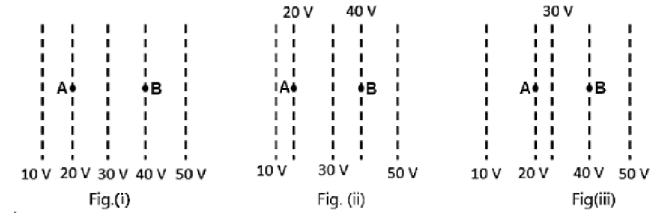
SECTION A

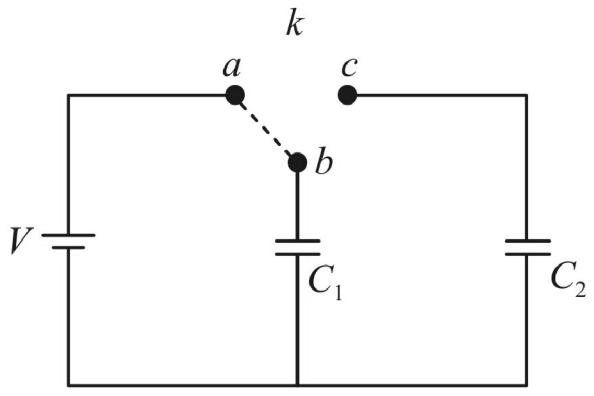
1 The figure shows some equipotential lines distributed in space. A charged object is moved from point A to point B.



Choose the correct option:

1.	The work done in Fig. (i) is the greatest.
2.	The work done in Fig. (ii) is the least.
3.	The work done is the same in Fig. (i), Fig. (ii) and Fig. (iii).
4.	The work done in Fig. (iii) is greater than Fig. (ii) but equal to that in Fig. (i).

2 Two identical capacitors C_1 and C_2 of equal capacitance are connected as shown in the circuit. Terminals a and b of the key k are connected to charge capacitor C_1 using a battery of emf V volt. Now disconnecting a and b terminals, terminals b and c are connected. Due to this, what will be the percentage loss of energy?



1. 75%
2. 0%
3. 50%
4. 25%

3

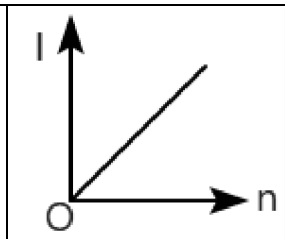
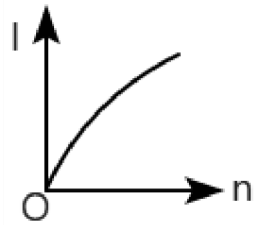
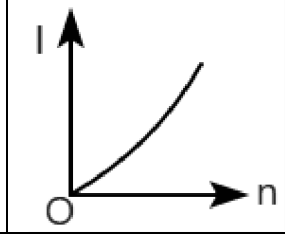
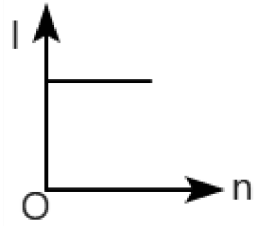
Assertion (A):	The lightning conductor at the top of high building has sharp pointed ends.
Reason (R):	The surface density of charge at sharp points is very high resulting in setting up of electric wind.

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.	Both **(A)** and **(R)** are false.

4 A capacitor is constructed by taking metallic circular discs of radius r placed face-to-face with a separation of d. A dielectric slab is inserted into the space between the plates so that it fills the entire width, but only half the area between the plates. The dielectric constant is K. Then, the capacitance is:

1. $\frac{K\varepsilon_0\pi r^2}{d}$
2. $\frac{K\varepsilon_0\pi r^2}{2d}$
3. $\frac{K+1}{2}\frac{\varepsilon_0\pi r^2}{d}$
4. None of the above

5 A battery consists of a variable number n of identical cells having equal internal resistance connected in series. The terminals of the battery are short-circuited and the current I measured. Which one of the graphs below shows the correct relationship between I and n?

1.		2.	
3.		4.	

6 Two charges q, $-q$ are placed at the two ends of the hypotenuse of an isosceles right angled triangle, the smaller sides being of length, a. A dipole of dipole moment p is placed at the right-angled vertex with its axis pointing towards the positive charge, q. The torque acting on the dipole is:

1. $\frac{kpq}{a^2}$
2. zero
3. $\frac{2kpq}{a^2}$
4. $\frac{\sqrt{5}kpq}{a^2}$

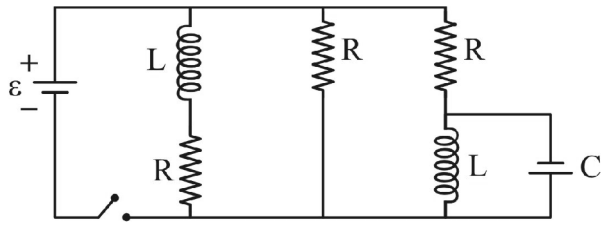
7 The electrostatic potential on the surface of a charged conducting sphere is 100 V. Two statements are made in this regard.

Statement-I:	At any point inside the sphere, electric intensity is zero.
Statement-II:	At any point inside the sphere, the electrostatic potential is 100 V.

Which of the following is a correct statement?

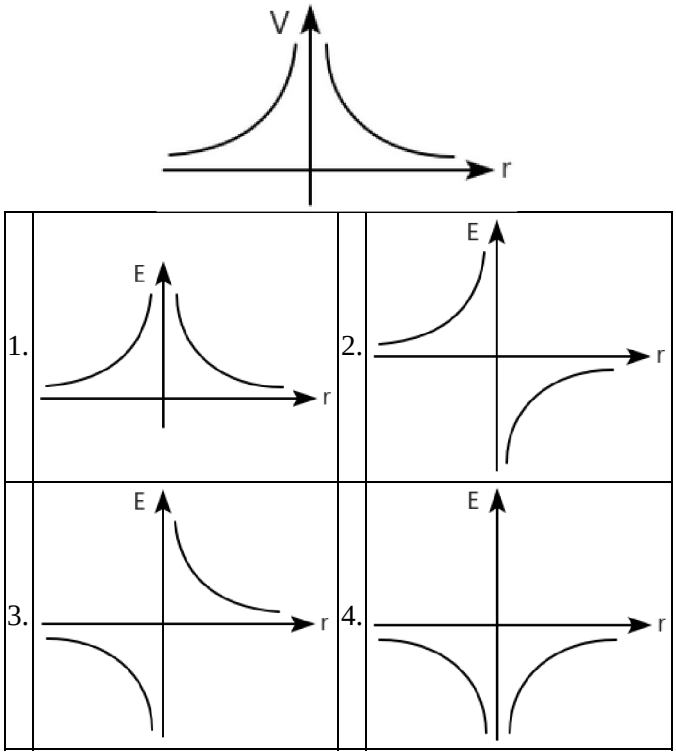
1.	Statement-I is true but Statement-II is false.
2.	Both Statement-I and Statement-II are false.
3.	Statement-I is true, Statement-II is also true and Statement-I is the cause of Statement-II.
4.	Statement-I is true, Statement-II is also true but the statements are independent.

8 The figure shows a circuit that contains three identical resistors with resistance R = 9.0 Ω each, two identical inductors with inductance L = 2.0 mH each, and an ideal battery with emf $\varepsilon = 18$ V. The current 'i' through the battery just after the switch is closed will be:

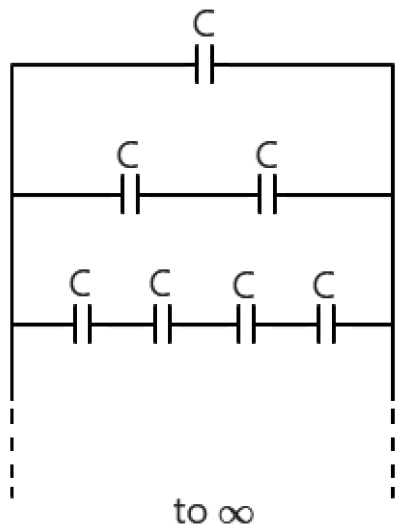


1. 0.2 A
2. 2 A
3. 4 A
4. 2 mA

9 The electric field (E) and potential (V) due to the field are related as $E=-\frac{dV}{dr}$. For the V vs r graph shown, identify the correct E vs r graph.

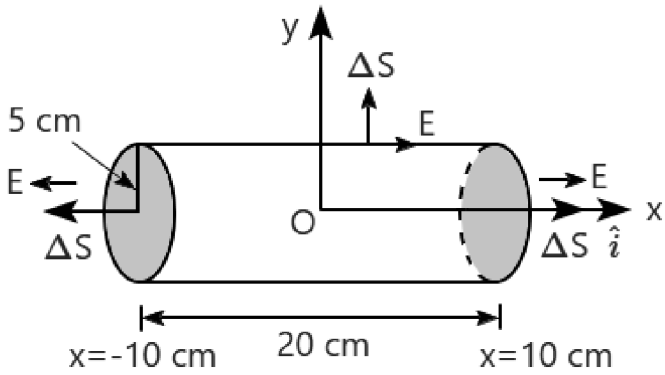


10 The equivalent capacitance of the given circuit is:



1. $\frac{C}{2}$
2. C
3. $2C$
4. $4C$

11 An electric field is uniform, and in the positive x-direction for positive x, and uniform with the same magnitude but in the negative x-direction for negative x. It is given that $\vec{E} = 200\hat{i}$ N/C for x > 0 and $\vec{E} = -200\hat{i}$ N/C for x < 0. A right circular cylinder of length 20 cm and radius 5 cm has its centre at the origin and its axis along the x-axis so that one face is at x = +10 cm and the other is at x = –10 cm (as shown in the figure). What is the net outward flux through the cylinder?



1. 0
2. 1.57 Nm^2C^{-1}
3. 3.14 Nm^2C^{-1}
4. 2.47 Nm^2C^{-1}

12 Terminal voltage of a battery is:

1.	always equal to its emf.
2.	always greater than its emf.
3.	greater or less than its emf depending on the direction of the current through the battery.
4.	greater or less than its emf depending on the magnitude of its internal resistance.

13 Two metal spheres, one of radius R and the other of radius $2R$ respectively have the same surface charge density σ. They are brought in contact and separated. What will be the new surface charge densities on them?

1. $\sigma_1 = \frac{5}{6}\sigma,\ \sigma_2 = \frac{5}{6}\sigma$
2. $\sigma_1 = \frac{5}{2}\sigma,\ \sigma_2 = \frac{5}{6}\sigma$
3. $\sigma_1 = \frac{5}{2}\sigma,\ \sigma_2 = \frac{5}{3}\sigma$
4. $\sigma_1 = \frac{5}{3}\sigma,\ \sigma_2 = \frac{5}{6}\sigma$

14 An electric dipole consisting of two opposite charges of 2×10^{-6} C each separated by a distance of 0.03 m, is placed in an electric field of 2×10^{5} NC^{-1}. The maximum torque on the dipole will be:

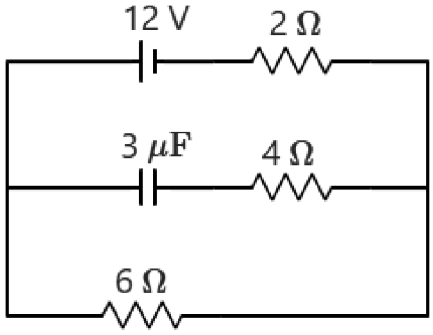
1. 12×10^{-1} N-m
2. 12×10^{-3} N-m
3. 24×10^{-1} N-m
4. 24×10^{-3} N-m

15

Two identical charged spheres suspended from a common point by two massless strings of lengths l, are initially at a distance d $(d \ll l)$ apart because of their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity v. Then, v varies as a function of the distance x between the sphere, as:

1. $v \propto x$
2. $v \propto x^{-1/2}$
3. $v \propto x^{-1}$
4. $v \propto x^{1/2}$

16 The charge on the plates of the capacitor in a steady state will be:



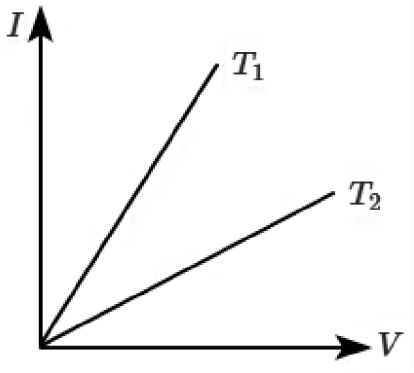
1. 3 μC
2. 9 μC
3. 27 μC
4. 36 μC

17 Given below are two statements:

Statement I:	Point charges q_1 and q_2 produce electric field of magnitude E_1 and E_2 at a point and potential V_1 and V_2 at the same point. The electric field due to both the charges at that point must be $E_1 + E_2$.
Statement II:	The electric potential at that point due to both the charges must be $V_1 + V_2$.

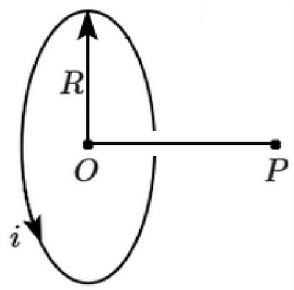
1.	Both Statement - I and Statement - II are true.
2.	Both Statement - I and Statement - II are false.
3.	Statement - I is true but Statement - II is false.
4.	Statement - I is false but Statement - II is true.

18 The current-voltage graph for a given metallic conductor at two different temperatures T_1 and T_2 is as shown in the figure. Then:



1. $T_1 = T_2$
2. $T_2 > T_1$
3. $T_1 > T_2$
4. nothing can be said

19 The mangetic field at a point(P) on the axis of a circular current carrying wire is $\frac{1}{8}$ of the field at its centre. The radius of the circular curve is R. The distance between P and the center of the circle is (OP).

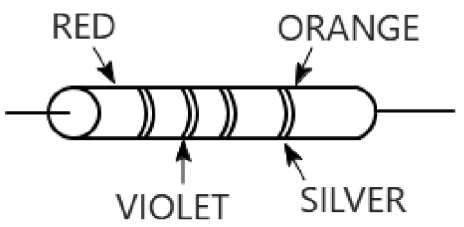


Then,
1. $OP = R$
2. $OP = \frac{R}{2}$
3. $OP = \sqrt{3}R$
4. $OP = 8R$

20 Two resistors of resistance, 100 Ω and 200 Ω are connected in parallel in an electrical circuit. The ratio of the thermal energy developed in 100 Ω resistor to that in 200 Ω resistor in a given time is:
1. 4:1
2. 1:2
3. 2:1
4. 1:4

21 For a given main current, the deflection in a moving coil galvanometer is reduced to half when it is shunted with a 70 Ω coil. The resistance of the galvanometer is:
1. 70 Ω
2. 35 Ω
3. 20 Ω
4. 115 Ω

22 A resistance is shown in the figure. Its value and tolerance are given respectively by:

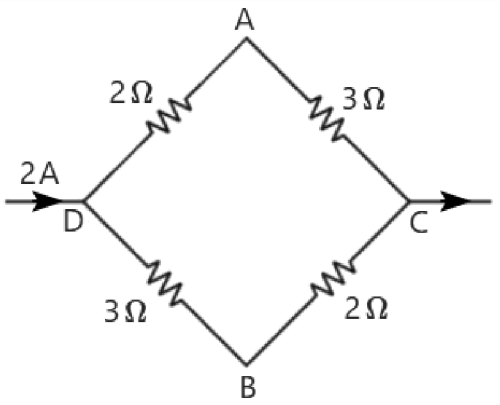


1. 27 kΩ, 20%
2. 270 kΩ, 5%
3. 270 kΩ, 10%
4. 27 kΩ, 10%

23 For comparing the emf's of two cells with a potentiometer, a driver cell is used to develop a potential gradient along the wires. Which of the following possibilities would make the experiment unsuccessful?

1.	the emf of the driver cell is larger than the emf's of the two cells.
2.	the diameter of the wires is the same and uniform throughout.
3.	the number of wires is 10.
4.	the emf of the driver cell is smaller than the emf's of the two cells.

24 A current of 2 A flows in a combination of resistors as shown in the figure. The potential difference $(V_A - V_B)$ will be:

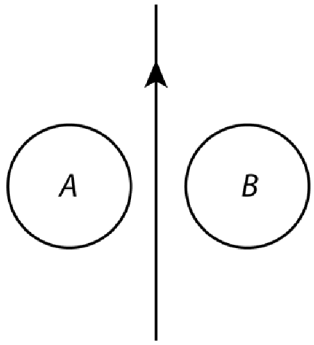


1. +2 V
2. +1 V
3. -1 V
4. -2 V

25 A circular coil of 20 turns and a radius of 10 cm is placed in a uniform magnetic field of 0.10 T normal to the plane of the coil. If the current in the coil is 5.0 A, what is the total torque on the coil?
1. 1.0 N-m
2. 0
3. 0.5 N-m
4. 0.3 N-m

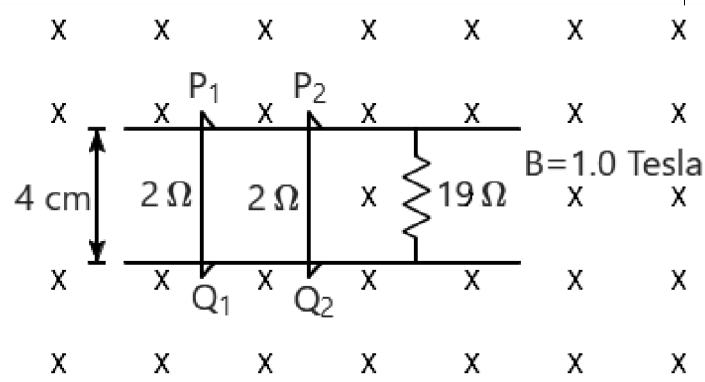
26 An ammeter of resistance 20 Ω measures upto 50 mA. The value of shunt required in parallel to measure current upto 5 A is nearly:
1. 0.1 Ω
2. 0.2 Ω
3. 0.02 Ω
4. 0.01 Ω

27 A and B are two metallic rings placed at opposite sides of an infinitely long straight conducting wire as shown. If current in the wire is slowly decreased, the direction of the induced current will be:



1.	clockwise in A and anticlockwise in B.
2.	anticlockwise in A and clockwise in B.
3.	clockwise in both A and B.
4.	anticlockwise in both A and B.

28 The wires P_1Q_1 and P_2Q_2 are made to slide on the rails with the same speed 10 m/s. If P_1Q_1 moves towards the left and P_2Q_2 moves towards the right, then the electric current in the 19 Ω resistor is:



1. zero
2. 10 mA
3. 0.1 mA
4. 1 mA

29 Two particles X and Y having equal charge, after being accelerated through the same potential difference enter a region of uniform magnetic field and describe circular paths of radii R_1 andR_2 respectively. The ratio of the mass of X to that of Y is:

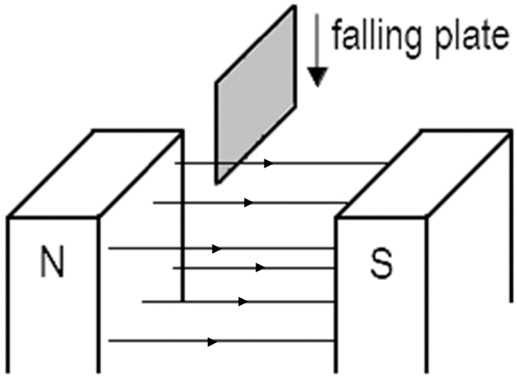
1. $(R_1/R_2)^{1/2}$
2. R_1/R_2
3. $(R_1/R_2)^2$
4. R_1R_2

30 Given below are two statements:

Assertion (A):	Angle of dip at the magnetic pole is 90°.
Reason (R):	Vertical component of the earth's magnetic field is absent at magnetic poles.

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.	Both **(A)** and **(R)** are false.

31 A thin metallic plate is allowed to fall through the space between two magnetic poles creating a horizontal magnetic field. The plate is vertical, and its face is perpendicular to the field lines as it falls. While it is entering the region of the magnetic field,



1.	the acceleration of the plate is equal to g.
2.	the acceleration of the plate is greater than g.
3.	the acceleration of the plate is less than g.
4.	the plate comes to a stop and rebounds upward.

32 A conducting rod is moved with a constant velocity v in a magnetic field. A potential difference appears across the two ends,

a.	if $\vec{v} \parallel \vec{l}$
b.	if $\vec{v} \parallel \vec{B}$
c.	if $\vec{l} \parallel \vec{B}$
d.	none of these

Choose the correct option:

1.	(a), (b)
2.	(b), (c)
3.	(d) only
4.	(a), (d)

33 The magnetic moment of a short dipole is 100 A-m^2. The magnetic induction in vacuum at 1 m from the dipole on the axis of the dipole is:

1. 2×10^{-5}T
2. 10^{-5} T
3. 2 μT
4. 1 μT

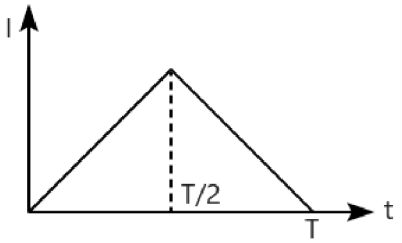
34 Read the passage given below and answer the given question.

Mutual Inductance is the phenomenon of induced emf in a coil, due to a change of current in the neighbouring coil. The amount of mutual inductance that links one coil to another depends very much on the relative positioning of the two coils, their geometry, and the relative separation between them. Mutual inductance between the two coils increases μ_r times if the coils are wound over an iron core of relative permeability μ_r

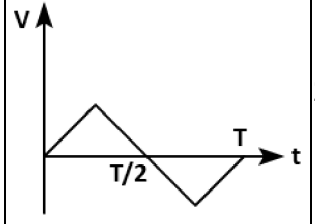
A short solenoid of radius a, number of turns per unit length n_1, and length L is kept coaxially inside a very long solenoid of radius b, number of turns per unit length n_2 . What is the mutual inductance of the system?

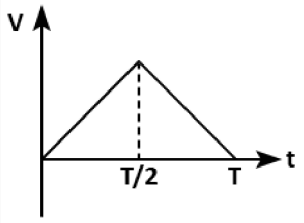
1. $\mu_0 \pi b^2 n_1 n_2 L$
2. $\mu_0 \pi a^2 n_1 n_2 L^2$
3. $\mu_0 \pi a^2 n_1 n_2 L$
4. $\mu_0 \pi b^2 n_1 n_2 L^2$

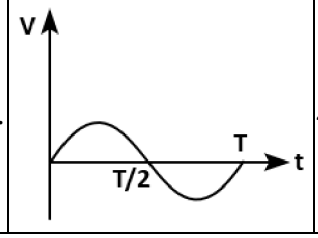
35 The current (I) in the inductance is varying with time according to the plot shown in the figure.

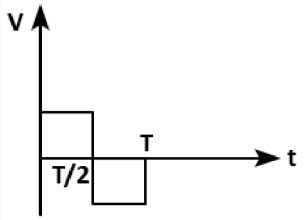


Which one of the following is the correct variation of voltage with time in the coil?

1.


2.


3.


4.


SECTION B

36 The magnetic moment of a bar magnet of length L and area of cross-section A is M. If the magnet is cut into four identical parts each of length L and area of cross-section $\frac{A}{4}$, then magnetic moment of each part is:

1. $\frac{M}{4}$
2. $\frac{M}{2}$
3. M
4. $4M$

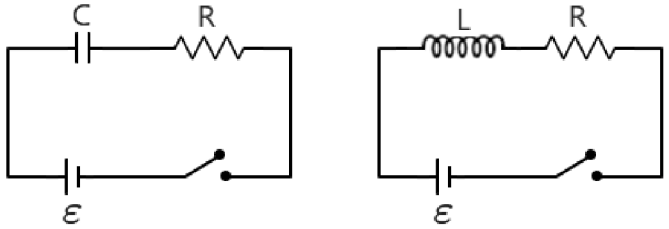
37 A galvanometer G (having very small resistance), when connected with a resistance of 10 kΩ in series, can function as a voltmeter measuring a maximum voltage of 20 V. The current required to give a full scale deflection on the galvanometer is:

1. 0.1 mA
2. 0.2 mA
3. 1 mA
4. 2 mA

38 A wire of length l is folded to form a double circular loop. If current in the wire is i, the magnetic field at the center is:

1. $\frac{\mu_0 i\pi}{2l}$
2. $\frac{\mu_0 i\pi}{l}$
3. $\frac{2\mu_0 i\pi}{l}$
4. $\frac{4\mu_0 i\pi}{l}$

39 The switches in figure (a) and (b) are closed at t = 0 and reopened after a long time at t = t_0

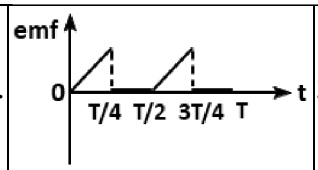


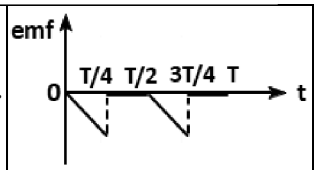
1.	The charge on C just after t = 0 is εC.
2.	The charge on C long after t = 0 is εC.
3.	The current in L just before t = t_0 is ε/R.
4.	The current in L long after t = t_0 is ε/R.

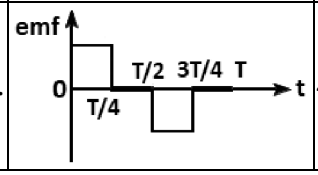
Choose the correct option:

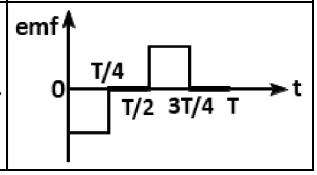
1.	(a), (b)
2.	(b), (c)
3.	(c), (d)
4.	(a), (d)

40 The current i in a coil varies with time as shown in the figure. The variation of induced emf with time would be:

1. 

2. 

3. 

4. 

41 A hollow tube is carrying an electric current along its length distributed uniformly over its surface. The magnetic field,

a.	increases linearly from the axis to the surface.
b.	is constant inside the tube.
c.	is zero at the axis.
d.	is zero just outside the tube.

Choose the correct option:

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

42 A long, straight wire carries a current i. The magnetizing field intensity H is measured at a point P close to the wire. A long, cylindrical iron rod is brought close to the wire so that the point P is at the centre of the rod. The value of H at P will:

1. increase many times
2. decrease many times
3. remain almost constant
4. become zero

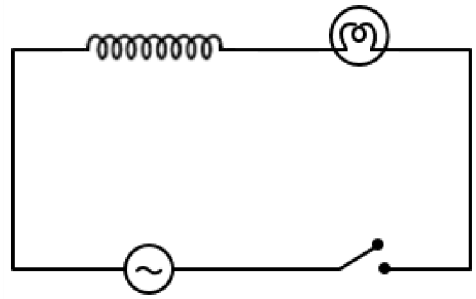
43 A current $I = I_0\, sin\left(\omega t - \frac{\pi}{2}\right)$, flows in an AC circuit across which an AC voltage $E_0 + E_0\, sin\omega t$ has been applied. The average power P consumed in the circuit will be:

1. $\frac{E_0 I_0}{\sqrt{2}}$
2. $\frac{E_0 I_0}{2}$
3. $\sqrt{2} E_0 I_0$
4. zero

44 A 40 μF capacitor is connected to a 200 V, 50 Hz ac supply. The RMS value of the current in the circuit is, nearly:

1. 2.05 A
2. 2.5 A
3. 25.1 A
4. 1.7 A

45 A light bulb and an inductor coil are connected to an AC source through a key as shown in the figure below. The key is closed and after some time an iron rod is inserted into the interior of the inductor. The glow of the light bulb:



1. decreases
2. remains unchanged
3. will fluctuate
4. increases

46 α- particles, β-particles and γ-rays are all having the same energy. Their penetrating power in a given medium in increasing order will be:
1. γ, α, β
2. α, β, γ
3. β, α, γ
4. β, γ, α

47 In the free oscillations of an LC circuit, the sum of energies stored in the capacitor and the inductor is:

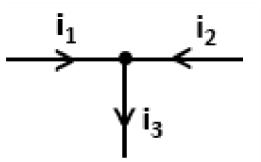
1.	maybe constant and variable in time
2.	variable in time
3.	constant in time
4.	none of the above

48 A transformer is used to light a 100 W and 110 V lamp from a 220 V mains. If the main current is 0.5 A, the efficiency of the transformer is approximately:
1. 30%
2. 50%
3. 90%
4. 10%

49 A compass needle is placed in the gap of a parallel plate capacitor. The capacitor is connected to a battery through a resistance. The compass needle

1.	does not deflect.
2.	deflects for a very short time and then comes back to the original position.
3.	deflects and remains deflected as long as the battery is connected.
4.	deflects and gradually comes to the original position in a time which is large compared to the time constant.

50 If current i_1 = 3A sinωt and current i_2 = 4A cosωt, then i_3 is:



1. $5A\sin(\omega t + 53^\circ)$
2. $5A\sin(\omega t + 37^\circ)$
3. $5A\sin(\omega t + 45^\circ)$
4. $5A\sin(\omega t + 30^\circ)$

Fill OMR Sheet*

*If above link doesn't work, please go to test link from where you got the pdf and fill OMR from there. After filling the OMR, you would get answers and explanations for the questions in the test.