Sample Paper 9

Time : 90 Minutes **Max. Marks : 35**

General Instructions

1. *The Question Paper contains three sections.*
2. *Section A has **25** questions. Attempt any **20** questions.*
3. *Section B has **24** questions. Attempt any **20** questions.*
4. *Section C has **6** questions. Attempt any **5** questions.*
5. *All questions carry equal marks.*
6. *There is no negative marking.*

SECTION-A

*This section consists of 25 multiple choice questions with overall choice to attempt **any 20** questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.*

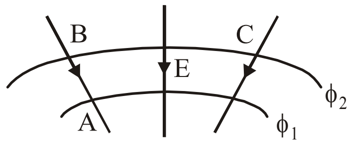
1. In moving from A to B along an electric field line, the work done by the electric field on an electron is 6.4×10^{-19} J. If ϕ_1 and ϕ_2 are equipotential surfaces, then the potential difference $V_C - V_A$ is

(a) –4 V

(b) 4 V

(c) zero

(d) 6.4 V



2. For distance far away from centre of dipole the change in magnitude of electric field with change in distance from the centre of dipole is

(a) zero.

(b) same in equatorial plane as well as axis of dipole.

(c) more in case of equatorial plane of dipole as compared to axis of dipole.

(d) more in case of axis of dipole as compared to equatorial plane of dipole.

3. A conductor carries a current of 50 μ A. If the area of cross-section of the conductor is 50 mm^2, then value of the current density in Am^{-2} is

(a) 0.5 (b) 1 (c) 10^{-3} (d) 10^{-6}

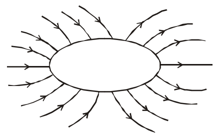
4. Figure below shows a hollow conducting body placed in an electric field. Which of the quantities are zero inside the body?

(a) Electric field and potential

(b) Electric field and charge density

(c) Electric potential and charge density.

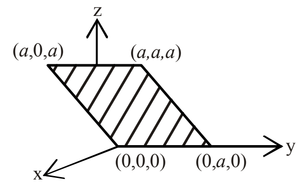
(d) Electric field, potential and charge density.



5. The energy required to charge a parallel plate condenser of plate separation *d* and plate area of cross-section *A* such that the uniform electric field between the plates is *E*, is

(a) $\in_0 E^2Ad$ (b) $\frac{1}{2}\in_0 E^2Ad$ (c) $\frac{1}{2}\in_0 E^2/Ad$ (d) $\in_0 E^2/Ad$

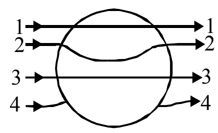
6. Consider an electric field $\vec{E} = E_0\hat{x}$ where E_0 is a constant. The flux through the shaded area (as shown in the figure) due to this field is



(a) $2E_0a_2$
(b) $\sqrt{2}E_0a^2$
(c) $E_0 a^2$
(d) $\frac{E_0a^2}{\sqrt{2}}$

7. The electric resistance of a certain wire of iron is R. If its length and radius are both doubled, then
(a) the resistance and the specific resistance, will both remain unchanged
(b) the resistance will be doubled and the specific resistance will be halved
(c) the resistance will be halved and the specific resistance will remain unchanged
(d) the resistance will be halved and the specific resistance will be doubled

8. A metallic sphere is placed in a uniform electric field. The line of force follow the path (s) shown in the figure as



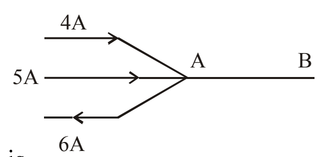
(a) 1
(b) 2
(c) 3
(d) 4

9. Eight drops of mercury of equal radii possessing equal charges combine to form a big drop. Then the capacitance of bigger drop compared to each individual small drop is
(a) 8 times (b) 4 times (c) 2 times (d) 32 times

10. A wire of radius r and another wire of radius 2r, both of same material and length are connected in series to each other. The combination is connected across a battery. The ratio of the heats produced in the two wires will be
(a) 4.00 (b) 2.00 (c) 0.50 (d) 0.25

11. Five cells each of emf E and internal resistance r send the same amount of current through an external resistance R whether the cells are connected in parallel or in series. Then the ratio $\left(\frac{R}{r}\right)$ is
(a) 2 (b) $\frac{1}{2}$ (c) $\frac{1}{5}$ (d) 1

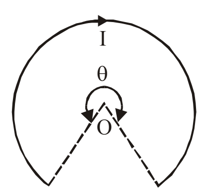
12. The four wires from a larger circuit intersect at junction A as shown. What is the magnitude and direction of the current between points A and B?



(a) 2 A from A to B
(b) 2A from B to A
(c) 3A from A to B
(d) 2A from B to A

13. The magnetic field around a long straight current carrying wire is
(a) spherical symmetry (b) cylindrical symmetry
(c) cubical symmetry (d) unsymmetrical

14. A current of I ampere flows in a wire forming a circular arc of radius r metres subtending an angle θ at the centre as shown. The magnetic field at the centre O in tesla is



(a) $\frac{\mu_0 I\theta}{4\pi r}$ (b) $\frac{\mu_0 I\theta}{2\pi r}$
(c) $\frac{\mu_0 I\theta}{2r}$ (d) $\frac{\mu_0 I\theta}{4r}$

15. If specific resistance of a potentiometer wire is $10^{-7}\Omega$m current flowing through it, is 0.1 amp and cross sectional area of wire is 10^{-6} m^2, then potential gradient will be
(a) 10^{-2} volt/m (b) 10^{-4} volt/m (c) 10^{-6} volt/m (d) 10^{-8} volt/m

16. In a Wheatstone bridge all the four arms have equal resistance R. If the resistance of galvanometer arm is also R, the equivalent resistance of combination is
(a) 2R (b) R/4 (c) R/2 (d) R

17. In a moving coil galvanometer, the deflection of the coil θ is related to the elecrical current *i* by the relation

(a) $i \propto \tan\theta$ (b) $i \propto \theta$ (c) $i \propto \theta^2$ (d) $i \propto \sqrt{\theta}$

18. The pole strength of the magnet does not depend on

(a) area of cross-section (b) nature of material

(c) length of the magnet (d) both (a) and (b)

19. The north pole of a bar magnet is moved towards a coil along the axis passing through the centre of the coil and perpendicular to the plane of the coil. The direction of the induced current in the coil when viewed in the direction of the motion of the magnet is

(a) clockwise (b) anti-clockwise

(c) no current in the coil (d) either clockwise or anti-clockwise

20. On cutting a solenoid in half, the field lines remain ...A..., emerging from one face of the solenoid and entering into the other face. Here, A refers to

(a) irregular (b) discontinuous (c) continuous (d) alternate

21. A magnet is moved towards a coil (i) quickly (ii) slowly, then the induced e.m.f. is

(a) larger in case (i)

(b) smaller in case (i)

(c) equal in both the cases

(d) larger or smaller depending upon the radius of the coil

22. Magnetic flux ϕ in weber in a closed circuit of resistance 10Ω varies with time ϕ (sec) as $\phi = 6t^2 - 5t + 1$. The magnitude of induced current at t = 0.25s is

(a) 0.2 A (b) 0.6 A (c) 1.2 A (d) 0.8 A

23. The peak value of the a.c. current flowing through a resistor is given by

(a) $I_0 = e_0/R$ (b) $I = e/R$ (c) $I_0 = e_0$ (d) $I_0 = R/e_0$

24. An alternating current is given by

$i = i_1 \cos\omega t + i_2 \sin\omega t$ The rms current is given by

(a) $\dfrac{i_1 + i_2}{\sqrt{2}}$ (b) $\dfrac{|i_1 + i_2|}{\sqrt{2}}$ (c) $\sqrt{\dfrac{i_1^2 + i_2^2}{2}}$ (d) $\sqrt{\dfrac{i_1^2 + i_2^2}{\sqrt{2}}}$

25. The heat produced in a given resistance in a given time by the sinusoidal current $I_0 \sin\omega t$ will be the same as that of a steady current of magnitude nearly

(a) $0.71\, I_0$ (b) $1.412\, I_0$ (c) I_0 (d) $\sqrt{I_0}$

SECTION-B

*This section consists of 24 multiple choice questions with overall choice to attempt **any 20** questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.*

26. The force between two small charged spheres having charges of 1×10^{-7} C and 2×10^{-7} C placed 20 cm apart in air is

(a) 4.5×10^{-2} N (b) 4.5×10^{-3} N

(c) 5.4×10^{-2} N (d) 5.4×10^{-3} N

27. If an electron has an initial velocity in a direction different from that of an electric field, the path of the electron is

(a) a straight line (b) a circle (c) an ellipse (d) a parabola

28. Gauss's law is valid for

(a) any closed surface (b) only regular close surfaces

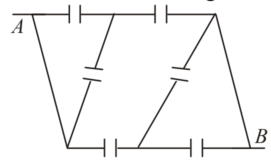
(c) any open surface (d) only irregular open surfaces

29. A point charge of magnitude +1 μC is fixed at (0, 0, 0). An isolated uncharged spherical conductor, is fixed with its center at (4, 0, 0). The potential and the induced electric field at the centre of the sphere is :

(a) 1.8×10^5 V and -5.625×10^6 V/m (b) 0 V and 0 V/m

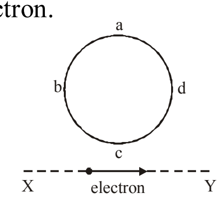
(c) 2.25×10^5 V and -5.625×10^6 V/m (d) 2.25×10^5 V and 0 V/m

30. A network of six identical capacitors, each of value C is made as shown in the figure. Equivalent capacitance between points A and B is



(a) $C/4$
(b) $3C/4$
(c) $4C/3$
(d) $3C$

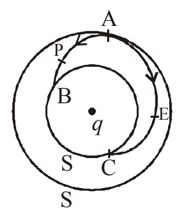
31. An electron moves on a straight line path XY as shown. The abcd is a coil adjacent to the path of electron. What will be the direction of current if any, induced in the coil ?



(a) adcb
(b) The current will reverse its direction as the electron goes past the coil
(c) No current induced
(d) abcd

32. A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn of the solenoid is 4×10^{-3} Wb. The self inductance of the solenoid is :
(a) 4H (b) 3H (c) 2H (d) 1H

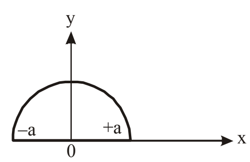
33. Two equipotential surfaces S_1 and S_2 are around a charge q. A test charge is moved from S_1 to S_2 along the paths APB and AEC as shown in figure. The work done is



(a) more in case of APB
(b) more in case of AEC
(c) same in both the cases
(d) cannot say

34. An alternating voltage of 220 V, 50 Hz frequency is applied across a capacitor of capacitance 2 μF. The impedence of the circuit is
(a) $\frac{\pi}{5000}$ (b) $\frac{1000}{\pi}$ (c) 500π (d) $\frac{5000}{\pi}$

35. Determine the rms value of a semi-circular current wave which has a maximum value of a.



(a) $\left(1\sqrt{2}\right)a$
(b) $\sqrt{(3/2)a}$
(c) $\sqrt{(2/3)a}$
(d) $\sqrt{(1/3)a}$

36. In an experiment, 200 V A.C. is applied at the ends of an LCR circuit. The circuit consists of an inductive reactance $(X_L) = 50\ \Omega$, capacitive reactance $(X_C) = 50\ \Omega$ and ohmic resistance $(R) = 10\ \Omega$. The impedance of the circuit is
(a) $10\ \Omega$ (b) $20\ \Omega$ (c) $30\ \Omega$ (d) $40\ \Omega$

37. In an oscillation of L-C circuit, the maximum charge on the capacitor is Q. The charge on the capacitor, when the energy is stored equally between the electric and magnetic field is
(a) $\frac{Q}{2}$ (b) $\frac{Q}{\sqrt{2}}$ (c) $\frac{Q}{\sqrt{3}}$ (d) $\frac{Q}{3}$

38. An electron, a proton and an alpha particle having the same kinetic energy are moving in circular orbits of radii r_e, r_p, r_α respectively in a uniform magnetic field B. The relation between r_e, r_p, r_α is :
(a) $r_e > r_p = r_\alpha$ (b) $r_e < r_p = r_\alpha$ (c) $r_e < r_p < r_\alpha$ (d) $r_e < r_\alpha < r_p$

39. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is :
$(\mu_0 = 4\pi \times 10^{-7}\ \text{T m A}^{-1})$
(a) 3.14×10^{-4} T (b) 6.28×10^{-5} T (c) 3.14×10^{-5} T (d) 6.28×10^{-4} T

40. For bar magnet effective length (L_e) related with geometrical length (L_g) as
(a) $Le = \frac{6}{5} L_g$ (b) $Le = \frac{5}{6} L_g$ (c) $Le = L_g$ (d) $Le = 2\,L_g$

41. If the magnetic flux linked with a coil through which a current of x A is set up is y Wb, then the coefficient of self inductance of the coil is

(a) (x – y) henry (b) $\frac{x}{y}$ henry (c) $\frac{y}{x}$ henry (d) x y henry

42. The primary of a transformer has 400 turns while the secondary has 2000 turns. If the power output from the secondary at 1000 V is 12 kW, what is the primary voltage?

(a) 200 V (b) 300 V (c) 400 V (d) 500 V

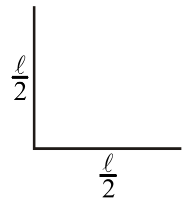
43. A steel wire of length ℓ has a magnetic moment M. It is bent in L-shape (Figure). The new magnetic moment is

(a) M

(b) $\frac{M}{\sqrt{2}}$

(c) $\frac{M}{2}$

(d) 2M



44. Whenever the magnetic flux linked with an electric circuit changes, an emf is induced in the circuit. This is called

(a) electromagnetic induction

(b) lenz's law

(c) hysteresis loss

(d) kirchhoff's laws 111

Given below are two statements labelled as Assertion (A) and Reason (R). Select the most appropriate answer from the options given below:

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

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

45. **Assertion :** On disturbing an electric dipole in stable equillibrium in an electric field, it returns back to its stable equillibrium orientation.

Reason : A restoring torque acts on the dipole on being disturbed from its stable equillibrium.

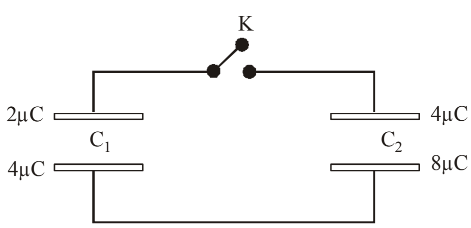
46. **Assertion :** Polar molecules have permanent dipole moment.

Reason : In polar molecules, the centres of positive and negative charges coincide even when there is no external field.

47. **Assertion :** The induced charge that flows in the circuit does not depends on the time rate change of flux.

Reason : $i = \frac{dq}{dt} = -\frac{1}{R}\left(\frac{d\phi}{dt}\right) \Rightarrow dq = -\frac{d\phi}{R}$

48. **Assertion :** Charges are given to plates of two plane parallel plate capacitors C_1 and C_2 (such that $C_2 = 2C_1$) as shown in figure. Then the key K is pressed to complete the circuit. Finally the net charge on upper plate and net charge on lower plate of capacitor C_1 is negative.



Reason : In a parallel plate capacitor both plates always carry equal and positive charge.

49. **Assertion :** A charged particle moves in a uniform magnetic field. The velocity of the particle at some instant makes an acute angle with the magnetic field. The path of the particle is a helix with constant pitch.

Reason : The force on the particle is given by $\vec{F} = q\left(\vec{v}.\vec{B}\right)$.

SECTION-C

This section consists of 6 multiple choice questions with an overall choice to attempt ***any 5****. In case more than desirable number of questions are attempted, ONLY first 5 will be considered for evaluation.*

50. A proton (mass m and charge + e) and an α-particle (mass 4m and charge + 2e) are projected with the same kinetic energy at right angles to the uniform magnetic field. Which one of the following statements will be true ?
(a) The α-particle will be bent in a circular path with a small radius that for the proton
(b) The radius of the path of the α-particle will be greater than that of the proton
(c) The α-particle and the proton will be bent in a circular path with the same radius
(d) The α-particle and the proton will go through the field in a straight line

51. The galvanometer cannot as such be used as an ammeter to measure the value of current in a given circuit. The following reasons are
I. galvanometer gives full scale deflection for a small current.
II. galvanometer has a large resistance.
III. a galvanometer can give inaccurate values.
The correct reasons are:
(a) I and II (b) II and III (c) I and III (d) I, II and III

Case Study : *Read the following paragraph and answers the questions.*

Terminal potential difference of a cell is defining the potential difference between the two electrodes of a cell when the cell is in closed circuit i.e. current is withdrawn from it.
Electromotive force or e.m.f of a cell is the maximum potential difference between the two electrodes of a cell when the cell is in open circuit i.e. no current is taken from the cell.

$V = E - Ir \leftarrow$ when current is withdrawn from the cell

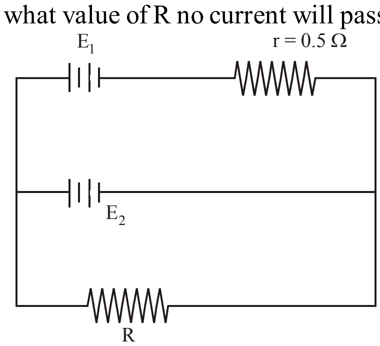
$V = E + Ir \leftarrow$ when the cell is charged.

The S.I. unit of emf and potential difference is same i.e., volt.

52. A capacitor is connected to a cell of emf E having some internal resistance r. The potential difference across the
(a) cell is < E (b) cell is E
(c) capacitor is > E (d) capacitor is < E

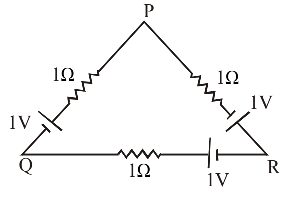
53. A primary cell has an e.m.f. of 1.5 volt. When short-circuited it gives a current of 3 ampere. The internal resistance of the cell is
(a) 4.5 ohm (b) 2 ohm (c) 0.5 ohm (d) (1/4.5) ohm

54. A dc source of emf $E_1 = 100$ V and internal resistance $r = 0.5\ \Omega$, a storage battery of emf $E_2 = 90$ V and an external resistance R are connected as shown in figure. For what value of R no current will pass through the battery ?



(a) 5.5 Ω (b) 3.5 Ω (c) 4.5 Ω (d) 2.5 Ω

55. Three batteries of emf 1V and internal resistance 1Ω each are connected as shown. Effective emf of combination between the points PQ is



(a) zero
(b) 1V
(c) 2V
(d) (2/3) V

OMR ANSWER SHEET

Sample Page No – ☐

- ✶ Use Blue / Black Ball pen only.
- ✶ Please do not make any atray marks on the answer sheet.
- ✶ Rough work must not be done on the answer sheet.
- ✶ Darken one circle deeply for each question in the OMR Answer sheet, as faintly darkend / half darkened circle might by rejected.

Start time : ____________________ End time ____________________ Time taken ____________________

1. Name (in Block Letters)

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2. Date of Exam

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3. Candidate's Signature ☐

Section-A

1.	a	b	c	d	9.	a	b	c	d	17.	a	b	c	d
2.	a	b	c	d	10.	a	b	c	d	18.	a	b	c	d
3.	a	b	c	d	11.	a	b	c	d	19.	a	b	c	d
4.	a	b	c	d	12.	a	b	c	d	20.	a	b	c	d
5.	a	b	c	d	13.	a	b	c	d	21.	a	b	c	d
6.	a	b	c	d	14.	a	b	c	d	22.	a	b	c	d
7.	a	b	c	d	15.	a	b	c	d	23.	a	b	c	d
8.	a	b	c	d	16.	a	b	c	d	24.	a	b	c	d
										25.	a	b	c	d

Section-B

26.	a	b	c	d	34.	a	b	c	d	42.	a	b	c	d
27.	a	b	c	d	35.	a	b	c	d	43.	a	b	c	d
28.	a	b	c	d	36.	a	b	c	d	44.	a	b	c	d
29.	a	b	c	d	37.	a	b	c	d	45.	a	b	c	d
30.	a	b	c	d	38.	a	b	c	d	46.	a	b	c	d
31.	a	b	c	d	39.	a	b	c	d	47.	a	b	c	d
32.	a	b	c	d	40.	a	b	c	d	48.	a	b	c	d
33.	a	b	c	d	41.	a	b	c	d	49	a	b	c	d

Section-C

50.	a	b	c	d	53.	a	b	c	d
51.	a	b	c	d	54.	a	b	c	d
52.	a	b	c	d	55.	a	b	c	d

No. of Qns. Attempted		Correct		Incorrect		Marks	