass number)



Q500. JEE Main 2022 (25 Jul Shift 2)

$\frac{x}{x+4}$ is the ratio of energies of photons produced due to transition of an electron of hydrogen atom from its

- (i) third permitted energy level to the second level and
- (ii) the highest permitted energy level to the second permitted level.

The value of x will be

Q501. JEE Main 2022 (24 Jun Shift 2)

In Bohr's atomic model of hydrogen, let K , P and E are the kinetic energy, potential energy and total energy of the electron respectively. Choose the correct option when the electron undergoes transitions to a higher level :

- (1) All K , P and E increase.
- (2) K decreases, P and E increase.
- (3) P decreases, K and E increase.
- (4) K increases, P and E decrease

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Q502. JEE Main 2021 (16 Mar Shift 1)

The first three spectral lines of H-atom in the Balmer series are given $\lambda_1, \lambda_2, \lambda_3$ considering the Bohr atomic model, the wave lengths of first and third spectral lines $\left(\frac{\lambda_1}{\lambda_3}\right)$ are related by a factor of approximately $x \times 10^{-1}$. The value of x , to the nearest integer, is _____.

Chapter: Nuclear Physics**Q503. JEE Main 2025 (8 April Shift 2)**

For a nucleus of mass number A and radius R , the mass density of nucleus can be represented as

- (1) A^3 (2) $A^{\frac{1}{3}}$
 (3) $A^{\frac{2}{3}}$ (4) Independent of A

Q504. JEE Main 2025 (3 April Shift 1)

Match the LIST-I with LIST-II

	LIST-I		LIST-II
A.	${}_0^1\text{n} + {}_{92}^{235}\text{U} \rightarrow {}_{54}^{140}\text{Xe} + {}_{38}^{94}\text{Sr} + 2{}_0^1\text{n}$	I.	Chemical reaction
B.	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$	II.	Fusion with +ve Q value
C.	${}_1^2\text{H} + {}_1^2\text{H} \rightarrow {}_2^3\text{He} + {}_0^1\text{n}$	III.	Fission
D.	${}_1^1\text{H} + {}_1^3\text{H} \rightarrow {}_1^2\text{H} + {}_1^2\text{H}$	IV.	Fusion with -ve Q value

Choose the correct answer from the options given below :

- (1) A-II, B-I, C-III, D-IV (2) A-III, B-I, C-II, D-IV
 (3) A-II, B-I, C-IV, D-III (4) A-III, B-I, C-IV, D-II

Q505. JEE Main 2025 (28 Jan Shift 1)

Choose the correct nuclear process from the below options

[p: proton, n : neutron, e^- : electron, e^+ : positron, ν : neutrino, $\bar{\nu}$: antineutrino]

- (1) $n \rightarrow p + e^+ + \bar{\nu}$ (2) $n \rightarrow p + e^+ + \nu$
 (3) $n \rightarrow p + e^- + \nu$ (4) $n \rightarrow p + e^- + \bar{\nu}$

Q506. JEE Main 2025 (23 Jan Shift 2)

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

Assertion (A) : The binding energy per nucleon is found to be practically independent of the atomic number A, for nuclei with mass numbers between 30 and 170.

Reason (R): Nuclear force is long range.

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

- (1) (A) is true but (R) is false
- (2) (A) is false but (R) is true
- (3) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (4) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

Q507. JEE Main 2025 (2 April Shift 2)

Energy released when two deuterons (${}_1\text{H}^2$) fuse to form a helium nucleus (${}_2\text{He}^4$) is :

(Given : Binding energy per nucleon of ${}_1\text{H}^2 = 1.1\text{MeV}$ and binding energy per nucleon of ${}_2\text{He}^4 = 7.0\text{MeV}$)

- (1) 8.1 MeV
- (2) 5.9 MeV
- (3) 23.6 MeV
- (4) 26.8 MeV

Q508. JEE Main 2024 (29 Jan Shift 1)

The explosive in a Hydrogen bomb is a mixture of

${}_1\text{H}^2$, ${}_1\text{H}^3$ and ${}_3\text{Li}^6$ in some condensed form.

The chain reaction is given by ${}_3\text{Li}^6 + {}_0\text{n}^1 \rightarrow {}_2\text{He}^4 + {}_1\text{H}^3$; ${}_1\text{H}^2 + {}_1\text{H}^3 \rightarrow {}_2\text{He}^4 + {}_0\text{n}^1$

During the explosion the energy released is approximately

[Given : $M(\text{Li}) = 6.01690 \text{ amu}$, $M({}_1\text{H}^2) = 2.01471 \text{ amu}$, $M({}_2\text{He}^4) = 4.00388 \text{ amu}$ and $1 \text{ amu} = 931.5 \text{ MeV}$]

- (1) 28.12 MeV
- (2) 12.64 MeV
- (3) 16.48 MeV
- (4) 22.22 MeV

Q509. JEE Main 2024 (09 Apr Shift 1)

A star has 100% helium composition. It starts to convert three ${}^4\text{He}$ into one ${}^{12}\text{C}$ via triple alpha process as

${}^4\text{He} + {}^4\text{He} + {}^4\text{He} \rightarrow {}^{12}\text{C} + Q$. The mass of the star is $2.0 \times 10^{32} \text{ kg}$ and it generates energy at the rate of

$5.808 \times 10^{30} \text{ W}$. The rate of converting these ${}^4\text{He}$ to ${}^{12}\text{C}$ is $n \times 10^{42} \text{ s}^{-1}$, where n is _____. [Take, mass of

${}^4\text{He} = 4.0026\text{u}$, mass of ${}^{12}\text{C} = 12\text{u}$]

Q510. JEE Main 2022 (28 Jun Shift 1)

The Q-value of a nuclear reaction and kinetic energy of the projectile particle, K_p are related as

- (1) $Q = K_p$
- (2) $(K_p + Q) < 0$
- (3) $Q < K_p$
- (4) $(K_p + Q) > 0$

Q511. JEE Main 2022 (26 Jul Shift 2)

Two lighter nuclei combine to form a comparatively heavier nucleus by the relation given below: ${}^2_1X + {}^2_1X = {}^4_2Y$. The binding energies per nucleon 2_1X and 4_2Y are 1.1 MeV and 7.6 MeV respectively. The energy released in this process is _____ MeV.

Q512. JEE Main 2022 (24 Jun Shift 1)

Nucleus A is having mass number 220 and its binding energy per nucleon is 5.6 MeV. It splits in two fragments B and C of mass numbers 105 and 115. The binding energy of nucleons in B and C is 6.4 MeV per nucleon. The energy Q released per fission will be:

- (1) 0.8 MeV (2) 275 MeV
(3) 220 MeV (4) 176 MeV

Q513. JEE Main 2021 (25 Jul Shift 2)

From the given data, the amount of energy required to break the nucleus of aluminium ${}^{27}_{13}\text{Al}$ is _____ $x \times 10^{-3}$ J. Find x .

Mass of neutron = 1.00866 u; Mass of proton = 1.00726 u; Mass of Aluminium nucleus = 27.18846 u (Assume 1 u corresponds to x J of energy) (Round off to the nearest integer)

Q514. JEE Main 2020 (03 Sep Shift 2)

The radius R of a nucleus of mass number A can be estimated by the formula $R = (1.3 \times 10^{-15}) A^{1/3}$ m. It follows that the mass density of a nucleus is of the order of: ($M_{\text{prot}} \cong M_{\text{neut}} \simeq 1.67 \times 10^{-27}$ kg)

- (1) 10^3 kg m^{-3} (2) $10^{10} \text{ kg m}^{-3}$
(3) $10^{24} \text{ kg m}^{-3}$ (4) $10^{17} \text{ kg m}^{-3}$

Chapter: Electromagnetic Waves**Q515. JEE Main 2025 (7 April Shift 1)**

Two plane polarized light waves combine at a certain point whose electric field components are

$$E_1 = E_0 \sin \omega t$$

$$E_2 = E_0 \sin \left(\omega t + \frac{\pi}{3} \right)$$

Find the amplitude of the resultant wave.

- (1) $0.9 E$ (2) E_0
(3) $1.7E_0$ (4) $3.4E_0$

Q516. JEE Main 2025 (29 Jan Shift 2)

A plane electromagnetic wave propagates along the $+x$ direction in free space. The components of the electric field, \vec{E} and magnetic field, \vec{B} vectors associated with the wave in Cartesian frame are

- (1) E_x, B_y (2) E_y, B_z
(3) E_z, B_y (4) E_y, B_x

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Q517. JEE Main 2025 (28 Jan Shift 2)

The magnetic field of an E.M. wave is given by $\vec{B} = \left(\frac{\sqrt{3}}{2} \hat{i} + \frac{1}{2} \hat{j} \right) 30 \sin \left[\omega \left(t - \frac{z}{c} \right) \right]$ (S.I. Units).

The corresponding electric field in S.I. units is :

(1) $\vec{E} = \left(\frac{1}{2} \hat{i} - \frac{\sqrt{3}}{2} \hat{j} \right) 30c \sin \left[\omega \left(t - \frac{z}{c} \right) \right]$

(2) $\vec{E} = \left(\frac{3}{4} \hat{i} + \frac{1}{4} \hat{j} \right) 30c \cos \left[\omega \left(t - \frac{z}{c} \right) \right]$

(3) $\vec{E} = \left(\frac{1}{2} \hat{i} + \frac{\sqrt{3}}{2} \hat{j} \right) 30c \sin \left[\omega \left(t + \frac{z}{c} \right) \right]$

(4) $\vec{E} = \left(\frac{\sqrt{3}}{2} \hat{i} - \frac{1}{2} \hat{j} \right) 30c \sin \left[\omega \left(t + \frac{z}{c} \right) \right]$

Q518. JEE Main 2025 (22 Jan Shift 2)

A parallel plate capacitor of area $A = 16 \text{ cm}^2$ and separation between the plates 10 cm , is charged by a DC current.

Consider a hypothetical plane surface of area $A_0 = 3.2 \text{ cm}^2$ inside the capacitor and parallel to the plates. At an

instant, the current through the circuit is 6 A . At the same instant the displacement current through A_0 is _____

mA .

Q519. JEE Main 2024 (27 Jan Shift 2)

An object is placed in a medium of refractive index 3 . An electromagnetic wave of intensity $6 \times 10^8 \text{ W m}^{-2}$ falls normally on the object and it is absorbed completely. The radiation pressure on the object would be (speed of light in free space $= 3 \times 10^8 \text{ m s}^{-1}$):

(1) 36 N m^{-2}

(2) 18 N m^{-2}

(3) 6 N m^{-2}

(4) 2 N m^{-2}

Q520. JEE Main 2024 (06 Apr Shift 1)

Electromagnetic waves travel in a medium with speed of $1.5 \times 10^8 \text{ m s}^{-1}$. The relative permeability of the medium is 2.0 . The relative permittivity will be:

(1) 2

(2) 4

(3) 5

(4) 1

Q521. JEE Main 2023 (24 Jan Shift 1)

If \vec{E} and \vec{K} represent electric field and propagation vectors of the EM waves in vacuum, then magnetic field vector is given by: (ω – angular frequency)

(1) $\frac{1}{\omega} (\vec{K} \times \vec{E})$

(2) $\omega (\vec{E} \times \vec{K})$

(3) $\omega (\vec{K} \times \vec{E})$

(4) $\vec{K} \times \vec{E}$

Q522. JEE Main 2023 (13 Apr Shift 2)

Given below are two statements:

Statement I : Out of microwaves, infrared rays and ultraviolet rays, ultraviolet rays are the most effective for the emission of electrons from a metallic surface

Statement II : Above the threshold frequency, the maximum kinetic energy of photoelectrons is inversely proportional to the frequency of the incident light

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

- (1) Statement I is false but Statement II is true
- (2) Statement I is true but Statement II is false
- (3) Both Statement I and Statement II are true
- (4) Both Statement I and Statement II are false

Q523. JEE Main 2023 (13 Apr Shift 1)

Which of the following Maxwell's equation is valid for time varying conditions but not valid for static conditions:

- (1) $\oint \vec{B} \cdot d\vec{l} = \mu_0 I$
- (2) $\oint \vec{E} \cdot d\vec{l} = 0$
- (3) $\oint \vec{D} \cdot d\vec{A} = Q$
- (4) $\oint \vec{E} \cdot d\vec{l} = -\frac{\partial \phi_B}{\partial t}$

Q524. JEE Main 2021 (31 Aug Shift 1)

The electric field in an electromagnetic wave is given by $E = (50 \text{ N C}^{-1}) \sin \omega(t - \frac{x}{c})$

The energy contained in a cylinder of volume V is $5.5 \times 10^{-12} \text{ J}$. The value of V is _____ cm^3 .
(given $\epsilon_0 = 8.8 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$)

Chapter: Semiconductors**Q525. JEE Main 2025 (4 April Shift 2)**

Consider a n-type semiconductor in which n_e and n_h are number of electrons and holes, respectively.

- (A) Holes are minority carriers
 - (B) The dopant is a pentavalent atom
 - (C) $n_e n_h \neq n_i^2$
(where n_i is number of electrons or holes in semiconductor when it is intrinsic form)
 - (D) $n_e n_h \geq n_i^2$
 - (E) The holes are not generated due to the donors
- Choose the correct answer from the options given below :
- (1) (A), (C), (D) only
 - (2) (A), (C), (E) only
 - (3) (A), (B), (E) only
 - (4) (A), (B), (C) only

Q526. JEE Main 2025 (4 April Shift 1)

The Boolean expression $Y = \overline{A}BC + \overline{A}\overline{C}$ can be realised with which of the following gate configurations.

- A. One 3-input AND gate, 3 NOT gates and one 2input OR gate, One 2-input AND gate,
- B. One 3-input AND gate, 1 NOT gate, One 2input NOR gate and one 2-input OR gate
- C. 3-input OR gate, 3 NOT gates and one 2-input AND gate

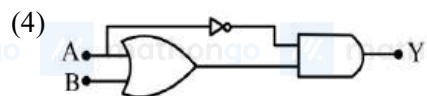
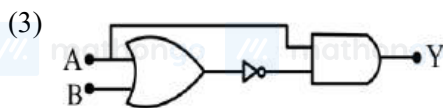
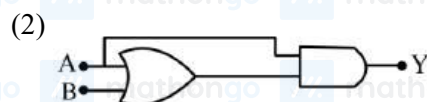
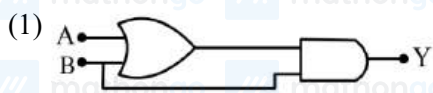
Choose the correct answer from the options given below

- (1) B, C Only
- (2) A,B Only
- (3) A, B, C Only
- (4) A, C Only

Q527. JEE Main 2025 (3 April Shift 1)

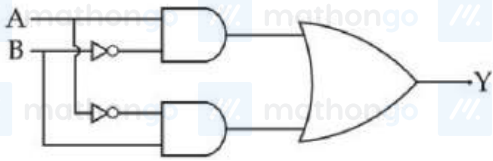
Choose the correct logic circuit for the given truth table having inputs A and B.

Inputs		Output
A	B	Y
0	0	0
0	1	0
1	0	1
1	1	1



Q528. JEE Main 2025 (29 Jan Shift 2)

The truth table for the circuit given below is :



(1)

A	B	Y
0	0	0
1	0	0
1	1	0
0	1	1

(2)

A	B	Y
0	0	0
1	1	1
1	0	1
0	1	1

(3)

A	B	Y
0	0	0
1	0	1
0	1	0
1	1	0

(4)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Q529. JEE Main 2025 (24 Jan Shift 1)

Consider the following statements:

- A. The junction area of solar cell is made very narrow compared to a photo diode.
- B. Solar cells are not connected with any external bias.
- C. LED is made of lightly doped p-n junction.
- D. Increase of forward current results in continuous increase of LED light intensity.
- E. LEDs have to be connected in forward bias for emission of light.

Choose the correct answer from the options given below:

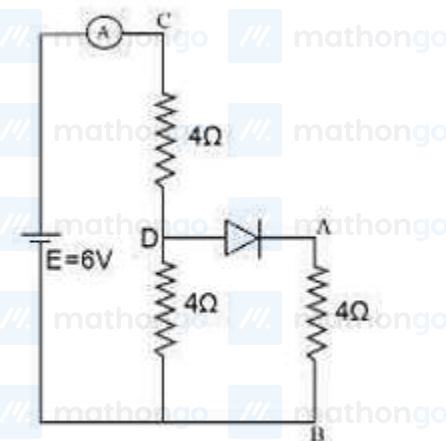
- (1) B, E Only
- (2) B, D, E Only
- (3) A, C Only
- (4) A, C, E Only

Q530. JEE Main 2025 (23 Jan Shift 1)

Refer to the circuit diagram given in the figure. which of the following observations are correct?

- A. Total resistance of circuit is 6Ω
- B. Current in Ammeter is 1 A
- C. Potential across AB is 4 Volts.
- D. Potential across CD is 4 Volts
- E. Total resistance of the circuit is 8Ω .

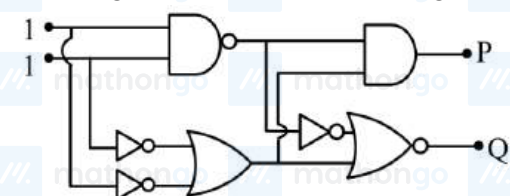
Choose the correct answer from the options given below:



- (1) A, B and D Only
- (2) A, B and C Only
- (3) A, C and D Only
- (4) B, C and E Only

Q531. JEE Main 2025 (2 April Shift 2)

In the digital circuit shown in the figure, for the given inputs the P and Q values are :



- (1) $P = 1, Q = 1$
- (2) $P = 0, Q = 0$
- (3) $P = 0, Q = 1$
- (4) $P = 1, Q = 0$

Q532. JEE Main 2025 (2 April Shift 1)

A zener diode with 5 V zener voltage is used to regulate an unregulated dc voltage input of 25 V. For a 400Ω resistor connected in series, the zener current is found to be 4 times load current. The load current (I_L) and load resistance (R_L) are :

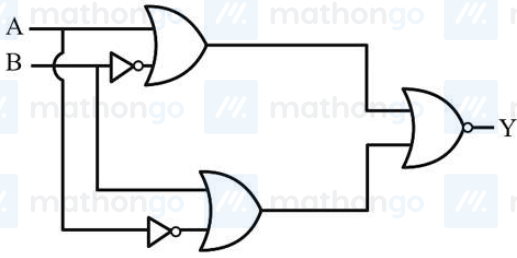
- (1) $I_L = 20 \text{ mA}; R_L = 250\Omega$
- (2) $I_L = 10 \text{ A}; R_L = 0.5\Omega$
- (3) $I_L = 0.02 \text{ mA}; R_L = 250\Omega$
- (4) $I_L = 10 \text{ mA}; R_L = 500\Omega$

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Q533. JEE Main 2024 (31 Jan Shift 2)

The output of the given circuit diagram is



(1)

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	1

(2)

A	B	Y
0	0	0
1	0	1
0	1	1
1	1	0

(3)

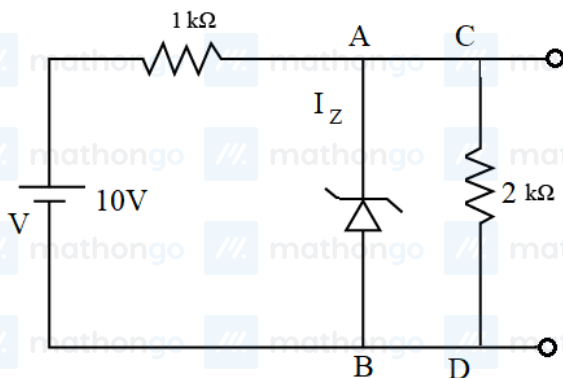
A	B	Y
0	0	0
1	0	0
0	1	0
1	1	0

(4)

A	B	Y
0	0	0
1	0	0
0	1	1
1	1	0

Q534. JEE Main 2024 (29 Jan Shift 1)

In the given circuit, the breakdown voltage of the Zener diode is 3.0 V. What is the value of I_z ?



(1) 3.3 mA

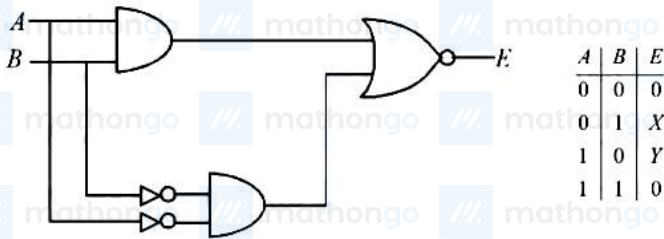
(2) 5.5 mA

(3) 10 mA

(4) 7 mA

Q535. JEE Main 2024 (09 Apr Shift 2)

In the truth table of the above circuit the value of X and Y are:



- (1) 0,0 (2) 1,1
(3) 1,0 (4) 0,1

Q536. JEE Main 2023 (25 Jan Shift 1)

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

Assertion A: Photodiodes are used in forward bias usually for measuring the light intensity.

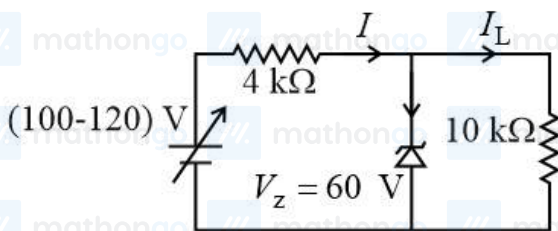
Reason R: For a $p - n$ junction diode, at applied voltage V the current in the forward bias is more than the current in the reverse bias for $|V_z| > \pm V \geq |V_0|$ where V_0 is the threshold voltage and V_z is the breakdown voltage.

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

- (1) Both A and R are true and R is correct explanation A
- (2) Both A and R are true but R is NOT the correct explanation A
- (3) A is false but R is true
- (4) A is true but R is false

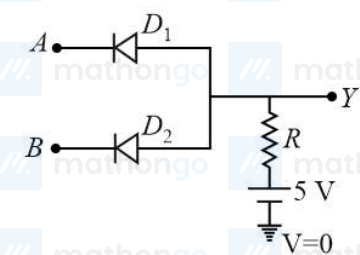
Q537. JEE Main 2022 (26 Jul Shift 1)

In the circuit shown below, maximum Zener diode current will be _____ mA.



Q538. JEE Main 2022 (25 Jul Shift 1)

In the circuit, the logical value of $A = 1$ or $B = 1$ when potential at A or B is 5 V and the logical value of $A = 0$ or $B = 0$ when potential at A or B is 0 V . The truth table of the given circuit will be:



(1)

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	1

(2)

A	B	Y
0	0	0
1	0	1
0	1	1
1	1	1

(3)

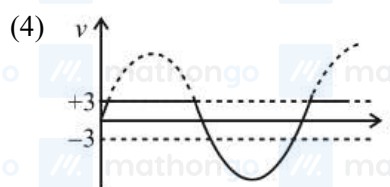
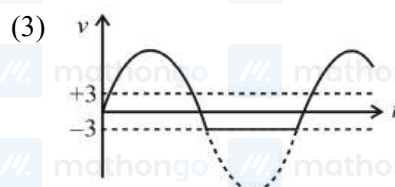
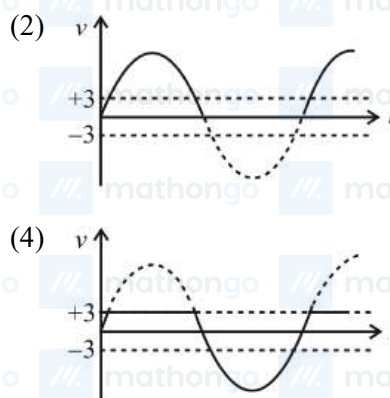
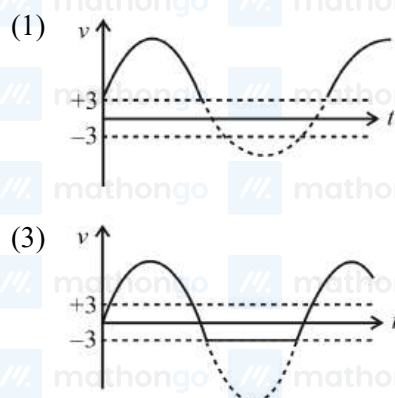
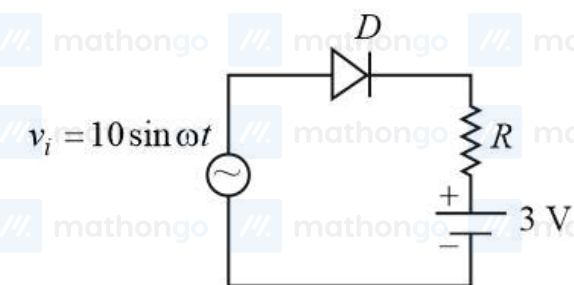
A	B	Y
0	0	0
1	0	0
0	1	0
1	1	0

(4)

A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

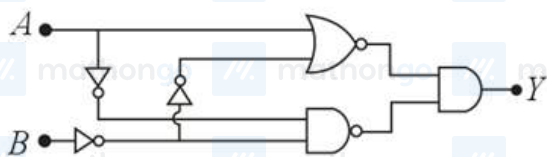
Q539. JEE Main 2021 (31 Aug Shift 1)

Choose the correct waveform that can represent the voltage across R of the following circuit, assuming the diode is ideal one:

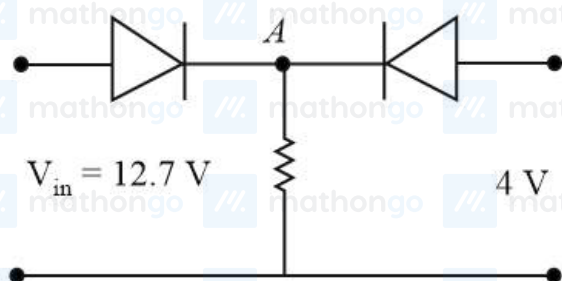


Q540. JEE Main 2021 (16 Mar Shift 1)

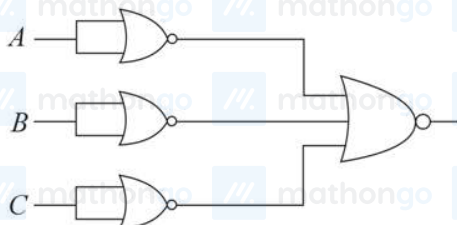
In the logic circuit shown in the figure, if input A and B are 0 to 1 respectively, the output at Y would be x . The value of x is _____.

**Q541. JEE Main 2020 (09 Jan Shift 1)**

Both the diodes used in the circuit shown are assumed to be ideal and have negligible resistance when these are forward biased. Built in potential in each diode is $0.7V$. For the input voltages shown in the figure, the voltage (in Volts) at point A is _____.

**Q542. JEE Main 2020 (04 Sep Shift 2)**

Identify the operation performed by the circuit given below :



- | | |
|----------|---------|
| (1) NAND | (2) OR |
| (3) AND | (4) NOT |

Chapter: Experimental Physics**Q543. JEE Main 2025 (4 April Shift 2)**

For the determination of refractive index of glass slab, a travelling microscope is used whose main scale contains 300 equal divisions equals to 15 cm. The vernier scale attached to the microscope has 25 divisions equals to 24 divisions of main scale. The least count (LC) of the travelling microscope is (in cm) :

- | | |
|------------|------------|
| (1) 0.001 | (2) 0.002 |
| (3) 0.0005 | (4) 0.0025 |

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Q544. JEE Main 2025 (28 Jan Shift 1)

A tiny metallic rectangular sheet has length and breadth of 5 mm and 2.5 mm, respectively. Using a specially designed screw gauge which has pitch of 0.75 mm and 15 divisions in the circular scale, you are asked to find the area of the sheet. In this measurement, the maximum fractional error will be $\frac{x}{100}$ where x is _____.

Q545. JEE Main 2024 (27 Jan Shift 2)

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

Assertion (A) : In Vernier calliper if positive zero error exists, then while taking measurements, the reading taken will be more than the actual reading.

Reason (R) : The zero error in Vernier Calliper might have happened due to manufacturing defect or due to rough handling.

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

- (1) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (3) (A) is true but (R) is false
- (4) (A) is false but (R) is true

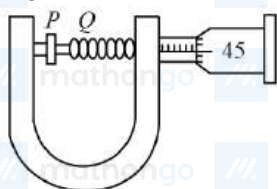
Q546. JEE Main 2023 (30 Jan Shift 1)

In a screw gauge, there are 100 divisions on the circular scale and the main scale moves by 0.5 mm on a complete rotation of the circular scale. The zero of circular scale lies 6 divisions below the line of graduation when two studs are brought in contact with each other. When a wire is placed between the studs, 4 linear scale divisions are clearly visible while 46th division the circular scale coincide with the reference line. The diameter of the wire is _____ $\times 10^{-2}$ mm.

Q547. JEE Main 2022 (29 Jul Shift 1)

In an experiment to find out the diameter of wire using screw gauge, the following observation were noted:

- (a) Screw moves 0.5 mm on main scale in one complete rotation (b) Total divisions on circular scale = 50 (c) Main scale reading is 2.5 mm (d) 45th division of circular scale is in the pitch line (e) Instrument has 0.03 mm negative error Then the diameter of wire is:



- (1) 2.92 mm
- (2) 2.54 mm
- (3) 2.98 mm
- (4) 3.45 mm

In a Vernier Caliper 10 divisions of Vernier scale is equal to the 9 divisions of main scale. When both jaws of Vernier calipers touch each other, the zero of the Vernier scale is shifted to the left of zero of the main scale and 4th Vernier scale division exactly coincides with the main scale reading. One main scale division is equal to 1 mm. While measuring diameter of a spherical body, the body is held between two jaws. It is now observed that zero of the Vernier scale lies between 30 and 31 divisions of main scale reading and 6th Vernier scale division exactly coincides with the main scale reading. The diameter of the spherical body will be:

- (1) Negative, $2\mu\text{m}$ (2) Positive $10\mu\text{m}$
(3) Positive 0.1mm (4) Positive, $0.1\mu\text{m}$

ANSWER KEYS

1. 15	2. 7700	3. (2)	4. (2)	5. (3)	6. (4)	7. (2)	8. 1
9. (4)	10. (3)	11. (4)	12. (4)	13. (1)	14. (3)	15. (4)	16. 0
17. (2)	18. (3)	19. (2)	20. (2)	21. (4)	22. (1)	23. (4)	24. (2)
25. (2)	26. (3)	27. (4)	28. (4)	29. 3	30. 2000	31. (1)	32. 10
33. (1)	34. (1)	35. 2	36. 200	37. (4)	38. (1)	39. 1	40. (3)
41. (1)	42. (4)	43. (4)	44. (3)	45. (2)	46. (4)	47. 5	48. (2)
49. (3)	50. 15	51. (3)	52. 5	53. 30	54. (2)	55. (1)	56. (2)
57. 36	58. (3)	59. (3)	60. (2)	61. (2)	62. (2)	63. (2)	64. 240
65. (3)	66. (3)	67. (1)	68. (1)	69. (3)	70. 3	71. (2)	72. 21
73. (4)	74. (3)	75. (2)	76. (2)	77. (4)	78. (2)	79. (2)	80. 2
81. (2)	82. (4)	83. (1)	84. (1)	85. (2)	86. (3)	87. 120	88. 1
89. 10	90. (4)	91. (3)	92. (1)	93. (4)	94. (3)	95. (4)	96. 15
97. 4	98. 2	99. 20	100. (1)	101. (1)	102. (2)	103. (4)	104. 40
105. 3	106. 32	107. (1)	108. (3)	109. 4	110. (1)	111. 4	112. (3)
113. (1)	114. 90	115. (2)	116. (2)	117. (3)	118. 250	119. 10	120. 16
121. (4)	122. 13	123. (3)	124. 2	125. 5	126. (3)	127. (3)	128. 15
129. (3)	130. (1)	131. (3)	132. (1)	133. (1)	134. 8	135. 8	136. 9
137. (3)	138. 3	139. (1)	140. (2)	141. (4)	142. (2)	143. (4)	144. (2)
145. (1)	146. (2)	147. (1)	148. (1)	149. (1)	150. 3	151. (4)	152. (2)
153. 4	154. (2)	155. (1)	156. (1)	157. 50	158. 2	159. (2)	160. (1)
161. 20	162. (4)	163. 2	164. 25	165. (1)	166. (1)	167. (4)	168. (4)
169. 5	170. (2)	171. 54	172. (3)	173. (1)	174. (4)	175. 1	176. 4
177. 150	178. (3)	179. (3)	180. (4)	181. (3)	182. (2)	183. (3)	184. 25600
185. (4)	186. (4)	187. 101	188. (4)	189. (4)	190. (1)	191. (4)	192. (4)
193. (4)	194. (2)	195. (4)	196. 8	197. 17	198. 20	199. 2	200. 1
201. (4)	202. (2)	203. (4)	204. (4)	205. 2	206. (2)	207. (4)	208. (2)
209. (4)	210. (2)	211. (4)	212. (4)	213. 152	214. (1)	215. 80	216. 10
217. 1	218. 2	219. (1)	220. (4)	221. 360	222. 5	223. (4)	224. (4)
225. (1)	226. (2)	227. (2)	228. (4)	229. 60	230. (2)	231. (1)	232. 314
233. (3)	234. (3)	235. (1)	236. (2)	237. 327	238. (4)	239. (3)	240. (1)
241. 273	242. (4)	243. (3)	244. 12	245. (3)	246. (4)	247. (4)	248. (2)
249. (3)	250. (4)	251. (3)	252. 750	253. (2)	254. (4)	255. 17258	256. 1819

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257. (1)	258. (1)	259. (3)	260. (2)	261. (2)	262. (1)	263. (3)	264. (4)
265. (2)	266. (1)	267. (4)	268. (2)	269. (2)	270. (4)	271. (1)	272. (4)
273. (4)	274. (1)	275. 2	276. (1)	277. (1)	278. (3)	279. (4)	280. 12
281. (3)	282. (2)	283. (4)	284. (1)	285. (4)	286. (2)	287. (3)	288. (4)
289. (2)	290. 2	291. 3	292. (3)	293. 16	294. (1)	295. (3)	296. (2)
297. (1)	298. (1)	299. (3)	300. 36	301. 1	302. (1)	303. (2)	304. 15
305. 64	306. (1)	307. (3)	308. (4)	309. (4)	310. (4)	311. (1)	312. 81
313. 4	314. 750	315. 75	316. (1)	317. (1)	318. 60	319. 6	320. (1)
321. (2)	322. (1)	323. (4)	324. (3)	325. 4	326. (4)	327. 5	328. (2)
329. (2)	330. (4)	331. (4)	332. (3)	333. (2)	334. (4)	335. 5	336. 5
337. 1	338. (3)	339. (1)	340. 48	341. (3)	342. 20	343. 2	344. 1
345. (1)	346. (4)	347. (1)	348. 40	349. (3)	350. (3)	351. (1)	352. (1)
353. (4)	354. (4)	355. (4)	356. 6	357. (1)	358. (4)	359. (3)	360. (4)
361. (1)	362. 1	363. 8	364. (4)	365. (1)	366. (4)	367. (4)	368. 2
369. (1)	370. (3)	371. 160	372. 500	373. 5	374. 50	375. (2)	376. (4)
377. (3)	378. 2	379. (2)	380. (2)	381. 250	382. (4)	383. (3)	384. (4)
385. (2)	386. (3)	387. 1	388. (3)	389. (4)	390. 2	391. 2	392. 10
393. 3	394. 0	395. 216	396. 18	397. (2)	398. (2)	399. (3)	400. (1)
401. 175	402. 1	403. 1	404. (1)	405. (2)	406. 2	407. (3)	408. 36
409. (3)	410. 250	411. (2)	412. 40	413. 100	414. (3)	415. (1)	416. (2)
417. (3)	418. (4)	419. (4)	420. (3)	421. (4)	422. (1)	423. 4	424. (2)
425. (3)	426. (4)	427. (4)	428. (2)	429. (1)	430. (2)	431. (1)	432. 8
433. (4)	434. (4)	435. 45	436. (1)	437. (2)	438. (2)	439. 20	440. (2)
441. (1)	442. (4)	443. (3)	444. 60	445. (2)	446. (1)	447. 27	448. (3)
449. 50	450. 30	451. (1)	452. (4)	453. (2)	454. 15	455. (1)	456. (2)
457. 24	458. (1)	459. 11	460. (2)	461. (1)	462. (2)	463. 462	464. (2)
465. (2)	466. 3	467. (2)	468. (1)	469. (2)	470. (2)	471. (1)	472. (2)
473. (4)	474. (3)	475. (4)	476. (2)	477. (1)	478. (3)	479. (3)	480. (2)
481. (4)	482. (4)	483. (2)	484. (2)	485. (1)	486. (4)	487. (2)	488. (4)
489. (3)	490. (4)	491. (3)	492. (3)	493. (2)	494. 121	495. (1)	496. 828
497. (1)	498. (4)	499. (2)	500. 5	501. (2)	502. 15	503. (4)	504. (2)
505. (4)	506. (1)	507. (3)	508. (4)	509. 15	510. (4)	511. 26	512. (4)
513. 27	514. (4)	515. (3)	516. (2)	517. (1)	518. 1200	519. (3)	520. (1)

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521. (1)	522. (2)	523. (4)	524. 500	525. (3)	526. (2)	527. (2)	528. (4)
529. (1)	530. (1)	531. (2)	532. (4)	533. (3)	534. (2)	535. (2)	536. (3)
537. 9	538. (1)	539. (1)	540. 0	541. 12	542. (3)	543. (2)	544. 3
545. (2)	546. 220	547. (3)	548. (3)	549. (4)	550. (2)		

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