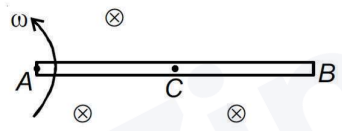
1. A copper rod AB of length ℓ, pivoted at one end A, rotates at constant angular velocity ω, at right angles to a uniform magnetic field of induction B. The emf, developed between the mid point C of the rod and end B is

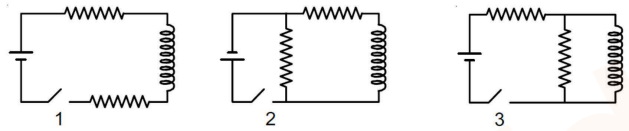


(A) $\frac{B\omega l^2}{8}$ (B) $\frac{3}{4}B\omega l^2$ (C) $\frac{B\omega l^2}{4}$ (D) $\frac{3}{8}B\omega l^2$

2. Radius of a circular loop placed in a perpendicular uniform magnetic field is increasing at a constant rate of $r_0\, ms^{-1}$. If at any instant radius of the loop is r, then emf induced in the loop at that instant will be

(A) $-2Brr_0$ (B) $-2B\pi r$ (C) $-B\pi r_0 r$ (D) $-2B\pi r_0 r$

3.



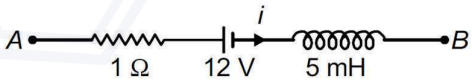
The figure shows three circuits with identical batteries, inductors and resistances. Rank the circuits according to the currents through the battery just after the switch is closed, greatest first

(A) $I_2 > I_3 > I_1$ (B) $I_2 > I_1 > I_3$ (C) $I_1 > I_2 > I_3$ (D) $I_1 > I_3 > I_2$

4. In an inductor, the current I varies with time t as I = 5A + 16 (A/s) t. If induced emf in the inductor is 5 mV, the self inductance of the inductor is

(A) 3.75×10^{-3} H (B) 3.75×10^{-4} H (C) 3.125×10^{-3} H (D) 3.125×10^{-4} H

5. The network shown in figure is a part of a complete circuit. If at a certain instant, the current i is 4 A and is increasing at a rate of 10^3 A/s. Then $V_B - V_A$ will be



(A) –11 V (B) 11 V (C) –21 V (D) 21 V

6. The magnetic flux through a stationary loop with resistance R varies during interval of time T as ϕ = at (T – t). The heat generated during this time neglecting the inductance of loop will be

(A) $\frac{a^2T^3}{3R}$ (B) $\frac{a^2T^2}{3R}$ (C) $\frac{a^2T}{3R}$ (D) $\frac{a^3T^2}{3R}$

7. In which of the following situations, the magnetic field can accelerate a charge particle at rest?

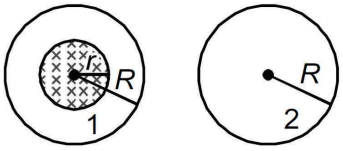
I. When the magnetic field is uniform with respect to time as well as position

II. When the magnetic field is time varying but uniform w.r.t. position

III. When the magnetic field is time independent but position dependent

(A) I, II & III (B) III only (C) II only (D) None of these

8. A uniform magnetic field is restricted within a region of radius r. The magnetic field changes with time at a rate $\frac{d\vec{B}}{dt}$. Loop 1 of radius R > r encloses the region r and loop 2 of radius R is outside the region of magnetic field as shown in the figure below. Then the e.m.f. generated is



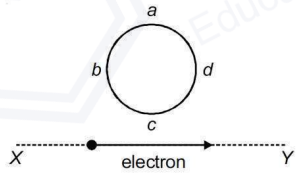
(A) Zero in loof 1 and zero in loop 2

(B) $-\frac{d\vec{B}}{dt}\pi r^2$ in loop 1 and $-\frac{d\vec{B}}{dt}\pi r^2$ in loop 2

(C) $-\frac{d\vec{B}}{dt}\pi R^2$ in loop 1 and zero in loop 2

(D) $-\frac{d\vec{B}}{dt}\pi r^2$ in loop 1 and zero in loop 2

9. An electron moves on a straight line path XY as shown. The abcd is a coil adjacent to the path of electron. What will be the direction of current, if any, induced in the coil?



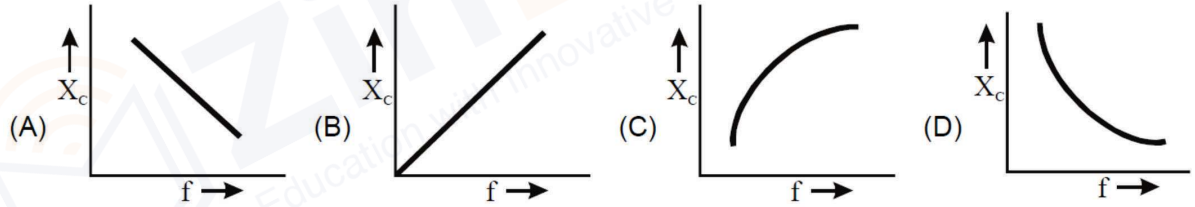
(A) No current induced

(B) abcd

(C) adcb

(D) The current will reverse its direction as the electron goes past the coil

10. The reactance of a capacitor X_c in an ac circuit varies with frequency f of the source voltage. Which one of the following represents this variation correctly?



11. A coil of resistance R and inductance L is connected to a battery of E volt emf. The final current flowing in the coil is :

(A) E/R (B) E/L (C) $E/(R^2+\omega^2L^2)^{1/2}$ (D) $EL(R^2+L^2)^{1/2}$

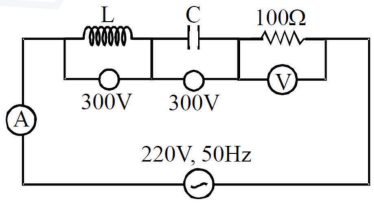
12. By what percentage the impedance in an AC series circuit should be increased so that the power factor changes from (1/2) to (1/4) (when R is constant)?

(A) 200% (B) 100% (C) 50% (D) 400%

13. A coil having an inductance of $\frac{1}{\pi}$ henry is connected in series with a resistance of 300Ω. If 20 volt from a 200 cycle source are impressed across the combination, the value of the phase angle between the voltage and the current is:

(A) $\tan^{-1}\frac{5}{4}$ (B) $\tan^{-1}\frac{4}{5}$ (C) $\tan^{-1}\frac{3}{4}$ (D) $\tan^{-1}\frac{4}{3}$

14. In the circuit shown in figure, what will be the readings of voltmeter and ammeter?



(A) 800 V, 2 A (B) 220 V, 2.2 A (C) 300 V, 2 A (D) 100 V, 2 A

15. A series LCR circuit containing a resistance of 120 ohm has angular resonance frequency 4×10^3 rad s^{-1}. At resonance, the voltage across resistance and inductance are 60V and 40 V respectively. The values of L and C are respectively :

(A) 20 mH, 25/8 μF (B) 2mH, 1/35 μF (C) 20 mH, 1/40 μF (D) 2mH, 25/8 nF

16. If two mirrors are kept at 45° to each other and a body is placed in the middle then total number of images formed is

(A) 7 (B) 8 (C) 14 (D) 4

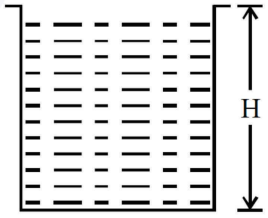
17. An astronomical telescope of ten fold angular magnification has a length of 44 cm. The focal length of the objective is:

(A) 44 cm (B) 440 cm (C) 40 cm (D) 4 cm

18. The refractive index of diamond is 2.0; velocity of light in diamond in cm per second is approximately:

(A) 1.5×10^{10} (B) 2.0×10^{10} (C) 6×10^{10} (D) 3×10^{10}

19. A cylindrical vessel is filled with water ($\mu = 4/3$) as shown in figure. A coin placed in water at the bottom appears upto maximum distance of :



(A) $\frac{3H}{4}$ from the surface (B) $\frac{H}{4}$ from the surface (C) H from the surface (D) $\frac{H}{2}$ from the surface

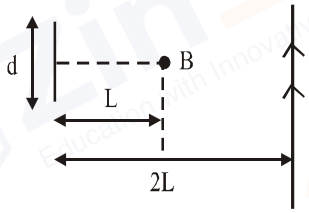
20. The critical angle for the material of a prism is 45°and its refracting angle is 30°. A monochromatic ray goes out perpendicular to the surface of emergence from the prism. Then the angle of incidence on the prism will be:

(A) 60° (B) 75° (C) 45° (D) 30°

21. Wavelength of light used in a optial instrument and $\lambda_1 = 4000\,\mathring{A}$ and $\lambda_2 = 5000\,\mathring{A}$ then ratio of their respective resolving powers (corresponding to λ_1 and λ_2) is

(A) 16 : 25 (B) 9 : 1 (C) 4 : 5 (D) 5 : 4

22. A point source of a light B, placed at a distance L in front of the centre of a mirror of width d, hungs vertically on a wall. A man walks in front of mirror along a line parallel to the mirror at a distance 2L from it as shown. The greatest distance over which he can see the image of the light source in the mirror is



(A) d/2 (B) d (C) 2d (D) 3d

23. A Young's double slit experiment uses a monochromatic source. The shape of the interference fringes formed on a screen is

(A) Straight line (B) parabola (C) hyperbola (D) circle.

24. If I_0 is the intensity of the principal maximum in the single slit diffraction pattern, then what will be its intensity when the slit width is doubled?

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

25. When an unpolarized light of intensity I_o is incident on a polarizing sheet, the intensity of the light which does not get transmitted is

(A) Zero (B) I_0 (C) $\frac{1}{2}I_0$ (D) $\frac{1}{4}I_0$

ANSWER KEY

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