Interactive Practice & Step-by-Step Solutions: Click any question to solve it with timer & full explanation on The Crucible.

Open on The Crucible ↗

Dot Product · JEE Main 2023 · Shift-II — View Solution on Crucible ↗

1. If two vectors $\vec{P} = \hat{i} + 2m\hat{j} + m\hat{k}$ and $\vec{Q} = 4\hat{i} - 2\hat{j} + m\hat{k}$ are perpendicular to each other. Then, the value of m will be:

(A) -1 **(B)** 2

(C) 3 **(D)** 1

Significant Figures in Arithmetic Operations · JEE Main 2025 · Shift-I — View Solution on Crucible ↗

2. 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:

(A) $y = 1326.19$ **(B)** $y = 1330$

(C) $y = 1326.186$ **(D)** $y = 1326.2$

Distance and Displacement · JEE Main 2023 · Shift-II — View Solution on Crucible ↗

3. A body is moving with constant speed, in a circle of radius 10 m. The body completes one revolution in 4 s. At the end of 3rd second, the displacement of body (in m) from its starting point is:

(A) 30 **(B)** 15π

(C) 5π **(D)** $10\sqrt{2}$

Centripetal Force · JEE Main 2023 · Shift-II — View Solution on Crucible ↗

4. A vehicle of mass 200 kg is moving along a levelled curved road of radius 70 m with angular velocity of $0.2\,\mathrm{rad/s}$. The centripetal force acting on the vehicle is:

(A) $560\,\mathrm{N}$ **(B)** $2800\,\mathrm{N}$

(C) $2240\,\mathrm{N}$ **(D)** $14\,\mathrm{N}$

Angular momentum · JEE Main 2024 · Shift-I — View Solution on Crucible ↗

5. A particle of mass m projected with a velocity u making an angle of 30° with the horizontal. The magnitude of angular momentum of the projectile about the point of projection when the particle is at its maximum height h is:

(A) $\frac{\sqrt{3}}{16}\frac{mu^3}{g}$ **(B)** $\frac{\sqrt{3}}{2}\frac{mu^2}{g}$

(C) $\frac{mu^3}{\sqrt{2}g}$ **(D)** zero

Problems using laws of motion · JEE Main 2024 · Shift-II View Solution on Crucible ↗

6. A stone of mass $900\,\mathrm{g}$ is tied to a string and moved in a vertical circle of radius $1\,\mathrm{m}$ making $10\,\mathrm{rpm}$. The tension in the string, when the stone is at the lowest point is (if $\pi^2 = 9.8$ and $g = 9.8\,\mathrm{m\,s^{-2}}$)

(A) $97\,\mathrm{N}$

(B) $9.8\,\mathrm{N}$

(C) $8.82\,\mathrm{N}$

(D) $17.8\,\mathrm{N}$

Circular motion in vertical plane · JEE Main 2022 · Shift-II View Solution on Crucible ↗

7. A stone of mass m, tied to a string is being whirled in a vertical circle with a uniform speed. The tension in the string is

(A) the same throughout the motion.

(B) minimum when the rope is in the horizontal position.

(C) minimum at the highest position of the circular path.

(D) minimum at the lowest position of the circular path.

Momentum and kinetic energy · JEE Main 2024 · Shift-I View Solution on Crucible ↗

8. Four particles A, B, C, D of mass $\frac{m}{2}, m, 2m, 4m$, have same momentum, respectively. The particle with maximum kinetic energy is :

(A) B

(B) A

(C) D

(D) C

Variation of g with Depth below Surface · JEE Main 2024 · Shift-II View Solution on Crucible ↗

9. Assuming the earth to be a sphere of uniform mass density, a body weighed $300\,\mathrm{N}$ on the surface of earth. How much it would weigh at $R/4$ depth under surface of earth?

(A) $75\,\mathrm{N}$

(B) $300\,\mathrm{N}$

(C) $375\,\mathrm{N}$

(D) $225\,\mathrm{N}$

Coulomb's Law · JEE Main 2022 · Shift-II View Solution on Crucible ↗

10. A charge of $4\,\mu\mathrm{C}$ is to be divided into two. The distance between the two divided charges is constant. The magnitude of the divided charges so that the force between them is maximum, will be:

(A) $1\,\mu\mathrm{C}$ and $3\,\mu\mathrm{C}$

(B) $2\,\mu\mathrm{C}$ and $2\,\mu\mathrm{C}$

(C) 0 and $4\,\mu\mathrm{C}$

(D) $1.5\,\mu\mathrm{C}$ and $2.5\,\mu\mathrm{C}$

Effect of temperature on elasticity · JEE Main 2024 · Shift-I

View Solution on Crucible ↗

11. With rise in temperature, the Young's modulus of elasticity

(A) changes erratically

(B) decreases

(C) increases

(D) remains unchanged

Capacitance · JEE Main 2023 · Shift-II

View Solution on Crucible ↗

12. A capacitor of capacitance C is charged to a potential V. The flux of the electric field through a closed surface enclosing the positive plate of the capacitor is:

(A) $\frac{CV}{\varepsilon_0}$

(B) Zero

(C) $\frac{2CV}{\varepsilon_0}$

(D) $\frac{CV}{2\varepsilon_0}$

Drift velocity, Mobility and Relaxation Time · JEE Main 2019 · Shift-II

View Solution on Crucible ↗

13. In a conductor, if the number of conduction electrons per unit volume is 8.5×10^{28} m^{-3} and mean free time is 25 fs (femto second), it's approximate resistivity is: ($m_e = 9.1 \times 10^{-31}$ kg)

(A) $10^{-7}\ \Omega$ m

(B) $10^{-6}\ \Omega$ m

(C) $10^{-5}\ \Omega$ m

(D) $10^{-8}\ \Omega$ m

Surface energy · JEE Main 2025 · Shift-I

View Solution on Crucible ↗

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

(A) $15\,\text{J}$

(B) $5\,\text{J}$

(C) $20\,\text{J}$

(D) $10\,\text{J}$

Simple pendulum · JEE Main 2022 · Shift-II

View Solution on Crucible ↗

15. The motion of a simple pendulum executing S.H.M. is represented by the following equation $y = A\sin(\pi t + \phi)$, where time is measured in second. The length of pendulum is

(A) 97.23 cm

(B) 25.3 cm

(C) 99.4 cm

(D) 406.1 cm

Magnetic Susceptibility · JEE Main 2023 · Shift-I View Solution on Crucible ↗

16. The free space inside a current carrying toroid is filled with a material of susceptibility 2×10^{-2}. The percentage increase in the value of magnetic field inside the toroid will be

(A) 0.2%
(B) 0.1%
(C) 2%
(D) 1%

Eddy Currents and Electromagnetic Damping · JEE Main 2023 · Shift-II View Solution on Crucible ↗

17. A bar magnet is released from rest along the axis of a very long vertical copper tube. After some time the magnet will

(A) Move down with an acceleration equal to g
(B) Oscillate inside the tube
(C) Move down with almost constant speed
(D) Move down with an acceleration greater than g

Constructive and Destructive Interference · JEE Main 2022 · Shift-II View Solution on Crucible ↗

18. Two light beams of intensities in the ratio of $9 : 4$ are allowed to interfere. The ratio of the intensity of maxima and minima will be :

(A) $9 : 4$
(B) $16 : 81$
(C) $25 : 169$
(D) $25 : 1$

Potential energy of magnetic dipole · JEE Main 2024 · Shift-II View Solution on Crucible ↗

19. The magnetic moment of a bar magnet is 0.5 Am^2. It is suspended in a uniform magnetic field of 8×10^{-2} T. The work done in rotating it from its most stable to most unstable position is:

(A) 8×10^{-2} J
(B) 4×10^{-2} J
(C) Zero
(D) 16×10^{-2} J

Defining Scale of Temperature · JEE Main 2024 · Shift-I View Solution on Crucible ↗

20. On celcius scale the temperature of body increases by 40°C. The increase in temperature on Fahrenheit scale is :

(A) 68°F
(B) 75°F
(C) 72°F
(D) 70°F

Relation of Cv with Degrees of Freedom · JEE Main 2023 · Shift-II
View Solution on Crucible ↗

21. According to law of equipartition of energy the molar specific heat of a diatomic gas at constant volume where the molecule has one additional vibrational mode is :-

(A) $\frac{9}{2}R$
(B) $\frac{5}{2}R$
(C) $\frac{3}{2}R$
(D) $\frac{7}{2}R$

First Law of Thermodynamics · JEE Main 2023 · Shift-I
View Solution on Crucible ↗

22. A source supplies heat to a system at the rate of 1000 W. If the system performs work at a rate of 200 W. The rate at which internal energy of the system increases is

(A) 600 W
(B) 800 W
(C) 500 W
(D) 1200 W

Properties of EM Waves · JEE Main 2023 · Shift-I
View Solution on Crucible ↗

23. The energy of an electromagnetic wave contained in a small volume oscillates with

(A) Double the frequency of the wave
(B) The frequency of the wave
(C) Half the frequency of the wave
(D) Zero frequency

Laws of reflection · JEE Main 2023 · Shift-II
View Solution on Crucible ↗

24. When one light ray is reflected from a plane mirror with 30° angle of reflection, the angle of deviation of the ray after reflection is:

(A) 120°
(B) 110°
(C) 140°
(D) 130°

Phase · JEE Main 2022 · Shift-II
View Solution on Crucible ↗

25. The equation of current in a purely inductive circuit is $5\sin(49\pi t - 30^\circ)$. If the inductance is $30\,\text{mH}$ then the equation for the voltage across the inductor, will be

(A) $1.47\sin(49\pi t - 30^\circ)$
(B) $1.47\sin(49\pi t + 60^\circ)$
(C) $23.1\sin(49\pi t - 30^\circ)$
(D) $23.1\sin(49\pi t + 60^\circ)$

de Broglie Waves · JEE Main 2023 · Shift-I View Solution on Crucible ↗

26. An α particle, a proton and an electron have the same kinetic energy. Which one of the following is correct in case of their de-Broglie wavelength:

(A) $\lambda_\alpha > \lambda_p > \lambda_e$
(B) $\lambda_\alpha < \lambda_p < \lambda_e$
(C) $\lambda_\alpha = \lambda_p = \lambda_e$
(D) $\lambda_\alpha > \lambda_p < \lambda_e$

Interference wave equations · JEE Main 2021 · Shift-II View Solution on Crucible ↗

27. The light waves from two coherent sources have same intensity $I_1 = I_2 = I_0$. In interference pattern the intensity of light at minima is zero. What will be the intensity of light at maxima?

(A) I_0
(B) $2I_0$
(C) $4I_0$
(D) $5I_0$

Radius of Nth Bohr orbit · JEE Main 2025 · Shift-II View Solution on Crucible ↗

28. 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 $X =$ _____. (Where a_0 is the first Bohr's radius.)

(A) 2
(B) 1
(C) 3
(D) 9

Kinematics of nuclear reactions · JEE Main 2024 · Shift-II View Solution on Crucible ↗

29. In a nuclear fission reaction of an isotope of mass M, three similar daughter nuclei of same mass are formed. The speed of a daughter nuclei in terms of mass defect ΔM will be :

(A) $\sqrt{\frac{2c\Delta M}{M}}$
(B) $\frac{\Delta Mc^2}{3}$
(C) $c\sqrt{\frac{2\Delta M}{M}}$
(D) $c\sqrt{\frac{3\Delta M}{M}}$

Light emitting diode · JEE Main 2024 · Shift-I View Solution on Crucible ↗

30. A light emitting diode (LED) is fabricated using GaAs semiconducting material whose band gap is $1.42\,\text{eV}$. The wavelength of light emitted from the LED is:

(A) $1400\,\text{nm}$
(B) $650\,\text{nm}$
(C) $875\,\text{nm}$
(D) $1243\,\text{nm}$

Cross Product · JEE Main 2022 · Shift-I View Solution on Crucible ↗

31. $\vec{A}$ is a vector quantity such that $|\vec{A}|$ = non-zero constant. Which of the following expression is true for $\vec{A}$?

(A) $\vec{A} \cdot \vec{A} = 0$
(B) $\vec{A} \times \vec{A} < 0$
(C) $\vec{A} \times \vec{A} = 0$
(D) $\vec{A} \times \vec{A} > 0$

Significant Figures in Arithmetic Operations · JEE Main 2024 · Shift-I View Solution on Crucible ↗

32. Time periods of oscillation of the same simple pendulum measured using four different measuring clocks were recorded as 4.62 s, 4.632 s, 4.6 s and 4.64 s. The arithmetic mean of these readings in correct significant figure is:

(A) 5 s
(B) 4.623 s
(C) 4.6 s
(D) 4.62 s

Average Speed · JEE Main 2023 · Shift-I View Solution on Crucible ↗

33. A car travels a distance of x with speed v_1 and then same distance x with speed v_2 in the same direction. The average speed of the car is:

(A) $\frac{v_1 v_2}{2(v_1+v_2)}$
(B) $\frac{v_1+v_2}{2}$
(C) $\frac{2x}{v_1+v_2}$
(D) $\frac{2v_1 v_2}{v_1+v_2}$

Velocity of Projectile at Any Instant · JEE Main 2023 · Shift-I View Solution on Crucible ↗

34. A stone is projected at angle 30° to the horizontal. The ratio of kinetic energy of the stone at point of projection to its kinetic energy at the highest point of flight will be:

(A) $1:2$
(B) $1:4$
(C) $4:1$
(D) $4:3$

Moment of Inertia of Ring · JEE Main 2025 · Shift-II View Solution on Crucible ↗

35. 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 :

(A) $\frac{1}{2}Mr^2$
(B) $\frac{3}{8}Mr^2$
(C) $\frac{3}{2}Mr^2$
(D) $2Mr^2$

Newton's laws of motion · JEE Main 2024 · Shift-II View Solution on Crucible ↗

36. A body of mass $4\,\text{kg}$ experiences two forces $\vec{F}_1 = 5\hat{i} + 8\hat{j} + 7\hat{k}$ and $\vec{F}_2 = 3\hat{i} - 4\hat{j} - 3\hat{k}$. The acceleration acting on the body is:

(A) $-2\hat{i} - \hat{j} - \hat{k}$
(B) $4\hat{i} + 2\hat{j} + 2\hat{k}$
(C) $2\hat{i} + \hat{j} + \hat{k}$
(D) $2\hat{i} + 3\hat{j} + 3\hat{k}$

Instantaneous power · JEE Main 2024 · Shift-II View Solution on Crucible ↗

37. A body of mass $2\,\text{kg}$ begins to move under the action of a time dependent force given by $\vec{F} = (6t\hat{i} + 6t^2\hat{j})\,\text{N}$. The power developed by the force at the time t is given by:

(A) $(6t^4 + 9t^5)\,\text{W}$
(B) $(3t^3 + 6t^5)\,\text{W}$
(C) $(9t^5 + 6t^3)\,\text{W}$
(D) $(9t^3 + 6t^5)\,\text{W}$

Momentum and kinetic energy · JEE Main 2024 · Shift-I View Solution on Crucible ↗

38. Three bodies A, B and C have equal kinetic energies and their masses are $400\,\text{g}$, $1.2\,\text{kg}$ and $1.6\,\text{kg}$ respectively. The ratio of their linear momenta is :

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

Variation of g with Height above Surface · JEE Main 2022 · Shift-I View Solution on Crucible ↗

39. The approximate height from the surface of earth at which the weight of the body becomes $\frac{1}{3}$ of its weight on the surface of earth is : [Radius of earth $R = 6400\,\text{km}$ and $\sqrt{3} = 1.732$]

(A) $3840\,\text{km}$
(B) $4685\,\text{km}$
(C) $2133\,\text{km}$
(D) $4267\,\text{km}$

Coulomb's Law in a Medium · JEE Main 2024 · Shift-II View Solution on Crucible ↗

40. Force between two point charges q_1 and q_2 placed in vacuum at r cm apart is F. Force between them when placed in a medium having dielectric $K = 5$ at $\frac{r}{5}$ cm apart will be:

(A) $\frac{F}{25}$
(B) $5F$
(C) $\frac{F}{5}$
(D) $25F$

Hooke's law · JEE Main 2022 · Shift-I View Solution on Crucible ↗

41. A wire of length L is hanging from a fixed support. The length changes to L_1 and L_2 when masses $1\,\text{kg}$ and $2\,\text{kg}$ are suspended respectively from its free end. Then the value of L is equal to

(A) $\sqrt{L_1 L_2}$
(B) $\frac{L_1+L_2}{2}$
(C) $2L_1 - L_2$
(D) $3L_1 - L_2$

Series and Parallel Combinations of Capacitor · JEE Main 2021 · Shift-I View Solution on Crucible ↗

42. Two equal capacitors are first connected in series and then in parallel. The ratio of the equivalent capacities in the two cases will be:

(A) $1:2$
(B) $1:4$
(C) $4:1$
(D) $2:1$

Electric current · JEE Main 2024 · Shift-I View Solution on Crucible ↗

43. The electric current through a wire varies with time as $I = I_0 + \beta t$, where $I_0 = 20$ A and $\beta = 3$ A s^{-1}. The amount of electric charge crossed through a section of the wire in 20 s is:

(A) 80 C
(B) 1000 C
(C) 800 C
(D) 1600 C

Pascal's Law · JEE Main 2023 · Shift-II View Solution on Crucible ↗

44. A hydraulic automobile lift is designed to lift vehicles of mass $5000\,\text{kg}$. The area of cross section of the cylinder carrying load is $250\,\text{cm}^2$. The maximum pressure the smaller piston would have to bear is [Assume $g = 10\,\text{m s}^{-2}$]

(A) $20 \times 10^6\,\text{Pa}$
(B) $2 \times 10^5\,\text{Pa}$
(C) $200 \times 10^6\,\text{Pa}$
(D) $2 \times 10^6\,\text{Pa}$

Displacement of S.H.M. and Phase · JEE Main 2025 · Shift-I View Solution on Crucible ↗

45. 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

(A) $\frac{16}{5}$
(B) 10
(C) $\frac{15}{4}$
(D) 25

Intensity of Magnetic Field · JEE Main 2023 · Shift-I

View Solution on Crucible ↗

46. A solenoid of 1200 turns is wound uniformly in a single layer on a glass tube 2 m long and 0.2 m in diameter. The magnetic intensity at the center of the solenoid when a current of 2 A flows through it is:

(A) 2.4×10^3 A m^{-1}

(B) 1.2×10^3 A m^{-1}

(C) 1 A m^{-1}

(D) 2.4×10^{-3} A m^{-1}

Energy Density in Magnetic Field · JEE Main 2025 · Shift-II

View Solution on Crucible ↗

47. 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 :

(A) $\frac{B^2 Al}{\mu_0}$

(B) $\frac{B^2 Al}{2\mu_0}$

(C) $B^2 Al$

(D) $\frac{B^2 Al}{4\mu_0}$

Time period · JEE Main 2025 · Shift-II

View Solution on Crucible ↗

48. 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 $300\,\mathrm{m/s}$ is :

(A) 5 m

(B) 3 m

(C) 0.5 m

(D) 0.33 m

Magnetic field on the axis of a circular coil · JEE Main 2023 · Shift-II

View Solution on Crucible ↗

49. A circular loop of radius R is carrying current i A. The ratio of magnetic field at the centre of circular loop and at a distance R from the center of the loop on its axis is :

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

(B) $3\sqrt{2} : 2$

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

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

Defining Scale of Temperature · JEE Main 2023 · Shift-I

View Solution on Crucible ↗

50. On a temperature scale 'X', the boiling point of water is 65°X and the freezing point is -15°X. Assuming that the X scale is linear. The equivalent temperature corresponding to -95°X on the Fahrenheit scale would be

(A) -112°F

(B) -48°F

(C) -148°F

(D) -63°F

Answer Key (Q1 to Q50)

Click any question number below to open its exact step-by-step solution on The Crucible ↗

1: (B)	2: (B)	3: (D)	4: (A)	5: (A)	6: (B)	7: (C)	8: (B)	9: (D)	10: (B)
11: (B)	12: (A)	13: (D)	14: (A)	15: (C)	16: (C)	17: (C)	18: (D)	19: (A)	20: (C)
21: (D)	22: (B)	23: (A)	24: (A)	25: (D)	26: (B)	27: (C)	28: (C)	29: (C)	30: (C)
31: (C)	32: (C)	33: (D)	34: (D)	35: (B)	36: (C)	37: (D)	38: (B)	39: (B)	40: (B)
41: (C)	42: (B)	43: (B)	44: (D)	45: (D)	46: (B)	47: (D)	48: (B)	49: (C)	50: (C)

Sample Solution — Question 1 (Correct Option: B)

Open Full Solution on Crucible ↗

Q1. If two vectors $\vec{P} = \hat{i} + 2m\hat{j} + m\hat{k}$ and $\vec{Q} = 4\hat{i} - 2\hat{j} + m\hat{k}$ are perpendicular to each other. Then, the value of m will be:

Perpendicular means the dot product is zero. A 30-second question.

$\vec{P} \cdot \vec{Q} = (1)(4) + (2m)(-2) + (m)(m)$

$\vec{P} \cdot \vec{Q} = m^2 - 4m + 4$

Set it to zero:

$(m - 2)^2 = 0$

$m = 2$

• **Watch out:** this comes out as a perfect square, so both roots are the same value. If your quadratic gives two different roots, check the middle term — the $\hat{j}$ components are $2m$ and -2, which give $-4m$, not $-2m$.

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