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

1. 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 ↗

2. 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

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

3. 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

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

4. The equation of current in a purely inductive circuit is $5\sin(49\pi t - 30^\circ)$. If the inductance is $30\,\mathrm{mH}$ 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) $23.1\sin(49\pi t + 60^\circ)$

Intensity of Magnetic Field · JEE Main 2023 · Shift-I View Solution on Crucible ↗

5. 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 ↗

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

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

7. 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) $1:\sqrt{2}$

Alternating Quantities · JEE Main 2025 · Shift-I View Solution on Crucible ↗

8. An alternating current is given by $I = I_A \sin\omega t + I_B \cos\omega t$. The r.m.s current will be

(A) $\frac{|I_A+I_B|}{\sqrt{2}}$
(B) $\sqrt{\frac{I_A^2+I_B^2}{2}}$
(C) $\sqrt{I_A^2+I_B^2}$
(D) $\frac{\sqrt{I_A^2+I_B^2}}{2}$

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

9. The susceptibility of a paramagnetic material is 99. The permeability of the material in Wb/A$-$m, is [Permeability of free space $\mu_0 = 4\pi \times 10^{-7}$ Wb/A$-$m]

(A) $4\pi \times 10^{-5}$
(B) $4\pi \times 10^{-6}$
(C) $4\pi \times 10^{-7}$
(D) $4\pi \times 10^{-4}$

Growth and Decay of Current in LR Circuit · JEE Main 2021 · Shift-I View Solution on Crucible ↗

10. An inductor coil stores 64 J of magnetic field energy and dissipates energy at the rate of 640 W when a current of 8 A is passed through it. If this coil is joined across an ideal battery, find the time constant of the circuit (in s).

(A) 0.4
(B) 0.2
(C) 0.125
(D) 0.8

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

11. 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

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

Power Factor · JEE Main 2024 · Shift-II
View Solution on Crucible ↗

12. In an a.c. circuit, voltage and current are given by: $V = 100\sin(100t)\,\text{V}$ and $I = 100\sin\left(100t + \frac{\pi}{3}\right)\,\text{mA}$ respectively. The average power dissipated in one cycle is :

(A) $5\,\text{W}$
(B) $10\,\text{W}$
(C) $2.5\,\text{W}$
(D) $25\,\text{W}$

Hysteresis Loop · JEE Main 2019 · Shift-I
View Solution on Crucible ↗

13. A bar magnet is demagnetized by inserting it inside a solenoid of length 0.2 m, 100 turns, and carrying a current of 5.2 A. The coercivity of the bar magnet is:

(A) 285 A/m
(B) 2600 A/m
(C) 520 A/m
(D) 1200 A/m

Self Inductance · JEE Main 2023 · Shift-I
View Solution on Crucible ↗

14. A 12 V battery connected to a coil of resistance $6\,\Omega$ through a switch, drives a constant current in the circuit. The switch is opened in 1 ms. The emf induced across the coil is 20 V. The inductance of the coil is :

(A) 10 mH
(B) 8 mH
(C) 5 mH
(D) 12 mH

Magnetic Moment · JEE Main 2023 · Shift-II
View Solution on Crucible ↗

15. The magnetic moments associated with two closely wound circular coils A and B of radius $r_A = 10$ cm and $r_B = 20$ cm respectively are equal if: (Where N_A, I_A and N_B, I_B are number of turn and current of A and B respectively)

(A) $2N_AI_A = N_BI_B$
(B) $N_A = 2N_B$
(C) $N_AI_A = 4N_BI_B$
(D) $4N_AI_A = N_BI_B$

Alternating Quantities · JEE Main 2025 · Shift-I View Solution on Crucible ↗

16. An alternating current is represented by the equation, $i = 100\sqrt{2}\sin(100\pi t)$ ampere. The RMS value of current and the frequency of the given alternating current are

(A) $100\sqrt{2}\,\text{A}, 100\,\text{Hz}$
(B) $\frac{100}{\sqrt{2}}\,\text{A}, 100\,\text{Hz}$
(C) $100\,\text{A}, 50\,\text{Hz}$
(D) $50\sqrt{2}\,\text{A}, 50\,\text{Hz}$

Magnetic Susceptibility · JEE Main 2021 · Shift-I View Solution on Crucible ↗

17. The magnetic susceptibility of a material of a rod is 499. Permeability in vacuum is $4\pi \times 10^{-7}$ Hm^{-1}. Absolute permeability of the material of the rod is

(A) $4\pi \times 10^{-4}$ Hm^{-1}
(B) $2\pi \times 10^{-4}$ Hm^{-1}
(C) $3\pi \times 10^{-4}$ Hm^{-1}
(D) $\pi \times 10^{-4}$ Hm^{-1}

Faraday's Law of Electromagnetic Induction · JEE Main 2024 · Shift-I View Solution on Crucible ↗

18. A coil is placed perpendicular to a magnetic field of 5000 T. When the field is changed to 3000 T in 2 s, an induced emf of 22 V is produced in the coil. If the diameter of the coil is 0.02 m, then the number of turns in the coil is:

(A) 7
(B) 70
(C) 35
(D) 140

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

19. A long straight wire of radius a carries a steady current I. The current is uniformly distributed across its cross section. The ratio of the magnetic field at $\frac{a}{2}$ and $2a$ from axis of the wire is :

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

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

20. A transformer has an efficiency of 80% and works at $10\,\text{V}$ and $4\,\text{kW}$. If the secondary voltage is $240\,\text{V}$, then the current in the secondary coil is:

(A) $1.59\,\text{A}$
(B) $13.33\,\text{A}$
(C) $1.33\,\text{A}$
(D) $15.1\,\text{A}$

Magnetic Susceptibility · JEE Main 2019 · Shift-II View Solution on Crucible ↗

21. A paramagnetic substance in the form of a cube with sides 1 cm has a magnetic dipole moment of 20×10^{-6} J/T when a magnetic intensity of 60×10^{3} A/m is applied. Its magnetic susceptibility is:

(A) 3.3×10^{-2} **(B)** 4.3×10^{-2}

(C) 2.3×10^{-2} **(D)** 3.3×10^{-4}

Self Inductance · JEE Main 2024 · Shift-II View Solution on Crucible ↗

22. In a coil, the current changes from -2 A to $+2$ A in 0.2 s and induces an emf of 0.1 V. The self inductance of the coil is :

(A) 4 mH **(B)** 1 mH

(C) 5 mH **(D)** 2.5 mH

Magnetic field on the axis of a circular coil · JEE Main 2025 · Shift-I View Solution on Crucible ↗

23. Let B_1 be the magnitude of magnetic field at center of a circular coil of radius R carrying current I. Let B_2 be the magnitude of magnetic field at an axial distance 'x' from the center. For $x : R = 3 : 4$, $\frac{B_2}{B_1}$ is :

(A) $4 : 5$ **(B)** $16 : 25$

(C) $64 : 125$ **(D)** $25 : 16$

RC Circuits · JEE Main 2023 · Shift-II View Solution on Crucible ↗

24. A capacitor of capacitance $150.0\,\mu\text{F}$ is connected to an alternating source of emf given by $E = 36\sin(120\pi t)$ V. The maximum value of current in the circuit is approximately equal to:

(A) 2 A **(B)** $\sqrt{2}$ A

(C) $2\sqrt{2}$ A **(D)** $\frac{1}{\sqrt{2}}$ A

Magnetic Susceptibility · JEE Main 2020 · Shift-II View Solution on Crucible ↗

25. An iron rod of volume 10^{-3} m^3 and relative permeability 1000 is placed as core in a solenoid with 10 turns cm^{-1}. If a current of 0.5 A is passed through the solenoid, then the magnetic moment of the rod will be :

(A) 50×10^{2} Am^2 **(B)** 5×10^{2} Am^2

(C) 500×10^{2} Am^2 **(D)** 0.5×10^{2} Am^2

Faraday's Law of Electromagnetic Induction · JEE Main 2024 · Shift-I View Solution on Crucible ↗

26. A rectangular loop of length 2.5 m and width 2 m is placed at 60° to a magnetic field of 4 T. The loop is removed from the field in 10 sec. The average emf induced in the loop during this time is

(A) -2 V
(B) $+2$ V
(C) $+1$ V
(D) -1 V

Magnetic field due to arc at centre · JEE Main 2023 · Shift-II View Solution on Crucible ↗

27. The electric current in a circular coil of four turns produces a magnetic induction 32 T at its centre. The coil is unwound and is rewound into a circular coil of single turn, the magnetic induction at the centre of the coil by the same current will be :

(A) 8 T
(B) 4 T
(C) 2 T
(D) 16 T

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28. The current flowing through an ac circuit is given by $I = 5\sin(120\pi t)$ A. How long will the current take to reach the peak value starting from zero?

(A) $\frac{1}{60}$ s
(B) 60 s
(C) $\frac{1}{120}$ s
(D) $\frac{1}{240}$ s

Motional EMI in loop by generated Area · JEE Main 2023 · Shift-II View Solution on Crucible ↗

29. An emf of 0.08 V is induced in a metal rod of length 10 cm held normal to a uniform magnetic field of 0.4 T, when move with a velocity of:

(A) 0.5 m s^{-1}
(B) 20 m s^{-1}
(C) 3.2 m s^{-1}
(D) 2 m s^{-1}

Magnetic Moment · JEE Main 2019 · Shift-II View Solution on Crucible ↗

30. A square loop is carrying a steady current I and the magnitude of its magnetic dipole moment is m. If this square loop is changed to a circular loop and it carries the same current, the magnitude of the magnetic dipole moment of circular loop will be:

(A) $\frac{4m}{\pi}$
(B) $\frac{3m}{\pi}$
(C) $\frac{2m}{\pi}$
(D) $\frac{m}{\pi}$

Answer Key (Q1 to Q30)

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

1: (C)	2: (C)	3: (A)	4: (D)	5: (B)	6: (D)	7: (C)	8: (B)	9: (A)	10: (B)
11: (B)	12: (C)	13: (B)	14: (A)	15: (C)	16: (C)	17: (B)	18: (B)	19: (B)	20: (B)
21: (D)	22: (C)	23: (C)	24: (A)	25: (B)	26: (C)	27: (C)	28: (D)	29: (D)	30: (A)

Sample Solution — Question 1 (Correct Option: C)

Open Full Solution on Crucible ↗

Q1. 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

Ten seconds. Filling the toroid multiplies the field by $\mu_r = 1 + \chi$.

$B_0 = \mu_0 n I$

$B = \mu_0 (1 + \chi) n I$

• *Fractional increase:**

$\frac{B - B_0}{B_0} = \chi = 2 \times 10^{-2}$

• *As a percentage:**

$2 \times 10^{-2} \times 100 = 2\%$

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