KENDRIYA VIDYALAYA SANGATHAN
ERNAKULAM REGION

STUDENT SUPPORT MATERIAL

TERM 1 (SESSION 2021-22)

CLASS XII-PHYSICS

STUDENT SUPPORT MATERIAL

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Message

I feel immense pleasure to publish the study material for Class XII Physics. This support material is prepared incorporating all the recent changes in curriculum and assessment process made by CBSE. I am sure it will definitely be of great help to Class XII students of all Kendriya Vidyalayas.

Getting acquainted with the latest changes will help students to prepare well for the board examination and enable students to face case based and Multiple-Choice Questions with confidence. This support material has been prepared by a team of dedicated and veteran teachers with expertise in their respective subjects.

The Support material contains all the important aspects required by the students- the design of question paper, term wise split up syllabus, important formula used, chapter wise question bank including Reason-assertion type and Case study questions and Sample question papers with answer key for all questions.

I hope that this Support Material will be used by students and teachers as well and will prove to be a good tool for quick revision.

I would like to express my sincere gratitude to the In- charge principal and all the teachers who have relentlessly worked for the preparation of this study material. Their enormous contribution in making this project successful is praiseworthy.

Meticulous planning blended with hard work, effective time management and sincerity will help the students to reach the pinnacle of success.

Wish you all the best

(R Senthil Kumar)

Ms. Hema K
Principal
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Physics Class XII (Code N. 042)

Syllabus For Term I (2021-22)

		Marks
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	Chapter–1: Electric Charges and Fields	
	Chapter–2: Electrostatic Potential and Capacitance	
Unit-II	**Current Electricity**	
	Chapter–3: Current Electricity	
Unit-III	**Magnetic Effects of Current and Magnetism**	**18**
N	Chapter–4: Moving Charges and Magnetism	
	Chapter–5: Magnetism and Matter	
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	Chapter–6: Electromagnetic Induction	
	Chapter 7: Alternating currents	
Total		**35**

DETAILED SYLLABUS

Unit I: Electrostatics

Chapter–1: Electric Charges and Fields

Electric Charges; Conservation of charge, Coulomb's law-force between two-point charges, forces between multiple charges; superposition principle and continuous charge distribution. Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, torque on a dipole in uniform electric field. Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet

Chapter–2: Electrostatic Potential and Capacitance

Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two-point charges and of electric dipole in an electrostatic field. Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor.

Unit II: Current Electricity

Chapter–3: Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm's law, electrical resistance, V-I characteristics (linear and non- linear), electrical energy and power, electrical resistivity and conductivity; temperature dependence of resistance. Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel, Kirchhoff's laws and simple applications, Wheatstone bridge, metre bridge(**qualitative ideas only).** Potentiometer - principle and its applications to measure potential difference and for comparing EMF of two cells; measurement of internal resistance of a cell **(qualitative ideas only)**

Unit III: Magnetic Effects of Current and Magnetism

Chapter–4: Moving Charges and Magnetism

Concept of magnetic field, Oersted's experiment. Biot - Savart law and its application to current carrying circular loop. Ampere's law and its applications to infinitely long straight wire. Straight and toroidal solenoids (only qualitative treatment), force on a moving charge in uniform magnetic and electric fields. Force on a current-carrying conductor in a uniform magnetic field, force between two parallel current-carrying conductors-definition of ampere, torque experienced by a current loop in uniform magnetic field; moving coil galvanometer-its current sensitivity and conversion to ammeter and voltmeter.

Chapter–5: Magnetism and Matter

Current loop as a magnetic dipole and its magnetic dipole moment, magnetic dipole moment of a revolving electron, bar magnet as an equivalent solenoid, magnetic field lines; earth's magnetic field and magnetic elements.

Unit IV: Electromagnetic Induction and Alternating Currents

Chapter–6: Electromagnetic Induction

Electromagnetic induction; Faraday's laws, induced EMF and current; Lenz's Law, Eddy currents. Self
and mutual induction.

Chapter–7: Alternating Current

Alternating currents, peak and RMS value of alternating current/voltage; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits. AC generator and transformer.

Syllabus For Practical (Term I)

First term practical examination will be organised by schools as per the directions of CBSE. The record to be submitted by the students at the time of first term examination has to include a record of at least 4 Experiments and 3 Activities to be demonstrated by teacher.

Time Allowed: one and half hours

Max. Marks: 15

Two experiments to be performed by students at time of examination	**8 marks**
Practical record [experiments and activities]	**2 marks**
Viva on experiments, **and** activities	**5 marks**
Total	**15 marks**

Experiments assigned for Term I

1. To determine resistivity of two / three wires by plotting a graph between potential difference versus current.
2. To find resistance of a given wire / standard resistor using metre bridge.

OR

To verify the laws of combination (series) of resistances using a metre bridge.

OR

To verify the laws of combination (parallel) of resistances using a metre bridge.

3. To compare the EMF of two given primary cells using potentiometer.

OR

To determine the internal resistance of given primary cell using potentiometer.

4. To determine resistance of a galvanometer by half-deflection method and to find its figure of merit.
5. To convert the given galvanometer (of known resistance and figure of merit) into a voltmeter of desired range and to verify the same.

OR

To convert the given galvanometer (of known resistance and figure of merit) into an ammeter of desired range and to verify the same.

6. To find the frequency of AC mains with a sonometer.

Activities assigned for Term I

1. To measure the resistance and impedance of an inductor with or without iron core.
2. To measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using multimeter.
3. To assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse and a power source.
4. To assemble the components of a given electrical circuit.
5. To study the variation in potential drop with length of a wire for a steady current.
6. To draw the diagram of a given open circuit comprising at least a battery, resistor/rheostat, key, ammeter and voltmeter. Mark the components that are not connected in proper order and correct the circuit and also the circuit diagram.

IMPORTANT FORMULAS USED

Electrostatics

1	$Quantisation\ of\ charge\ \ Q = \pm ne, where\ n = 1,2,3 \ldots \& \ e = 1.6 \times 10^{-19} C$
2	Coulomb's force $F = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$ air or vacuum
3	Coulomb's force $F = \frac{1}{4\pi\epsilon_0\epsilon_r}\frac{q_1 q_2}{r^2}$ in a medium of dielectric constant ϵ_r
4	Absolute permittivity of a medium $\epsilon = \epsilon_0\ \epsilon_r$
5	Relative permittivity of dielectric constant K or $\epsilon_r = \frac{\epsilon}{\epsilon_0} = \frac{F_{air}}{F_{med}}$
6	Electric field intensity E=$\frac{F}{q_0}$
7	Electric field due to a point charge E=$\frac{1}{4\pi\epsilon_0}\frac{q}{r^2}$
8	Electric dipole moment $\vec{P} = q \times \overrightarrow{2a}$, Where 2a is the length of dipole
9	Electric filed due to an electric dipole at axial point $E_{axial} = \frac{1}{4\pi\epsilon_0}\frac{2Pr}{(r^2-a^2)^2}$,r is the distance from the centre of dipole
10	Electric filed due to an electric dipole on the equatorial line $E_{eq} = \frac{1}{4\pi\epsilon_0}\frac{P}{(r^2+a^2)^{3/2}}$, r is the distance from the centre of dipole
11	At any point due to a short dipole= $\frac{1}{4\pi\epsilon_0}\frac{\sqrt{3cos^2\theta+1}}{r^3}$
12	Torque on electric dipole in a uniform electric field E , $\boldsymbol{\tau = PEsin\theta}$
13	Work done on a dipole in a uniform electric field W=$PE\ (cos\theta_1 - cos\theta_2)$
14	PE stored in a dipole in a uniform electric field U=$PE\ (cos\theta_1 - cos\theta_2)$ If $\theta_1 = 90\ and\ \theta_2 = \theta$ U=- PE Cos θ Stable equilibrium θ =0, U=- PE Unstable equilibrium $\theta = 180$,U =+PE
15	Electric flux $\phi_E = \oint \overrightarrow{E}.\overrightarrow{dS} = \frac{q}{\epsilon_0}$
16	Electric filed due to linear conductor E=$\frac{\lambda}{2\pi\epsilon_0 r}$
17	Electric filed due to plane sheet $E = \frac{\sigma}{2\epsilon_0}$

18	Electric filed due to charged spherical shell $E = \frac{\sigma R^2}{\epsilon_0 r^2}$
19	Potential gradient E= $-\frac{dV}{dr}$
20	Capacitance C=$\frac{Q}{V}$
21	Dielectric constant K=$\frac{E_0}{E}$
22	Induced diploe moment acquired by an atom =$\alpha\epsilon_0 E_0$, where $\alpha$is a constant called molecular polarizability
23	Polarisation density P= N$\alpha\epsilon_0 E_0$, , N number of atoms per unit volume
24	Capacitance of a parallel plate capacitor C=$\frac{\epsilon_0 A}{d}$,air as medium
25	C=$\frac{\epsilon_0 A}{d-t+\frac{t}{K}}$, with dielectric slab
26	C=$\frac{\epsilon_0 A}{d-t}$ with a conducting slab of thickness t
27	Electrostatic potential energy U=q V= $\frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r}$
28	Electrostatic potential energy for an assembly of three charges U=$\frac{1}{4\pi\epsilon_0}\left[\frac{q_1 q_2}{r_{12}}+\frac{q_1 q_2}{r_{12}}+\frac{q_1 q_2}{r_{12}}\right]$ In the absence of external field.
29	Electrostatic potential energy of two charges in an external field U= v(r_1)+ V(r_2) +$\frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r}$
30	Common potential in capacitor V=$\frac{C_1 V_v + C_2 V_2}{V_1 + V_2}$
31	Electrostatic potential at the equatorial point of a dipole=0
32	Electrostatic potential at any point of a dipole =$\frac{1}{4\pi\epsilon_0}\frac{Pcos\theta}{r^2}$ Electrostatic potential at any point of a dipole=$\frac{1}{4\pi\epsilon_0}\frac{Pcos\theta}{r^2}$
33	C= $C_1 + C_2 + C_3$ in parallel
34	$\frac{1}{C}=\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}$ in series
35	Energy in capacitor $\frac{1}{2}CV^2 = \frac{q^2}{2C} = \frac{1}{2}qV$
36	Loss of energy in sharing charges=$\frac{C_1 C_2 (V_1 - V_2)^2}{2(C_1 + C_2)}$

Current Electricity

1	Ohm's Law V=IR, R $\frac{\rho l}{A}$ I=$\frac{dq}{dt}$,
2	Drift velocity $V_d = \frac{eE}{m}\tau$ =$\frac{eV}{ml}\tau$
3	I=neA V_d resistivity$\rho = \frac{m}{ne^2\tau}$
4	conductance= $\frac{1}{Resistance}$, conductivity=$\frac{1}{resistivity}$
5	Electrical power, P=VI = $I^2R = \frac{V^2}{R}$, electrical energy=Pt
6	Potential gradient K=$\frac{V}{l}$
7	potentiometer $\frac{\mathcal{E}_1}{\mathcal{E}_2} = \frac{l_1}{l_2}$, internal resistance r=$(\frac{l_1 - l_2}{l_2}) \times R$
8	Mobility $\mu = \frac{q\tau}{m} = \frac{V_d}{E}$
9	R =$R_1 + R_2 + R_3$, in series current same
10	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$, in parallel, voltage same
11	V= $\mathcal{E} - Ir, \mathcal{E}. emf\ of\ cell$, I=$\frac{\mathcal{E}}{R+r}$
12	Cell in- series I= $\frac{n\mathcal{E}}{R+r}$, parallel I= $\frac{n\mathcal{E}}{R+nr}$,
13	Balance Wheatsone Bridge $\frac{P}{Q} = \frac{R}{S}$
14	Metre Bridge $\frac{l}{100-l} = \frac{R}{S}$

Moving charges and Magnetism

1	Biot- savart's Law $dB = \frac{\mu_0}{4\pi}.\frac{I\ dl\ Sin\theta}{r^2}$
2	For straight conductor$B = \frac{\mu_0 I}{2\pi r}$
3	Circular loop at axial point $B = \frac{\mu_0 N\ I a^2}{2(R^2 + a^2)^{3/2}}$
4	Centre of circular loop B= $\frac{\mu_0 NI}{2r}$
5	Ampere's circuital Law $\oint \overrightarrow{B}.\overrightarrow{dl}$ =$\mu_0 I$
6	Magnetic Lorentz force on(1) charge F=qvBsinθ (2) current carrying conductor F = IL Bsinθ
7	Force in a crossed field F= (qE+**v**X**B**)
8	Magnetic dipole moment of a current carrying coil M= NIA= NI πr^2 Magnetic dipole moment of a revolving electron=$\frac{evr}{2}$
	Cyclotron
9	Radius , r =$\frac{qB}{mv}$, v=$\frac{qBr}{m}$
10	Time period T=$\frac{2\pi m}{qB}$,independent od radius
11	Kinetic Energy =$\frac{q^2B^2r^2}{2m}$
12	Force per unit length of two current carrying conductors, F=$\frac{\mu_0 I_1 I_2}{2\pi r}$
13	Torque experienced on a coil $\tau = NIABSin\theta$
14	Moving coil galvanometer K$\theta = NIAB$

15	Current sensitivity =$\frac{NAB}{K}$ Voltage sensitivity = $\frac{NAB}{KR}$
16	Conversion of galvanometer to (1)ammeter, shunt resistance to be connected in parallel $$S = (\frac{I_g}{I - I_r}) \times G$$ (2) Voltmeter , high resistance in series $$R = \frac{V}{I_g} - G$$

Magnetism and Matter

1	Magnetic dipole moment= pole strength x dipole length
2	Magnetic field at axial point of dipole $B_{axial} = \frac{\mu_0}{4\pi(}\frac{2Md}{d^2-l^2)^2}$
3	Equatorial line $B_{eq} = \frac{\mu_0}{4\pi(}\frac{M}{d^2+l^2)^{3/2}}$
4	Torque , $\tau = MBsin\theta$ where M is the magnetic dipole moment
5	PE stored in a magnetic dipole in a uniform magnetic field U=$MB\ (cos\theta_1 - cos\theta_2)$
6	Stable equilibrium θ =0, U=- MB Unstable equilibrium $\theta = 180$,U =MB
7	earth's magnetic field B=$\sqrt{{B_v}^2 + {B_H}^2}$
8	Dip angle $tan\delta = \frac{B_v}{B_H}$
9	Magnetic intensity H=$\frac{B_0}{\mu_0}$, intensity of magnetisation I=$\frac{M}{V}$=$\frac{Dipolemoment}{volume}$
10	Magnetic induction B=$\mu_0(H + I)$,χ_m=$\frac{I}{H}$

Electromagnetic Induction

1	Magnetic flux $\phi_B = \int \vec{B}.\overrightarrow{ds}$ =$\int Bds\cos\theta, \theta \text{ is the angle between direction of } B \text{ and area vector}$
2	Faradays law, $\mathcal{E} = -N\frac{d\phi}{dt}$, N- no of turns Magnetic flux ϕ_B =L I, L self-inductance, I current ϕ_B =M I, M –mutual inductance
3	$\mathcal{E}$=$-L\frac{dI}{dt}$ & $\mathcal{E}$=$-M\frac{dI}{dt}$,$\frac{dI}{dt}$ is the rate of change of current.
4	Self-inductance of solenoid L=$\mu_0 n^2 Al$,where n=$\frac{N}{l}$, is the number of turns per unit length
5	Mutual inductance of solenoid M=$\mu_0 n_1 n_2 Al$ Mutual inductance of two concentric circular coil
6	Motional emf $\mathcal{E}$ =Blv , I= $\frac{Blv}{R}$. P =$\frac{B^2 l^2 V^2}{R}$
7	Motional emf for conductor one end fixed and rotating with angular velocityω , $\mathcal{E} = \frac{1}{2}B\omega l^2$

AC circuits

1	Induced emf $\mathcal{E} = \mathcal{E}_0 sin\omega t$, $\mathcal{E}_0 = NAB\omega$(peak) $I = I_0 sin\omega t$ where $I_0 = \frac{E_0}{R}$ $\omega = 2\pi v$
2	Mean value of Ac over a full cycle=0 , half cycle$\frac{2I_0}{\pi}$
3	RMS value of AC $I_{rms} = \frac{I_0}{\sqrt{2}} = 0.707I_0$, & $E_{rms} = \frac{E_0}{\sqrt{2}} = 0.707E_0$
4	Purely resistive: emf and current are in phase $\mathcal{E} = \mathcal{E}_0 sin\omega t,\ I = I_0 sin\omega t,$ P=I^2R Power factor cos$\phi = 1$
5	Purely inductive: emf leads current by a phase angle of $\frac{\pi}{2}$ $\mathcal{E} = \mathcal{E}_0 sin\omega t$ $I = I_0 \sin(\omega t - \frac{\pi}{2})$, $I_0 = \frac{\mathcal{E}_0}{\omega L}$, P=0 Power factor cos$\phi = 0$
6	inductive reactance , $X_L = \omega L$ capacitive reactance$X_c = \frac{1}{\omega C}$

7	Purely capacitor circuit current leads voltage by a phase angle of $\frac{\pi}{2}$ Purely capacitor circuit $\mathcal{E} = \mathcal{E}_0 sin\omega t$, $I = I_0 \sin(\omega t + \frac{\pi}{2})$, P=0, $\cos\phi = 0$
8	LCR circuit Impedance ,Z=$\sqrt{R^2 + (X_c - X_L)^2}$
9	LCR circuit, phase angle, $tan\phi = \frac{X_c - X_l}{R}$ Average power,$V_{rms} I_{rms} \cos\phi$
10	Resonant frequency ,$\omega_r = \frac{1}{\sqrt{LC}}$, $\nu_r = \frac{1}{2\pi\sqrt{LC}}$ At resonance Z=R, $X_L = X_c$, $\cos\phi = 0$
11	Q- factor=$\frac{V_L}{V_R} = \frac{V_c}{V_R} = \frac{resonant\ frequency}{band\ width}$
12	Magnetic potential energy stored in inductor $\frac{1}{2}LI^2$, energy density =$\frac{B^2}{2\mu_0}$
	Few important points 1. Potential at the equatorial line of a dipole is zero 2. Work done to move a charge on an equipotential surface is zero 3. Electric field inside a conductor is zero 4. Potential on the surface and potential within a conductor is same 5. Capacitor does not allow Ac to pass through it 6. Work done by Lorentz force is zero 7. Total charge of a diploe is zero 8. Total charge of a capacitor is zero 9. Electric field is in the direction of decreasing potential in the steepest 10. Magnetic field along the direction of current carrying straight conductor is zero 11. Magnetic field in the open space in a toroid is zero 12. Voltmeter is always connected in parallel to the circuit component and Ammeter is connected in series 13. Potentiometer is less potential gradient is more sensitive 14. Resistivity of given material is constant. Does not depend on the dimensions 15. Gauss theorem in magnetism indicates that magnetic monopole does not exit 16. In Lorentz force F, q, V are perpendicular to each other. 17. In capacitor series connection, charge is same. Parallel voltage is same. 18. In resistors series current is same parallel voltage is same

CHAPTER 1
ELECTRIC CHARGES AND FIELDS

SECTION A- MULTIPLE CHOICE QUESTIONS

1. Two charges are placed a certain distance apart. A metallic sheet is placed between them. What will happen to the force between them?
   (i) Increases
   (ii) Decreases
   (iii) Remains unchanged
   (iv) May increase or decrease depending on the nature of the dielectric.

2. Two charges q_1 and q_2 repel each other with a force of 0.1 N. What will be the force exerted by q_1 on q_2 when a third charge is placed near them?
   (i) Less than 0.1 N.
   (ii) More than 0.1 N
   (iii) 0.1 N
   (iv) Less than 0.1 N if q_1 and q_2 are similar and more than 0.1 N if q_1 and q2 are dissimilar.

3. Two charged spheres separated by a distance **d** exerts a force **F** on each other. If they are immersed in a liquid of dielectric constant 2, then what is the force?
   (i) F/2
   (ii) F
   (iii) 2F
   (iv) 4F

4. A charge **q** is placed at the midpoint of the line joining two similar and equal charges, each equal to +2 micro coulomb. The system will be in equilibrium if q =
   (i) – 0.5 μ C
   (ii) – 1.0 μ C
   (iii) + 1.0 μ C
   (iv) + 0.5 μ C

5. A hollow copper sphere is positively charged. The electric field at the centre will be
   (i) Same as on the surface.
   (ii) Less than that on the surface but not zero.
   (iii) More than that on the surface.
   (iv) Zero

6. How does the electric field strength vary when we enter a uniformly charged spherical cloud?
   (i) Decreases inversely as the square of the distance from the surface.
   (ii) Decreases directly as the square of the distance from the centre.
   (iii) Increases directly as the square of the distance from the centre.
   (iv) Increases directly as the distance from the centre.

7. Which of the following are not properties of electric field lines?
   A. They never intersect.
   B. They start from negative charge and terminate at the positive charge.
   C. The tangent to the field line at any point gives the direction electric field at that point
   D. Each unit positive charge gives rise to $1/4\pi\epsilon$ lines in free space.
      (i) A and D
      (ii) B and D
      (iii) A and C
      (iv) B and C

8. Two-point charges +8 q and -2 q are located at X= 0 and X= L respectively. The location of the point on the X-axis at which the net electric field due to these point charges is zero is
   (i) 8 L
   (ii) 4L
   (iii) 2L
   (iv) L/4

9. Two-point charges placed in a medium of dielectric constant 9 at a distance **r** between them experience an electrostatic force **F**. The electrostatic force between them in vacuum at the same distance will be
   (i) 9F
   (ii) F
   (iii) F/2
   (iv) F/9

10. A positively charged rod is brought near an uncharged conductor. If the rod is then suddenly withdrawn, the charge left on the conductor will be
   (i) Positive
   (ii) Zero
   (iii) Negative
   (iv) None

11. A surface encloses an electric dipole. The flux trough the surface is
    (i) Zero
    (ii) Positive
    (iii) Negative
    (iv) Infinite

12. In a certain region of space there exists a uniform electric field of 2000kV/m. A rectangular coil of sides 10cm × 20cm is kept XY plane. the electric flux through the coil in SI will be
    (i) Zero
    (ii) 40
    (iii) 4×10^5
    (iv) 4

13. The electric field at a certain point is 10 N/C. The electric filed lines crossing unit area around the point at right angles to it is
    (i) ε_0
    (ii) $1/\varepsilon_0$
    (iii) 5
    (iv) 10

14. If one penetrates into a uniformly charged sphere, the electric field strength **E** will
    (i) Decrease
    (ii) Increase
    (iii) Remains the same as that at the surface
    (iv) Zero at all points

15. The electric filed lines coming out of a charged body "A" is parallel and equidistant up to infinity, this body is
    (i) A solid sphere
    (ii) A hollow sphere
    (iii) A needle
    (iv) A plane sheet

16. A cube of side "**a**" is placed in an electric field directed along the positive X -axis. The net number of flux lines passing through the cube is
    (i) $6a^2 E_0$
    (ii) $2a^2 E_0$
    (iii) $4a^2 E_0$
    (iv) Zero

17. The electric flux through a closed surface S enclosing a charge Q is φ_0. If the surface area is doubled, then the flux is
    (i) $2\ \varphi_0$
    (ii) $3\ \varphi_0$
    (iii) $4\varphi_0$
    (iv) φ_0

18. A charge q is located at the centre of a cube. The electric flux through any one face of the cube is
    (i) q/ε_0
    (ii) Zero
    (iii) $q/4\varepsilon_0$
    (iv) $q/6\varepsilon_0$

19. Electric flux over a surface in an electric field may be
    (i) Positive
    (ii) Negative
    (iii) Zero
    (iv) Positive, Negative, Zero

20. In a region where intensity of electric field is 5 NC^{-1}, 50 electric field lines are crossing per square metre. The number of electric field lines crossing per square metre, where intensity of electric field is 20 NC^{-1} will be
    (i) 20
    (ii) 200
    (iii) 100
    (iv) 50

21. Six charges each equal to +Q are placed at the corners of a regular hexagon of each side x. What is the electric field at the intersection of the diagonals?
    (i) $36kQ/x^2$
    (ii) $6kQ/x^2$
    (iii) kQ/x^2
    (iv) Zero

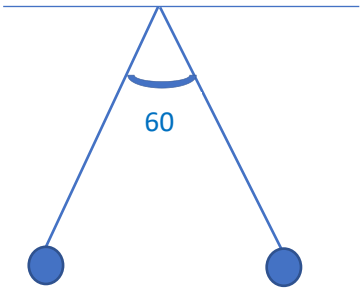
22. An electron moves through a small distance in a uniform electric field. The magnitude of the electric field is $2x\ 10^4$ N/C. Now the electric field is reversed keeping the magnitude same and a proton moves through the same distance. Then which of the following options is correct?
    (i) The time of fall will be more in case of electron.
    (ii) The time of fall will be more in the case of proton.
    (iii) The time of fall will be same in both the cases.
    (iv) The time of fall will be independent of charge.

23. A point charge A of charge +4 μ C and another charge B of charge -1 μ C are placed in air at a distance 1 m apart. The distance of the point on the line joining the charges and from the charge B, where the resultant electric field is zero is
    (i) 2 m
    (ii) 1m
    (iii) 0.5 m
    (iv) 1.5 m

24. Two spherical conductors A and B having equal radii and carrying equal charges on them repel each other with a force F when kept apart at some distance. A third spherical conductor C having same radius but uncharged is brought in contact with A, then brought in contact with B and finally removed away from both. The new force of repulsion between A and B is
    (i) F/4
    (ii) 3F/4
    (iii) F/8l
    (iv) 3F/8

25. A charged oil drop is suspended in a uniform electric field of $3x\ 10^4$ V/m so that it neither falls nor rises. The charge on the drop will be (mass= $9.9x10^{-15}$ kg; g =10 m/s^2)
    (i) 3.3×10^{-18} C
    (ii) 2.0×10^{-18} C
    (iii) 1.6×10^{-18} C
    (iv) 4.8×10^{-18} C

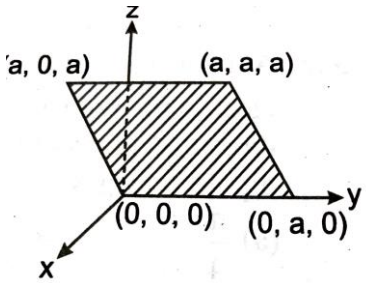
26.



Two small spherical balls each carrying charge q= 10 micro-Coulomb are suspended by two insulated threads of equal length 1 m each from a point fixed in the ceiling. It is found that in equilibrium, threads are separated by an angle 60^0 between them as shown in figure. The tension in the thread is
    (i) 0.18 N
    (ii) 18 N
    (iii) 1.8 N
    (iv) None

27. A certain charge q is divided in the ratio m:n so that when kept at a distance, the force between them is maximum. The ratio m:n is
(i) 2:1 (ii)4:1 (iii) 1:1 (iv) 3:1

28. Consider an electric field $E=E_0$ x, where E_0 is a constant. The flux through the (a,0, a) shaded area due to the field is



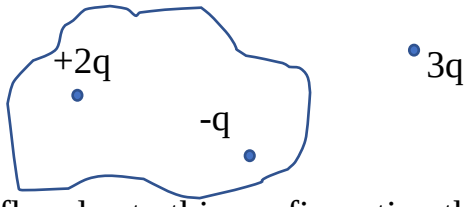
(i) $2E_0\ a^2$
(ii) $\sqrt{2}\ E_0\ a^2$
(iii) $E_0\ a^2$
(iv) $\frac{E_0\ a^2}{\sqrt{2}}$

29. Number of electric field lines from 0.5C of positive charge in a dielectric medium of constant 10 is
(i) 5.6×10^9
(ii) 1.13×10^{11}
(iii) 9×10^9
(iv) 8.85×10^{-12}

30. A semi-circular arc of radius a is charged uniformly and the charge per unit length is λ. The electric field at its centre is
(i) $\frac{\lambda}{2\pi\varepsilon_0 a^2}$
(ii) $\frac{\lambda}{4\pi\varepsilon_0 a}$
(iii) $\frac{\lambda}{2\pi\varepsilon_0 a}$
(iv) $\frac{\lambda^2}{2\pi\varepsilon_0 a^2}$

31. A charge q is placed at the centre of a cube of side " l ". What is the electric flux through two opposite faces of the cube.
(i) $\frac{q}{\varepsilon_0}$
(ii) $\frac{q}{3\varepsilon_0}$
(iii) $\frac{q}{6\varepsilon_0}$
(iv) Zero

32.



The electric flux due to this configuration through the surface is

(i) $\frac{q}{\varepsilon_0}$

(ii) $\frac{2q}{\varepsilon_0}$

(iii) $\frac{4q}{\varepsilon_0}$

(iv) Zero

33. When an electric dipole is held at an angle in a uniform electric field, the net force F and the torque τ on the dipole are

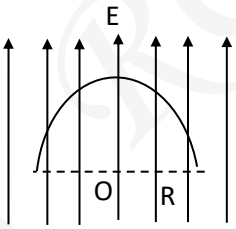
(i) $F = 0; \tau = 0$

(ii) $F \neq 0; \tau \neq 0$

(iii) $F = 0; \tau \neq 0$

(iv) $F \neq 0; \tau = 0$

34. The electric flux passing through a hemispherical surface of radius R placed in an electric field E with its axis parallel to the field is



(i) $\pi R^2 E$

(ii) $2\pi R^2 E$

(iii) $2\pi RE$

(iv) $2\pi R^3 E$

35. Two infinite plane parallel sheets separated by a distance 'd' have equal and opposite uniform charge densities σ. Electric field at point between the sheets is

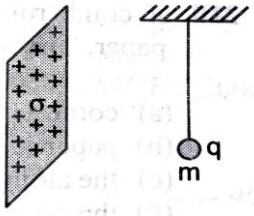
(i) Zero

(ii) $\frac{\sigma}{\varepsilon_0}$

(iii) $\frac{\sigma}{2\varepsilon_0}$

(iv) Depends on the location of the point

36. A small, charged particle of mass m and charge q is suspended by an insulated thread in front of a very large conducting charged sheet of surface charge density the angle made by the thread with the vertical in equilibrium is



(i) $tan^{-1}\frac{\sigma q}{2\varepsilon_0 mg}$

(ii) $tan^{-1}\frac{\sigma}{q\varepsilon_0 mg}$

(iii) $tan^{-1}\frac{q}{2\sigma\varepsilon_0 mg}$

(iv) $Zero$

Section B- Assertions & Reasons

1. Given below are two statements labelled as Assertion(A) and Reason(R).
Assertion(A) Insulators do not allow flow current through themselves.
Reason(R) They have no free charge carriers.
Select the most appropriate answer from the options given below.
(i) Both A and R are true, and R is the correct explanation of A.
(ii) Both A and R are true, and R is not the correct explanation of A.
(iii) A is true but R is false
(iv) A is false and R is also false.

2. Given below are two statements labelled as Assertion(A) and Reason(R).
Assertion(A) During charging by rubbing, the insulating material with lower work function becomes positively charged.
Reason(R) Electrons are negatively charged.
Select the most appropriate answer from the options given below.
(i) Both A and R are true, and R is the correct explanation of A.
(ii) Both A and R are true, and R is not the correct explanation of A.
(iii) A is true but R is false
(iv) A is false and R is also false.

3. Given below are two statements labelled as Assertion(A) and Reason(R).
Assertion(A) A metallic shield in the form of a hollow shell, can be built to block an electric field.
Reason(R) In a hollow spherical shell, electric field inside is not zero at every point.

Select the most appropriate answer from the options given below.
(i) Both A and R are true and, R is the correct explanation of A.
(ii) Both A and R are true and, R is not the correct explanation of A.
(iii) A is true but R is false
(iv) A is false and R is also false.

4. Given below are two statements labelled as Assertion(A) and Reason(R).
Assertion (A). A charge is quantized because only integral number of electrons can be transferred.
Reason (R) There is no possibility of transfer of some fraction of electron.
Select the most appropriate answer from the options given below.
(i) Both A and R are true and, R is the correct explanation of A.
(ii) Both A and R are true and, R is not the correct explanation of A.
(iii) A is true but R is false
(iv) A is false and R is also false

5. Given below are two statements labelled as Assertion(A) and Reason(R).
Assertion (A): The Coulomb force is dominating force in the universe.
Reason(R): The Coulomb force is weaker than the gravitational force.
Select the most appropriate answer from the options given below.
(i) Both A and R are true and, R is the correct explanation of A.
(ii) Both A and R are true and, R is not the correct explanation of A.
(iii) A is true but R is false
(iv) A is false and R is also false

6. Given below are two statements labelled as Assertion(A) and Reason(R)
Assertion (A): Gauss theorem can used to find the electric field at any point.
Reason (R): Gauss theorem can be applied to any type of charge distribution.
(i) Both A and R are true and R is the correct explanation of A
(ii) Both A and R are true but R is not the correct explanation of A.
(iii) A is true but R is false.
(iv) A is false and R is also false.

7. Given below are two statements labelled as Assertion(A) and Reason(R)
Assertion (A): If a dipole is enclosed by a surface, then according to the gauss theorem, electric flux linked with it is zero
Reason (R): The charge enclosed by the surface is zero.
(i) Both A and R are true and R is the correct explanation of A
(ii) Both A and R are true but R is not the correct explanation of A.
(iii) A is true but R is false.
(iv) A is false and R is also false.

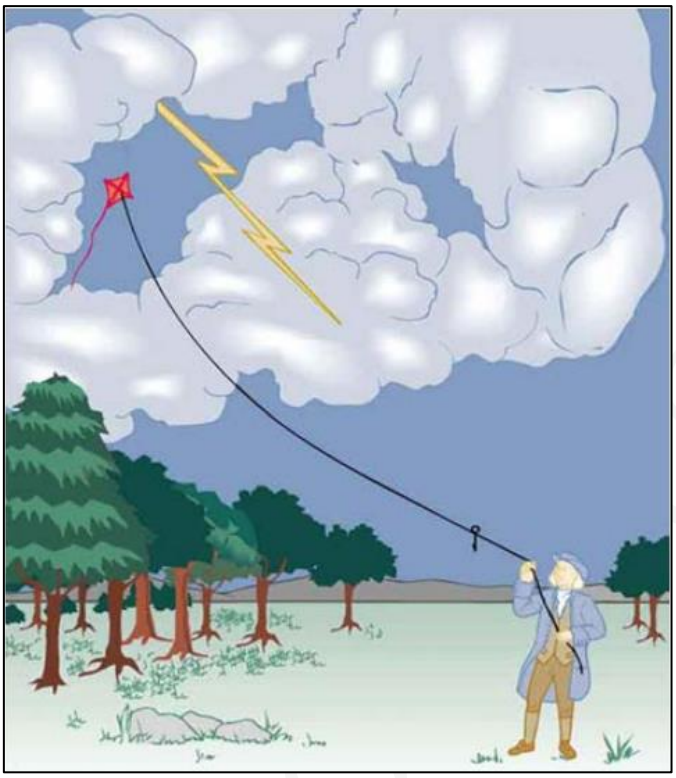
8. Given below are two statements labelled as Assertion(A) and Reason(R)
   Assertion (A): positive electric flux indicates that electric lines of force are directed outwards
   Reason (R): Positive electric flux is due to a positive charge
   (i) Both A and R are true and R is the correct explanation of A
   (ii) Both A and R are true but R is not the correct explanation of A.
   (iii) A is true but R is false.
   (iv) A is false and R is also false.

9. Given below are two statements labelled as Assertion(A) and Reason(R)
   Assertion (A): Coulombs law is useful for calculation of electric field intensity due to point charges
   Reason (R): Gauss law is used for calculating electric field intensity due to symmetric charge distributions
   (i) Both A and R are true and R is the correct explanation of A
   (ii) Both A and R are true but R is not the correct explanation of A.
   (iii) A is true but R is false.
   (iv) A is false and R is also false.

10. Given below are two statements labelled as Assertion(A) and Reason(R)
    Assertion (A): A graph showing the variation of electric field at a point with distance due to an infinite plane sheet of charge is a straight line parallel to the distance axis
    Reason (R): The electric field at a point due to an infinite plane sheet of charge is independent of the distance to the point.
    (i) Both A and R are true and R is the correct explanation of A
    (ii) Both A and R are true but R is not the correct explanation of A.
    (iii) A is true but R is false.
    (iv) A is false and R is also false

Section C-Case Study Questions

Case Study Based Question -1



The image of American politician and scientist Benjamin Franklin flying a kite in a thunderstorm is familiar to every school child. In this experiment, Franklin demonstrated connection between lightning and static electricity.
Sparks were drawn from a key hung on a kite string during an electrical storm. These sparks were like those produced by static electricity, such as the spark that jumps from your finger to a metal doorknob after you walk across a wool carpet.
What Franklin demonstrated in his dangerous experiment was a connection between phenomena on 2 different scales: the grand power of an electrical storm, the other an effect of more human proportions. Connections like this one reveal the underlying the unity of the laws of nature, an aspect we humans find particularly appealing.
Some of the most basic characteristics of static electricity include:

- *the effects of static electricity are explained by a physical quantity called electric charge.*
- *Like charges repel and unlike charges attract*
- *Force between charges decrease with distance*

If we pack a proton and an electron together in a small volume, the combination does not attract or repel another proton or electron placed at the same distance

Questions

1. If we pack a proton and an electron together in a small volume, the combination does not attract or repel another proton or electron placed at the same distance because
   (i) Like charges repel
   (ii) Electron is a small particle
   (iii) Electrostatic force is small
   (iv) Net charge on the proton electron system is zero

2. If an object contains n_1 electrons and n_2 protons, the net charge on the object is
   (i) $(n_1 - n_2)\, e$
   (ii) $(n_2 - n_1)\, e$
   (iii) $(n_1 + n_2)\, e$
   (iv) Zero

3. Benjamin Franklin demonstrated that lightning was related to static electricity, there he made a connection that all directly experienced forces are manifestations of the electromagnetic force. Is the statement true
   (i) Yes
   (ii) No
   (iii) Yes, for all the forces except gravitational force
   (iv) No, for all the forces except gravitational force

4. Which statement is wrong:
   (i) Charge of an isolated system is conserved
   (ii) It is possible to create or destroy charged particles, but it is not possible to create or destroy net charge
   (iii) Total charge of the universe is constant
   (iv) Total positive charge of the universe is constant

Case Study Based Question -2

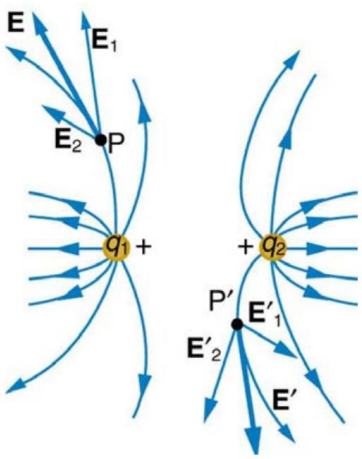


Figure shows how the electric field from two point charges can be drawn by finding the total field at representative points and drawing electric field lines consistent with those points. While the electric fields from multiple charges are more complex than those of single charges, some simple features are easily noticed.

For example, the field is weaker between like charges, as shown by the lines being farther apart in that region. (This is because the fields from each charge exert opposing forces on any charge placed between them.). Furthermore, at a great distance from two like charges, the field becomes identical to the field from a single, larger charge.

Questions

1. Which statement is not true about electric field
   (i) They are purely a geometrical construction to visualize the nature of electric field
   (ii) They have no physical existence
   (iii) We can compare the strength of electric field between 2 points by just looking at the distribution of field lines
   (iv) Electric filed lines due to a positive charge is represented by a straight line terminating at the charge

2. Electric field lines about a positive point charge are
   (i) Radially outwards
   (ii) Circular and clockwise
   (iii) Radially inwards
   (iv) Parallel straight lines

3. A proton and electron are placed in a uniform electric field. Which statement is right?
   (i) The electric forces acting on them will be equal
   (ii) The magnitude of the electric forces will be equal
   (iii) Their acceleration will be equal
   (iv) The magnitude of their acceleration will be equal

4. A hemisphere is uniformly charged positively. The electric field at a point on a diameter away from the centre is directed
   (i) Perpendicular to the diameter
   (ii) Parallel to the diameter
   (iii) At an angle tilted towards the diameter
   (iv) At an angle tilted away from the diameter

ANSWER KEY

MCQ

1. Ans. *Option (ii)*
   F varies inversely as the dielectric constant. The dielectric constant of the metal is very large. So the force will decrease.
2. Ans. *Option (iii).*
   Force between two charges is independent of the charge in its surroundings.
3. Ans. *Option (i).*
   F is proportional to 1/k.
4. Ans. *Option A.*
   The system will be in equilibrium if the net electric force on each of the three charges is zero.
5. Ans. *Option (iv)*
   Knowledge based question.
6. Ans. *Option (iv)*
7. Ans. *Option (ii)*
8. Ans. *Option (iii)*
   At p, $k.8q/(L+x)^2 = k.2q/x^2$
   x=L. So distance p from the origin =2L
9. Ans. *Option (i)*
10. Ans. *Option (ii)*
11. Ans. *Zero*.
    Total charge of a dipole is zero
12. Ans. *40 units*.
    The area vector is perpendicular to the plane of the coil that is along the z-axis.so $A=10 \times 20 \times 10^{-4}\mathbf{k}$. Flux=40 units.
13. Ans.*10*.
    The intensity of electric field at point is the number of lines of force crossing unit area around the point normally.
14. *Ans. decrease.*
    The field inside a charged conducting sphere I proportional to distance from the centre.
15. Ans. *a plane sheet*.
    The filed due to a charged plane sheet is uniform and is independent of distance.

16. Ans. *zero.*
The cube is placed such that the electric field is parallel to one of the edges along the positive X axis. The number of lines of force entering the face perpendicular to the edge is equal to the number of lines of force leaving.

17. Ans. φ_0.
The total flux is independent of the area.

18. Ans. $\frac{q}{6\varepsilon_0}$.
Total flux is $\frac{q}{\varepsilon_0}$. A cube has six faces so the flux through a face is $\frac{q}{6\varepsilon_0}$

19. Ans. *Positive, negative, zero*.
Though electric flux is scalar, yet its value may be positive, negative or zero.

20. Ans.*200*.
Number of electric lines of force is directly proportional to electric intensity. Therefore, required number of electric lines of force = 4 (50) = 200

21. Ans. *Option (iv)*
Electric field due to charges at the opposite corners cancel each other.

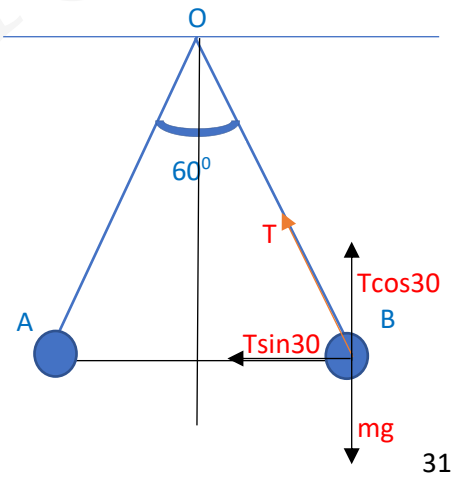
22. Ans. *Option (ii)*
$a = qE/m$. $s = 1/2\ at^2$
$t = \frac{\sqrt{2sm}}{\sqrt{qe}}$

23. Ans. *Option (ii)*
$k.1/x^2 = k.4/(1+x)^2$

24. Ans. *Option (iv)*
$F = k.\ q.q/r^2$
$F' = k.(q/2)(3\ q/4)/r^2 = (3/8).F$

25. Ans. *Option (i)*
qE = mg

26.



OAB is the equilateral triangle. Therefore, AB =1 m.
Force of repulsion F = T sin 30.
$k.q^2/r^2$ = T sin 30. T =1.8 N

27. Ans.*1:1*.

Let the charges are q and Q-q. The force is maximum when dF/dq=0.This gives the two charges are Q/2 each.

28. Ans. $E_0\ a^2$.

Electric flux φ=EScosɵ
Here ɵ=45° E=E_0

S=$(\sqrt{2}a)$(a)=$\sqrt{2}a^2$

So, flux=$E_0\sqrt{2}a^2$ cos 45°= $E_0\ a^2$.

29. Ans. 5.6×10^9 Flux φ=$\frac{q}{K\varepsilon_0}$

30. Ans. Option *(iii)* $\frac{\lambda}{2\pi\varepsilon_0 a}$

31. Ans. Option *(ii)*

32. Ans. Option *(i)*

33. Ans. Option *(iii)*

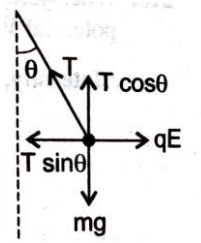
34. Ans. $\pi R^2 E$.

The electric flux through any surface is equal to the product of electric field intensity at the surface and component of the surface perpendicular to the electric field. =E× πR^2=$\pi R^2 E$

35. Ans. $\frac{\sigma}{\varepsilon_0}$.

E=E_1-E_2 =$\frac{\sigma}{2\varepsilon_0}$ - $\left(-\frac{\sigma}{2\varepsilon_0}\right)$ = $\frac{\sigma}{\varepsilon_0}$

36. Ans . $tan^{-1}\frac{\sigma q}{2\varepsilon_0 mg}$.



Tsinɵ=qE=$\frac{q\sigma}{2\varepsilon_0}$

Tcosɵ=mg

tanɵ=$\frac{\sigma q}{2\varepsilon_0 mg}$

ASSERTION REASON

1. Ans. *Option (i)*
2. Ans. *Option (ii)*
3. Ans. *Option(iii)*
4. Ans. *Option (i)*
5. Ans. *Option (iv)*
6. Ans. *Option(iii)*
7. Ans. *Option(i)*
8. Ans. *Option(ii)*
9. Ans. *Option(ii)*
10. Ans. *Option(i)*

CASE STUDY BASED QUESTION

CASE STUDY BASED QUESTION -1

1. Ans. Option *(iv)*
2. Ans. Option *(ii)*
3. Ans. Option *(iii)*
4. Ans. Option *(iv)*

CASE STUDY BASED QUESTION -2

1. Ans. Option *(iv)*
2. Ans. Option *(i)*
3. Ans. Option *(ii)*
4. Ans. Option *(i)*

CHAPTER-2

ELECTROSTATIC POTENTIAL AND CAPACITANCE

SECTION A- MULTIPLE CHOICE QUESTIONS

1. Electric potential V at any point x,y,z is space is given by $V= 6z^2$. The value of electric field at the point (2,-1, 3) is
   a) 24 b) -12 c) -36 d) 12
2. If a positive unit charge is taken from one point to another point over an equipotential surface , then
   a)work is done on the charge b) work is done by the charge
   c) work done is constant d) no work is done
3. A conducting sphere of radius 10 cm is charged with 10 µC. Another uncharged sphere of radius 20 cm is allowed to touch it for some time. After that if the spheres are separated, then surface density of charges on the spheres will be in the ratio of
   a) 1:4 b) 2:1 c) 1:3 d) 1:1
4. The plates of a parallel plate capacitor are charged up to 100 V. A 2 mm thick plate is inserted between the plates. Then to maintain the same potential difference, the distance between the plates is increased by 1.6 mm. The dielectric constant of the plate is
   a) 5 b) 1.25 c) 4 d) 2.5
5. A 40 µF capacitor in a defibrillator is charged to 3000 V. The energy stored in the capacitor is sent through the patient during a pulse of duration 2 ms. The power delivered to the patient
   a) 45 KW b)90 KW c) 180 KW d) 360 KW
6. The voltage of cloud is $4x\ 10^6$ V with respect to ground. In a lightning strike lasting 100 ms. A charge of 4 C is delivered to ground. The power of the lighting strike is
   a)160 MW b) 80 MW c) 20 MW d) 500 Kw
7. A conducting sphere of radius R carrying charge Q lies inside an uncharged conducting shell of radius 2R. If they are joined by a metal wire, the amount of heat produced is
   a) $1/4\pi\varepsilon^* Q^2/4R$ b) $1/4\pi\varepsilon^* Q^2/2$ c) $1/4\pi\varepsilon^* Q^2/R$ d) $1/4\pi\varepsilon^* Q^2/3R$
8. Two capacitors of 10 µF and 20 µF are connected in series with a 30 V battery. The charges on the capacitors will be
   a) 100µC, 100 µC b) 200µC ,100 µC
   c) 200 µC, 200 µC d) 100 µC, 200 µC
9. A spherical drop of capacitance 1 µF is broken in to eight drops of equal radius. Then , the capacitance of each small drop is
   a) ½ µF b) ¼ µF c) 1/8 µF d) 8 µF

10. In a uniform electric field a charge of 3C experiences a force 3000 N. The potential difference between two points 1 cm apart along the electric lines of force will be

    a) 10 V b) 30 V c) 300 V d) 100 V

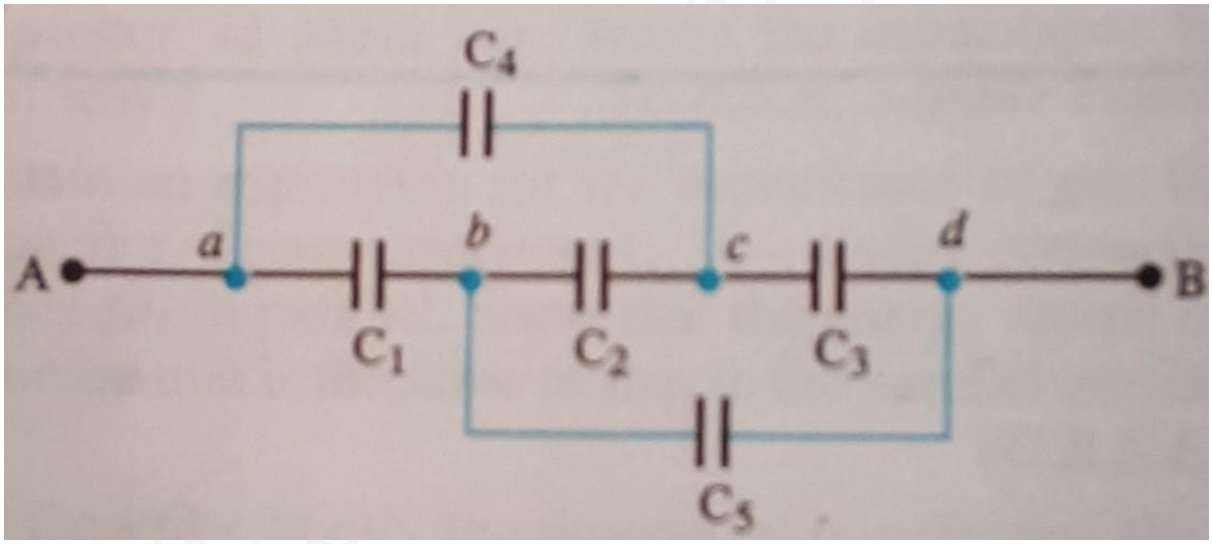
11. A hexagon of side 8 cm has a charge 4 μC at each of its vertices. The potential at the centre of hexagon is

    a) 2.7×10^6 V b) 7.2×10^{11} V c) 2.5×10^{12} V d) 3.4×10^4 V

12. A parallel plate capacitor with air as a dielectric has capacitance C . A slab of dielectric constant K having thickness as the separation between the plates is introduced so as to fill one fourth of the capacitor. The new capacitance will be

    a) (K+3) C/4 b) (K+2) C/4 c) (K+1) C/4 d) K C/4

13. In the given figure the capacitors C_1, C_3, C_4, C_5 have a capacitance 4 μF each. If the capacitor C_2 has capacitance of 4μF, then the effective capacitance between A and B will be



    a)2μF b) 6 μF c) 4 μF d) 8 μF

14. A bullet of mass 2 g is having a charge of 2 μC. Through what potential difference must be accelerated, starting from rest to acquire a speed of 10 m/s

    a) 5 kV b) 50 KV c) 5V d) 50 V

15. 27 small drops having charge q and radius r coalesce to form big drop. How many times charge and capacitance will become ?

    a) 3,27 b) 27,3 c) 27,27 d) 3,3

16. If a capacitor of capacitance 900 μF is charged to 100 V and its total energy transferred to a capacitor of capacitance 100 μF, then its potential is

    a) 200V b) 30 V c) 300 V d) 400 V

17. Two identical mercury drops each of radius r are charged to potential V. If the mercury drops coalesce to form a big drop of radius R, then the potential of big drop will be
    a) $2^{3/2}$ V b) $3^{1/2}$ V c) $3^{2/3}$ V d) $2^{2/3}$ V
18. Four charges –Q,-q,2q and 2Qare placed, one at each corner of a square. The relation between Q and q for which potential at the centre of the square is zero is
    a) Q=-q b) Q= - 1/q c) Q=q d) Q= 1/q
19. Two metal plate form a parallel plate capacitor. The distance between the plates is d. A metal sheet of thickness d/2 and of the same area is introduced between the plates. What is the ratio of capacitances in two cases
    a) 4:1 b) 2:1 c)3:1 d) 5:1
20. The minimum value of effective capacitance that can be obtaining 3 capacitors of capacitances 1 pF, 2 pF and 4 pF is
    a) 4/7 pF b) 1 pF c) 2 pF d) 7/4 pF
21. Two capacitors of capacitances 3 µF and 6 µF are connected in series and a potential difference of 900V is applied across the combination. They are then disconnected and reconnected in parallel .The potential difference across the combination is
    a) Zero b) 100 V c) 200 V d) 400 V
22. The electrostatic force between the metal plates of an isolated capacitor C having a charge Q and area A is
    a) independent of the distance between the plates
    b) linearly proportional to the distance between the plates
    c) proportional to the square root of the distance between the plates
    d) inversely proportional to the distance between the plates
23. If there are n capacitors in parallel connected to a V volt source, then the energy stored is equal to
    a) CV b) ½ nCV^2 c) CV^2 d) 1/2n CV^2
24. A battery is used to charge a parallel plate capacitor till the potential difference between the plates become equal to EMF of battery. The ratio of energy stored in the capacitor and the work done by the battery will be
    a)2 b) ¼ c) ½ d) 1
25. N identical drops of mercury are charged simultaneously to 10 V. When combined to form one large drop, the potential is found to be 40 V. The value of N is
    a)4 b) 6 c) 8 d) 10
26. Two points P and Q are maintained at potentials of 10 V and -4V respectively. The work done in moving 100 electrons from P to Q is
    a) -19×10^{-17} J b) 9.6×10^{-17} j
    c) -2.24×10^{-16} j d) 2.24×10^{-16} J

27. Two positive charges 12 and 5 μ C are placed 10 cm apart in air. The work needed to bring them 4 cm closer is

a) 2.4 J b) 3.6 J c) 4.8 J d) 6 J

28. The electrostatic potential inside a charged spherical ball is given by $V= ar^2 +$ b where r is the distance from the centre, a and b are constants. Then charge density inside the ball is

a)- 24πaεr b) - 6πaεr c) - 24πaε d) - 6πaε

29. Three capacitors each of 4μ F are to be connected in such a way that the effective capacitance is 6 μF. This can be done by connecting them

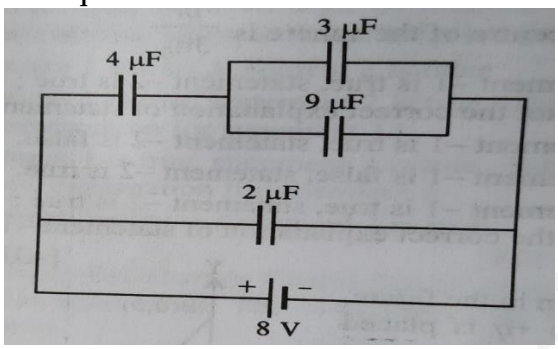
a) all in series

b) all in parallel

c) two in parallel and one in series

d) two in series and one in parallel

30. A combination of capacitors is setup as shown in figure. The magnitude of electric field due to point charge Q (having a charge equal to the sum of the charges on 4 μF and 9μF capacitors), at a point distance 30 m from it would equal



a) 480 N/C b) 240 N/C c) 360 N/C d) 420 N/ C

Section B- Assertions & Reasons Questions

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.

1. A- The work done by an electrostatic field in moving a charge from one point to another depends only on the initial and the final points.

   R- Electrostatic force is a conservative fore.

2. A- For a point charge potential V=kQ/r is applicable for Q>0 &Q<0

   R- for Q < 0, the force on a unit positive test charge is attractive

3. A- The electric field at every point is normal to the equipotential surface passing through that point.

   R- No work is required to move a test charge on an equipotential surface.

4. A- For a uniform electric field E along the x -axis, the equipotential surfaces are planes parallel to the y-z plane.
   R- Electric field is in the direction in which the potential increases.
5. A- A non polar molecule is one in which the centres of positive and negative charges are separated.
   R- Non polar molecules have a permanent dipole moment.
6. A- In an external electric field, the positive and negative charges of a non polar molecule are displaced in opposite directions.
   R- Oxygen & Hydrogen are non polar molecules.
7. A- When a dielectric is inserted between the plates of a capacitor, capacitance increases.
   R- The dielectric is polarised by the field.
8. A- A capacitor with large capacitance can hold large amount of charge Q at a relatively small V.
   R- The charge of the capacitor leaks away due to the reduction in insulating power of the intervening medium.
9. A- When capacitors are connected in series net capacitance decreases.
   R- In series combination, charges on the two plates are the same on each capacitor.

10. A- Two concentric spherical shell of different radius are at potential V_A and V_B. If outer shell is earthed then potential difference will not be changed.
    R- Potential difference between the surfaces of two concentric spherical shells does not depends on the charge on the outer shell.

11. A- When a capacitor is charged by a battery, both the plates receive charge equal in magnitude, no matter sizes of plates are identical or not.
    R -. The charge distribution on the plates of capacitor is in accordance with charge conservation principle

12. A- When a charged capacitor is filled completely with a metallic slab, its capacitance is increased by a large amount.
    R -The dielectric constant for metal is infinite.
13. A: Electric potential of a positively charged body may be negative.
    R - The potential of a conductor does not depend on the charge of the conductor.
14. A – In the absence of an external electric field, the dipole moment per unit volume of a polar dielectric is zero.
    R – The dipoles of a polar dielectric are randomly oriented.

Section C-Case Study Questions

Study the following table and answer the questions given below.

Dielectric	Dielectric constant	Dielectric strength(kV/mm)
Vacuum	1	Infinite
Air	1.00054	0.8
Water	81	-
Paper	3.5	14
Glass	4.5	13
Mica	5.4	160
Porcelain	6.5	4

1. Which of the above material can withstand maximum electric field

a) Mica
b) water
c) vacuum
d) air

2. Which of the above material will be most suitable for a capacitor

A) vacuum
B) mica
C) paper
D) air

3. Polarisation occurs in

a) polar molecules
b) non polar molecules
c) both polar and non polar molecules
d) Always in polar, some times in nonpolar.

4. A polarised dielectric when placed in an external field

a) Does not affect the applied field
b) adds to the applied field
c) reduces the applied field
d) Changes the field if the dielectric is polar.

5. A comb run through one's dry hair attracts small bits of paper. This is due to

a) Comb is a good conductor
b) Paper is a good conductor
c) The atoms in the paper get polarized by the charged comb.
d) The comb possesses magnetic properties.

1. LIGHTNING

Around 2,500 people die in lightning strikes around India each year. The Indian Meteorological Department (IMD) has said that deaths by lightning strikes have doubled in the country since the 1960s - one of the reasons they cited was the climate crisis.

What to do when lightning strikes?

- Seek shelter inside a large building or a car
- Get out of wide, open spaces and away from exposed hilltops
- If you have nowhere to shelter, make yourself as small a target as possible by crouching down with your feet together, hands on knees and head tucked in
- Do not shelter beneath tall or isolated trees
- If you are on water, get to the shore and off wide, open beaches as quickly as possible

1. During lightning you are safe inside a car because
   (i) Electric potential inside car is zero
   (ii) Electrostatic shielding
   (iii) Car is made of insulated material
   (iv) None of the above

2. Sharp pointed ends have high electric field. This is used in
   p) lightning arrestors q) high voltage generators r) corona discharge

   i) p alone ii) P& Q ONLY
   iii) p,q &r iv) none of them

3.During lightning it is advised to unplug electronic devices because
   i) lightning can cause a surge of electricity to burst through the power lines.
   ii) lightning can cause shock from devices.
   iii) lightning can destroy earthing of the building
   iv) all of the above

4. The potential of earth is taken to be
   i) infinite
   ii) zero
   iii) constant value on the surface
   iv) varies from place to place

5. A bird sitting on a high power line is not affected because
   i) feathers of birds are insulators
   ii) They do not maintain a potential difference
   iii) The nerve cells of bird can with stand high current.
   iv) none of these.

ANSWERS

MCQs Answers

1. c	6. a	11.a	16.c	21.d	26.d
2. d	7. a	12.a	17.d	22.a	27.b
3. b	8. c	13.c	18.a	23.b	28.d
4. a	9. a	14.b	19.b	24.c	29.d
5. b	10.a	15.b	20.a	25.c	30.d

ANSWERS - ASSERTION REASON

1. A
2. A
3. A
4. C
5. D
6. B
7. A
8. B
9. B
10.D
11.C
12.A
13.C
14.A

ANSWERS CASE STUDY QUESTIONS

Answers

1. c) vacuum
2. b) mica
3. c) both polar and non polar molecules
4. c)Reduces the applied field
5. c)The atoms in the paper get polarized by the charged comb.

1).ii
2) iii
3) iv
4) ii
5) ii

CHAPTER 3
CURRENT ELECTRICITY

SECTION A- MULTIPLE CHOICE QUESTIONS

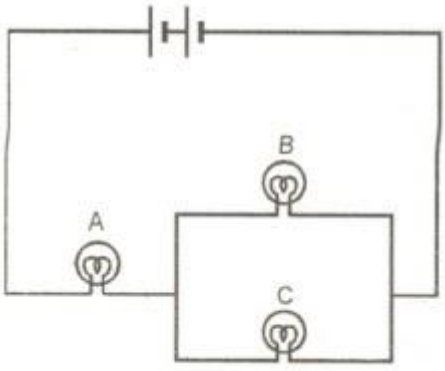
1.Two wires A and B of equal masses and of the same metals are taken. The diameter of the wire A is half the diameter of the wire B. If the resistance of A is 24 Ω then find the resistance of wire B?

(A) 0.5 (B)1 (C)1.5 (D)3

2. Resistance n, each of r Ω, when connected in parallel give an equivalent resistance of R Ω. If these resistances were connected in series, the combination would have a resistance in Ω, equal to

(A)n^2R (B)R/n^2 (C)R/n (D) nr

3. The bulbs A, B and C are connected as shown in the figure given below. The bulbs B and C are identical. If the bulb C is fused then:



(A)Both A and B will glow more brightly
(B) Both A and B will glow less brightly
(C) A will glow less brightly and B will glow more brightly
(D) A will glow more brightly and B will glow less brightly

4. A copper wire is stretched to make it 0.2%. What is the percentage change in its resistivity?

(A)0.4 (B)2 (C)1.5 (D)None of these

5. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is

(A)0.5 (B)1 (C)1.5 (D)0.2

6. The resistance of silver wire at 0^0 is 1.25 Ω. Up to what temperature it must be heated so that its resistance is doubled? (given α for silver=0.00410C -1)

(A)350^0C (B)200^0C (C)244^0C (D)300^0C

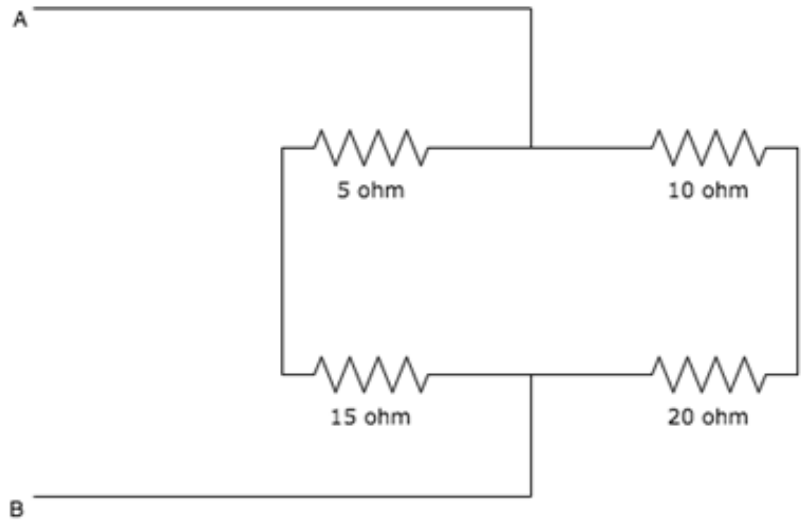
7. A wire connected to a power supply of 230 V has power dissipation P_1. Suppose the wire is cut into two equal pieces and connected parallel to the same power supply. In this case power dissipation is P_2. The ratio P_2 / P_1 is

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

8. A conducting wire has resistance R. If its length is doubled and radius is halved simultaneously, then its new resistance will be

(A) 2R (B)4R (C)8R (D)R/2

9. Calculate the equivalent resistance between A and B.



A) 60 ohm B) 15 ohm C) 12 ohm D) 48 ohm

10. Two wires of A and B with circular cross section made up of the same material with equal lengths. Suppose $R_A = 3 R_B$, then what is the ratio of radius of wire A to that of B?

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

11. By a cell a current of 0.9 A flows through 2 *ohm* resistor and 0.3 A through 7 *ohm* resistor. The internal resistance of the cell is

(A) 0.5 (B)1 (C)2 (D)1.2

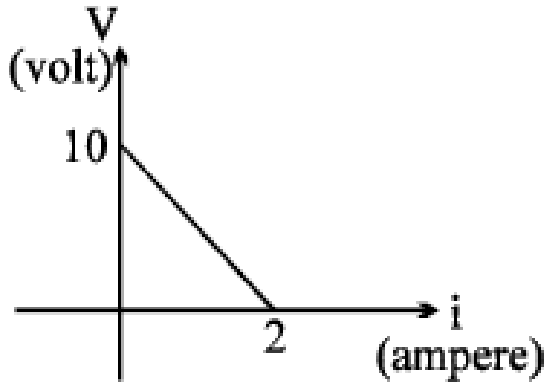
12. When the wires are connected in parallel, the heat produced in the thinner wire is H_1 and that in the thicker wire is H_2 Then:

(A) $H_1 = H_2$ (B) $H_1 < H_2$ (C) $H_1 > H_2$ (D) $H_1 \geq H_2$

13. Two equal resistors are connected in series across a battery and consume a power of P. If these are connected in parallel, then the' power consumed will be:

(A) 2P (B) 4P (C) P/4 (D) P

14. A battery of emf E and internal resistance r is connected across a resistance R. Resistance R can be adjusted to any value greater than or equal to zero. A graph is plotted between the current (i) passing through the resistance and potential difference (V) across it. Select the correct alternative(s).



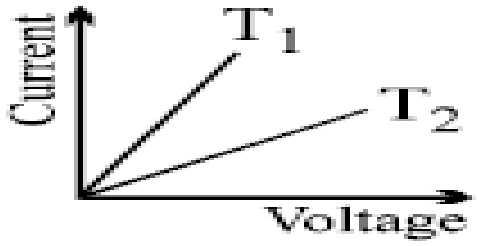
(A) Internal resistance of battery is 5Ω

(B) Emf of the battery is 20V

(C) Maximum current which can be taken from the battery is 4A

(D) V- I graph can never be a straight line as shown in figure.

15. The current in a metallic conductor is plotted against voltage at two different temperatures T1 and T2. Choose the correct answer.



(A)T1 > T2 (B) T1 < T2 (C) T1 = T2 (D) none

16. On interchanging the resistances, the balance point of a meter bridge shifts to the left by 10cm. The resistance of their series combination is 1kΩ. How much was the resistance on the left slot before interchanging the resistances?

A) 550 Ω B) 910 Ω C) 990 Ω D) 505 Ω

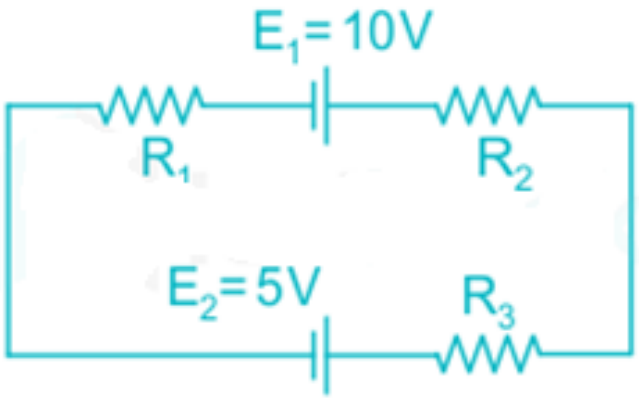
17) Four conductors of resistance 4, 3, 9 and 6 ohm are connected in AB,BC, CD and DA arms of a Wheatstone bridge. The bridge can be balanced by connecting.

A) 6 ohm in series with 3 ohm conductor
B) 4 ohm in series with 6 ohm conductor
C) 3 ohm in series with 3 ohm conductor
D) 5 ohm in series with 6 ohm conductor

18.“The sum of emfs & potential differences around a closed loop is zero” is a consequence of

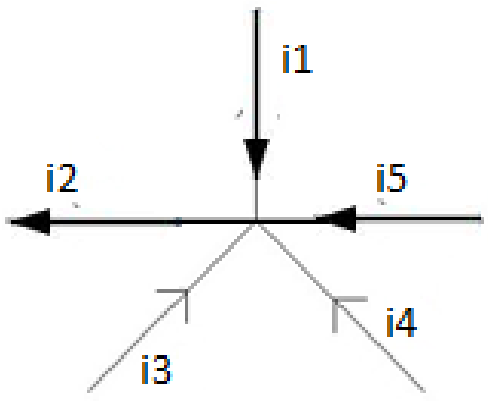
A) Ohm’s law
B) Conservation charge
C) Conservation momentum
D) Conservation energy

19. If $R_1=2\Omega$, $R_2=4\Omega$ & $R_3=6\Omega$, determine the electric current flows in the circuit.



A) 0.42 A
B) 0.84 A
C) 1.42 A
D) 1.84 A

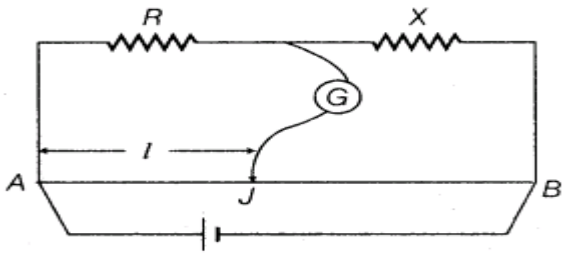
20. What is the relation between currents in the figure below?



A) i2 = i1 + i3 + i4 +i5
B) i2 – i1 = i3 – i4 +i5
C) i3 +i4 =i1+i2+i5
D) I1+i5 =i2+i3+i4

21. In the meter bridge experiment, balance point was observed at J

with AJ =l.



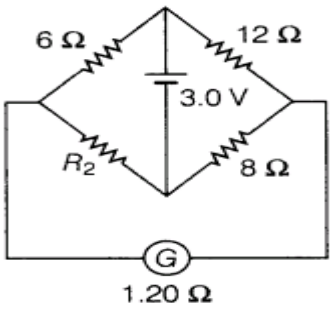
The values of R and X were doubled and then interchanged. What would be the new position of balance point?

A) Shifts to the side of B
B) Shifts to the side of A
C) No change
D) Not predictable

22. If the galvanometer and battery of a Meter bridge are interchanged at the balanced position, how will the balance point get affected?

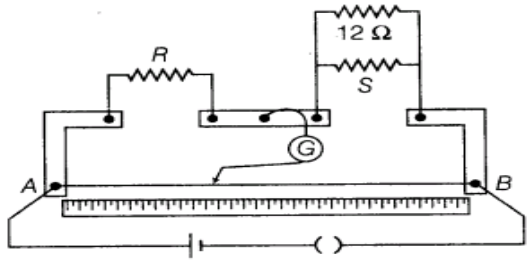
A) Shifts to left sideof balance point
B) Shifts to right side of balance point
C) No change
D) Not predictable

23. Estimate the value of R_2 from the following balanced Wheatstone's bridge.



A) 6Ω
B) 1Ω
C) 9Ω
D) 4Ω

24. In a Meter Bridge, null point is found at a distance of 40cm from A. If a resistance of 12Ω is connected in parallel with S, then null point occurs at 50cm from A. Determine the values of S & R.



A) 6Ω,,4 Ω
B) 8Ω, 7 Ω
C) 12Ω , 2Ω
D) 7Ω, 4Ω

25. Two resistances 1Ω & 4Ω are connected in the left & right gaps of Wheatstone's meter bridge. The balancing length L is noted. Now the resistances are interchanged in the two gaps. The new balancing length L' is noted.. Then,

A) L/L'= ¼
B) L=L'
C) L=L'=69cm
D) L=L'=60cm

26. For which of the following pair of resistors, the balancing length is not 0.25m in a meter bridge?

A) 1Ω, 3 Ω
B) 7/3 Ω, 7 Ω
C) 25 Ω, 75 Ω
D) 2 Ω, 3 Ω

27. A battery of 6V is connected to the terminals of a three meter long wire of uniform thickness & resistance of 100Ω. The difference of potential between two points separated by 50cm on the wire be,

A) 1 V
B) 1.5 V
C) 2 V
D) 3 V

28. If the radius of the wire of the meter bridge is doubled, what will happen to the balancing length?

A) The balancing length will become zero
B) The balancing length will also get doubled
C) The balancing length will remain the same
D) The balancing length will get reduced

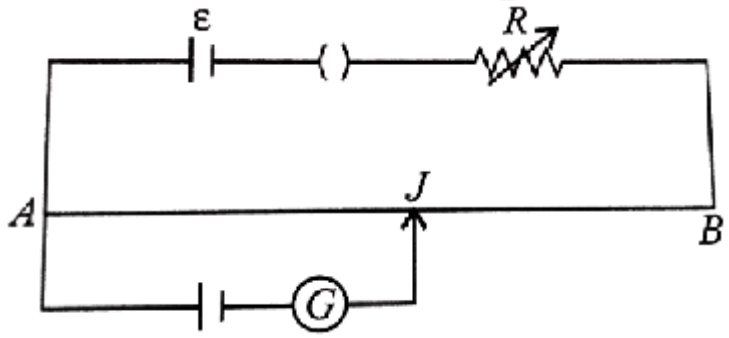
29. Why is the Wheatstone bridge better than the other methods of measuring resistances?

A) It's a null method
B) It has four resistance arms
C) Its based on Kirchhoff's law
D) It does not involve Ohm's law.

30. In Meter Bridge or Wheatstone's bridge for measurement of resistance, the known & the unknown resistance are interchanged. The error so removed is:

A) End correction
B) Index error
C) Error due to temperature effect
D) Random error

31. AB is a wire of potentiometer. With the increase in the value of resistance R, the shift in the balance point J will be



A) Towards B
B) Towards A
C) Remains constant
D) First towards B then back towards A

Section B- Assertions & Reasons Questions

Following questions consider two statements: one labelled as statement-1 and another as statement-2. Study both statements and mark your answer using the codes given blow.

A. Both Statement-1 and Statement-2 are true and Statement-2 is correct explanation of Statement-1.
B. Both Statement-1 and Statement-2 are true and Statement-2 is not a correct explanation of Statement-1.
C.Statement-1 is true but statement-2 is false.
D.Statement-1 is false and statement-2 is true.
E. Statement-1 is false and also statement-2 is true.

Question-1
Statement-1 Free electrons in conductor are always in state of continuous random motion.
Statement-2 The random motion of free electrons is due to thermal energy of the conductor.

Question-2
Statement-1 Drift velocity of electrons in a conductor increase on increasing the temperature of the conductor.
Statement-2 On increasing the temperature of a conductor, resistivity of the conductor increases.

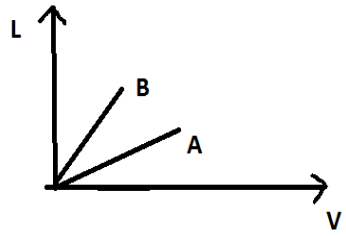
Question-3
Statement-1 For metals relaxation time for electrons decreases with increase in temperature.
Statement-2 With the increase in temperature, number of collision per unit time that electrons made with lattice ion also increases.

Question-4
Statement-1 Fuse wire has high resistance and low melting point.
.Statement-2 Fuse wire is for small current flow only.

Question-5
Statement-1 Power rating of resistance is not so important when used in a circuit.
Statement-2 The resistance value changes with temperature.

Question-6

Statement-1 The potentiometer A is more sensitive than the potentiometer B as per the graph shown.



Statement-2 Potential gradient of a potentiometer decides its sensitivity proportionally.

Question-7

Statement-1 After a long use, a potentiometer is declared to be less sensitive.

Statement-2. The potential gradient of a potentiometer depends on the area of cross section of the wire used.

Question-8

Statement-1 In meter bridge experiment, a high resistance is always connected in series with a galvanometer.

Statement-2 As resistance increases current through the circuit increases.

Question-9

Statement-1 In a balanced Wheatstone's bridge no current runs across the galvanometer.

Statement-2. The terminals of the path across which the galvanometer is connected are at the same potential.

Question-10

Statement-1 Kirchhoff's junction law follows from conservation of charge.

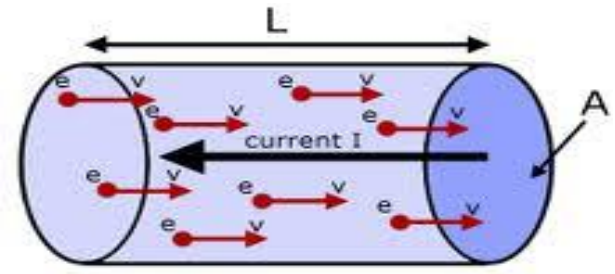
Statement-2. Kirchhoff's loop law follows from conservative nature of electric field.

Section C-Case Study Questions

I) DRIFT VELOCITY

In physics, a drift velocity is the average velocity attained by charged particles, such as electrons, in a material due to an electric field. In general, an electron in a conductor will propagate randomly at the Fermi velocity, resulting in an average velocity of zero. Applying an electric field adds to this random motion a small net flow in one direction; this is the drift. When a potential difference is applied across a conductor, free electrons gain velocity in the direction opposite to the electric field between successive collisions (and lose velocity when traveling in the direction of the field), thus acquiring a velocity component in that direction in addition to its random thermal velocity. As a result, there is a definite small drift

velocity of electrons, which is superimposed on the random motion of free electrons. Due to this drift velocity, there is a net flow of electrons opposite to the direction of the field.



1. Drift velocity of electrons is due to

(a) motion of conduction electrons due to random collisions.

(b) Motion of conduction electrons due to electric field E

(c) repulsion to the conduction electrons due to inner electrons of ions.

(d) Collision of conduction electrons with each other.

2. When potential difference across a given copper wire is increase, drift velocity of charge carriers

(a) Decreases (b) Increases

(c) Remain same (d) Get reduced to zero

3. A metal wire is subjected to a constant potential difference. When the temperature of the metal wire increases, the drift velocity of the electron in it

(a) increases, thermal velocity of the electron increases

(b) decreases, thermal velocity of the electron increases

(c) increases, thermal velocity of the electron decreases

(d) decreases, thermal velocity of the electron decreases

4. For which of the following dependence of drift velocity electric field E is Ohm's law obeyed.

(a) $v_d < \sqrt{E}$ (b) $v_d \propto E$ (c) $v_d \propto E^2$ (d) v_d = constant

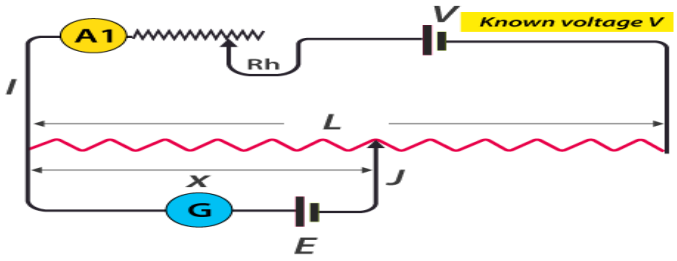
5.A current of 2 ampere is passing through a metallic wire of cross-sectional area 2×10^{-6} m^2. If the density of the charge carriers in the wire is 5×10^{26} m^{-3}, then the drift velocity of the electrons will be

(A)1.5×10^{-4} m/s (B)2.5×10^{-2}m/s (C) 1.25×10^{-2}m/s (D)2.5×10^{-6}m/s

II) POTENTIOMETER

Potentiometer is preferred over voltmeter to measure emf of a cell because it measures true emf of the cell. It uses null method, so no current is drawn by the galvanometer from the cell in balanced condition of potentiometer. On the other hand, a voltmeter measures the voltage across the terminals of a cell when the cell is in closed circuit, that is, when current is flowing through the cell. This voltage is not equal to the

emf of the cell. In fact, it is equal to the emf minus the potential drop across the internal resistance of the cell. The potentiometer is more sensitive than a voltmeter. The potentiometer measures the emf as well as the terminal potential difference of a cell. Its least count is much better than that of a voltmeter.



1. Choose the correct statement from the following.

A) The potentiometer with more wire length is less sensitive than that with less wire length.
B) A steady & high current needs to be allowed to make the potentiometer more sensitive.
C) Area of cross-section of the wire needs to be high & uniform
D) The potentiometer wire needs to have high specific resistance for its material.

2. Two cells of e.m.f. E1 and E2 are joined in series and the balancing length of the potentiometer wire is 625 cm. If the terminals of E1 are reversed, the balancing length obtained is 125 cm. Given E2>E1, the ratio E1:E2 will be

A) 2:3 b) 5:1 c)3:2 d)1:5

3. A potentiometer wire of length 10m is connected in series with a battery. The e.m.f. of a cell balances against 250cm length of wire. If length of potentiometer wire is increased by 1m, the new balancing length of wire will be

A) 2m B) 2.25m C) 2.5m D) 2.75m

4. A potentiometer experiment is set up to compare the e.m.f.s E1, and E2, of two cells. When the null point is obtained, the current is drawn from…

A) only the driver cell B) only the cell of e.m.f. E1 C) only the cell of e.m.f. E2

D) both the driver cell and the cells of e.m.f.s E1, and E2

5. In the potentiometer of 5 wires, the balance point is obtained on the 2nd wire. To shift the balance point to the 4th, we should decrease the current of the main circuit.

A) True
B) False

ANSWER KEY:

MULTIPLE CHOICE QUESTIONS:

1	C	12	B	23	D
2	A	13	B	24	A
3	C	14	A	25	A
4	D	15	B	26	D
5	A	16	A	27	A
6	C	17	C	28	C
7	D	18	D	29	A
8	C	19	A	30	A
9	C	20	A	31	B
10	C	21	C		
11	A	22	C		

ASSERTION AND REASON TYPE QUESTIONS:

Question1	Question2	Question3	Question4	Question5
A	D	B	C	B
Question6	Question7	Question8	Question9	Question10
E	A	C	A	B

CASE STUDY TYPE QUESTION:

(I)	**1**	**2**	**3**	**4**	**5**
	B	**B**	**B**	**B**	**C**
(II)	**1**	**2**	**3**	**4**	**5**
	C	**B**	**D**	**A**	**A**

CHAPTER 4 - MOVING CHARGES AND MAGNETISM

SECTION A- MULTIPLE CHOICE QUESTIONS

1. For the magnetic field to be maximum due to a small element of current carrying conductor at a point, the angle between the element and the line joining the element to the given point must be

(a) 0° (b) 90°
(c) 180° (d) 45°

2. Magnetic field at the centre of a current carrying circular loop having 1A current and number of turns one will be (radius of the loop is 1m)

(a) $\mu_{\circ}/2$ (b) $2\mu_{\circ}$
(c) $\mu_{\circ}/4$ (d) $4\mu_{\circ}$

3. To produce a magnetic field of π tesla at the centre of circular loop of diameter 1m, the current flowing through loop is

(a) 5×10^6 A (b) 10^7 A
(c) 2.5×10^6 A (d) 2×10^6 A

4. Two circular coils of diameter 10cm and 20cm have same number of turns. The ratio of magnetic field inductions produced at the centre of coils when connected in series is

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

5. The force on a charge due to a magnetic field can act

(a) on a charge which is at rest
(b) which is moving in the direction of the magnetic field
(c) moving in the opposite direction of the magnetic field
(d) moving in the perpendicular direction

6. A positive charge is moving upward in a magnetic field which is towards north. The particle will be deflected towards

(a) east (b) west
(c) north (d) south

7. If a particle is moving in a uniform magnetic field, then

(a) both momentum and total energy will change
(b) its momentum changes but total energy remains the same
(c) both momentum and total energy remain the same
(d) its total energy changes but momentum remains the same

8. The radius of the circular path of an electron moving in magnetic field perpendicular to its path is equal to

(a) Be/mv (b) me/B

(c) mE/B (d) mv/Be

9. A charged particle is moving in a uniform magnetic field in a circular path with a radius R. When energy of the particle is doubled, then the new radius will be

(a) R√**2** **(b) R/2**

(c) 2R (d) R/ √2

10. A proton and an α-particle follow the same circular path in a transverse magnetic field. Their kinetic energies are in the ratio

(a) 1:4 (b) 1: √2

(c) 1:2 (d) 1:1

11. The ratio of time period of α particle to that of proton circulating with same speed in the same uniform magnetic field is

(a) √2:1 (b) 1: √2

(c) 1:2 (d) 2:1

12. If resistance of a galvanometer is 6 Ω and it can measure a maximum current of 2A. Then required shunt resistance to convert it into an ammeter reading up to 6A, will be

(a) 2Ω (b) 4Ω

(c) 3Ω (d) 5Ω

13. If number of turns in moving coil galvanometer becomes half, then the deflection for the same current will become

(a) same (b) half

(c) double (d) four times

14. An electron is moving in a region of electric field and magnetic field, it will gain energy from

(a) electric field (b) magnetic field

(c) both of these (d) none of these

15. When two parallel wires carry currents in the same direction,

(a) they attract each other

(b) they repel each other

(c) magnetic forces on two wires are perpendicular to each other

(d) they do not experience any magnetic force

16. If the beams of electrons and protons move parallel to each other in the same direction, then they

(a) attract each other (b) repel each other

(c) no relation (d) neither attract not repel

17. Tesla is the unit of

(a) electric flux (b) magnetic flux

(c) electric field (d) magnetic induction

18. The magnetic field at a distance r from a long wire carrying current I is 0.4 tesla. The magnetic field at a distance 2r is

(a) 0.1 tesla (b) 0.2 tesla

(c) 0.8 tesla (d) 1.6 tesla

19. A straight wire of diameter 0.5 mm carrying a current of 1A is replaced by another wire of 1 mm diameter carrying the same current. The strength of the magnetic field far away is

(a) twice the earlier value

(b) one half of the earlier value

(c) one quarter of the earlier value

(d) same as the earlier value

20. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is doubled and the number of turns per cm is halved, then new value of the magnetic field is

(a) B (b) 2 B

(c) 4 B (d) B/2

21. A proton and an alpha particle enter in a uniform magnetic field with the same velocity. The time period of rotation of the alpha particle will be

(a) four times that of the proton

(b) two times that of the proton

(c) three times that of the proton

(d) same as that of the proton

22. A charge moving with velocity v in X- direction is subjected to a field of magnetic induction in negative X- direction. As a result, the charge will

(a) remain unaffected

(b) start moving in a circular path in Y-Z plane

(c) retard along X- axis

(d) moving along a helical path around X- axis

23. A coil carrying electric current is placed in a uniform magnetic field.

(a) torque is produced
(b) emf is induced
(c) both (a) and (b) are correct
(d) none of these

24. To convert a galvanometer into an ammeter, we connect

(a) low resistance in series
(b) low resistance in parallel
(c) high resistance in series
(d) high resistance in parallel

25.The nature of magnetic field used in a moving coil galvanometer is

(a) Linear
(b) Elliptical
(c) Horseshoe
(d) Radial

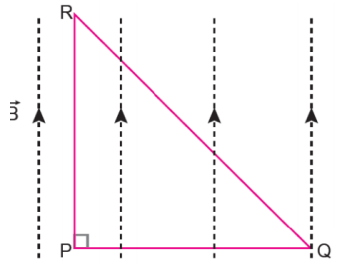
26. Two wires of the same length are shaped into a square of side 'a' and a circle of radius 'r'. If they carry same current, the ratio of their magnetic moment is

(a) 2 :π
(b) Π :2
(c) Π :4
(d) 4 :π

27. A proton enters a perpendicular magnetic field of intensity 'B' with speed 'v'. The proton moves along a circular path of radius 'R'. If a deuteron enter in to the same magnetic field with same speed, the radius of its circular trajectory will be?

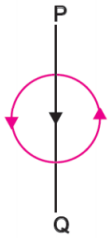
(a) R
(b) Less than R
(c) More than R
(d) cannot be said

28. An isosceles right angled current carrying loop PQR is placed in a uniform magnetic field B which is along the direction of PR. If the magnetic force acting on PQ is F, then the magnetic force which acts on QR will be



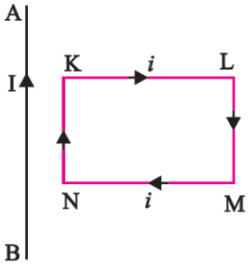
(a) F
(b) $F/\sqrt{2}$
(c) $\sqrt{2}$ F
(d) $-F$

29. PQ is a long current carrying wire which is placed near a current carrying coil. The direction of the force acting on PQ will be



(a) parallel to PQ towards P
(b) parallel to PQ towards Q
(c) perpendicular to PQ towards left
(d) perpendicular to PQ towards right

30. A rectangular loop carrying current "i" is placed near a long straight wire such that the wire is parallel to one of the sides of the loop and is in the plane of the loop. If a current I is established in the wire, the loop will



(a) moves towards the wire
(b) rotate about an axis parallel to the wire
(c) move away from the wire
(d) remains stationary

31. Two concentric coils each of radius equal to 2π cm are placed at right angle to each other. 3 A and 4 A are the currents flowing in each coil respectively. The magnetic induction (in Wb m^{-2}) at the centre of the coils ($\mu_0 = 4\pi \times 10^{-7}$ Wb A^{-1} m^{-1}) will be

(a) 12×10^{-5}
(b) 10^{-5}
(c) 5×10^{-5}
(d) 7×10^{-5}

32. Two coaxial solenoids of different radii carry current *I* in the same direction. Let F_1 be the magnetic force on the inner solenoid due to the outer one and F_2 be the magnetic force on the outer solenoid due to the inner one. Then

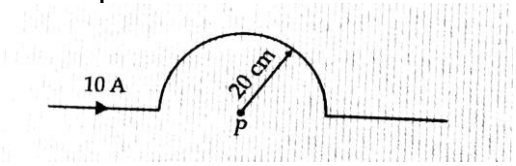
(a) $F_1 = F_2 = 0$
(b) F_1 is radially inwards and F_2 is radially outwards
(c) F_1 is radially inwards and $F_2 = 0$
(d) F_1 is radially outwards and $F_1 = 0$

33. Two long conductors, separated by a distance d carry currents I_1 and I_2 in the same direction. They exert a force F on each other. Now the current in one of them is increased to two times and its direction is reversed. The distance is also increased to $3d$. The new value of force between them is

(a) $-2F$ (b) $F/3$

(c) $(-2F)/3$ (d) $-F/3$

34. A current of 10 A is passing through a long wire which has semi-circular loop of the radius 20 cm as shown in the figure.

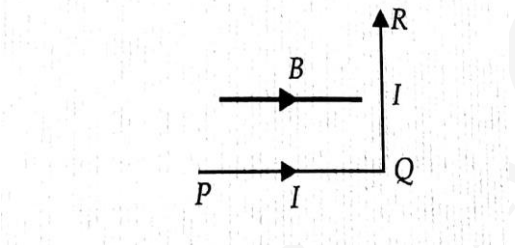


Magnetic field produced at the centre of the loop is

(a) $10\pi\ \mu$ T (b) $5\ \pi\ \mu$ T

(c) $4\ \pi\ \mu$ T (d) $2\ \pi\ \mu$ T

35. A wire PQR is bent as shown in the figure and is placed in a region of uniform magnetic field B. The length of $PQ=QR=l$. A current I ampere flows through the wire as shown.

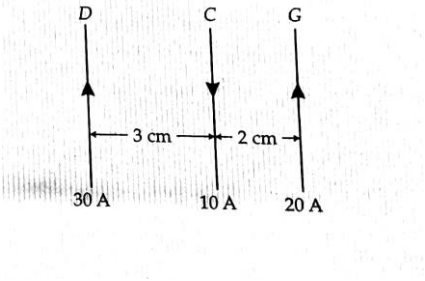


The magnitude of the force on PQ and QR will be

(a) BIl,0 (b) 2 BIl, 0

(c) 0, BIl (d) 0, 0

36. Three long, straight parallel wires, carrying current, are arranged as shown in the figure.



The force experienced by a 25 cm length of wire C is

(a) 10^{-3} N (b) 2.5×10^{-3} N

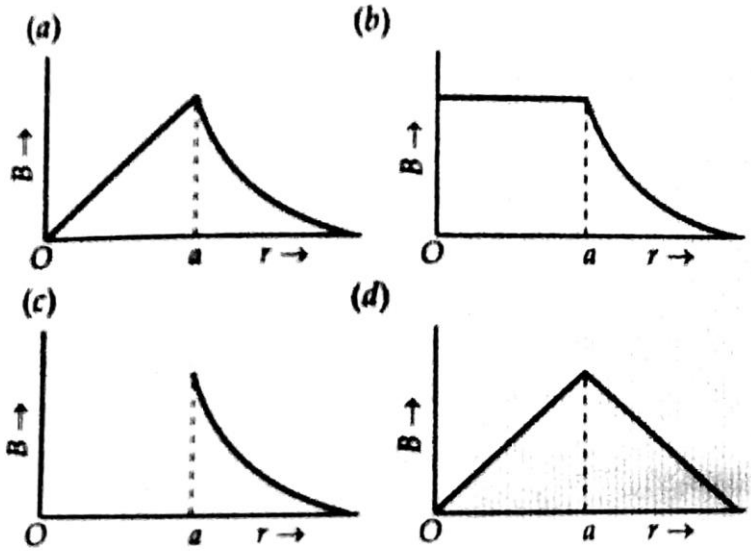
(c) zero (d) 1.5×10^{3} N

37. A circular coil of 20 turns and radius 10 cm is placed in an uniform magnetic field of 0.1 T normal to the plane of the coil. The coil carries a current of 5 A. The coil is made up of copper wire of cross-sectional area 10^{-5} m^2 and the number of free electrons per unit volume of copper is 10^{29}. The average force experienced by an electron in the coil due to magnetic field is

(a) 5×10^{-25}N (b) zero

(c) 8×10^{-24} (d) none of these

38. The magnetic field due to a straight conductor of uniform cross-section of radius *a* and carrying a steady current is represented by



39. Two similar coils of radius *R* are lying concentrically with their planes at right angles to each other. The currents flowing in them are *I* and 2*I*, respectively. The resultant magnetic field induction at the centre will be

(a) $(\sqrt{5}\ \mu_0 I)/\ 2R$ (b) $(3\mu_0 I)/\ 2R$

(c) $(\mu_0 I)/\ 2R$ (d) $(\mu_0 I)/\ R$

40. What is the magnitude of magnetic force per unit length of a wire carrying a current of 5 A and making an angle of 30º with direction of a uniform magnetic field of 0.1 T ?

(a) 0.25 Nm (b) 0.45 Nm

(c) 0.35 Nm (d) 0.55 Nm

SECTION B - ASSERTION REASONING QUESTIONS

Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). While answering these questions, you are required to choose any one of the following four responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

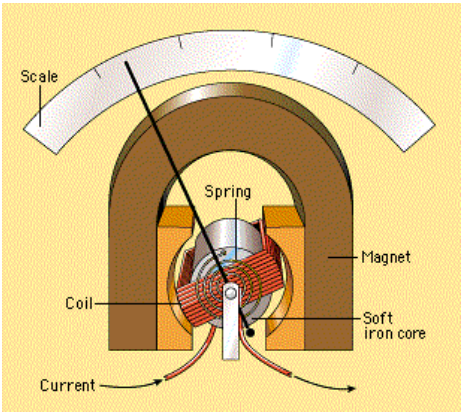
(d) If both the Assertion and Reason are incorrect.

1. **Assertion**: When radius of circular loop carrying current is doubled, its magnetic moment becomes four times.
   Reason: Magnetic moment depends on area of the loop.
2. **Assertion**: When a magnetic dipole is placed in a non-uniform magnetic field, only a torque acts on the dipole.
   Reason: Force would also act on dipole if magnetic field were uniform .
3. **Assertion**: The poles of magnet cannot be separated by breaking into two pieces.
   Reason: The magnetic moment will be reduced to half when a magnet is broken into two equal pieces.
4. **Assertion**: Magnetic moment of an atom is due to both, the orbital motion and spin motion of every electron.
   Reason : All charged particles produce a magnetic field.
5. **Assertion**: The coils of a spring come close to each other, when current is passed through it.
   Reason: The coils of a spring carry current in the same direction and hence attract each other.
6. **Assertion**: If an electron and proton enter a magnetic field with equal momentum, then the paths of both of them will be equally curved.
   Reason: The magnitude of charge on an electron is same as that on a proton.
7. **Assertion**: Magnetic field due to an infinite straight conductor varies inversely as the distance from it.
   Reason: The magnetic field due to a straight conductor is in the form of concentric circles.
8. **Assertion**: Force experienced by moving charge will be maximum if direction of velocity of charge is parallel to applied magnetic field.
   Reason: Force on moving charge is independent of direction of applied magnetic field.

9. **Assertion** : The magnetic field at the ends of a very long current carrying solenoid is half of that at the centre.
   Reason : If the solenoid is sufficiently long, the field within it is uniform.
10. **Assertion :** If the current in a solenoid is reversed in direction while keeping the same magnitude, the magnetic field energy stored in the solenoid remains unchanged.
    Reason : Magnetic field energy density is proportional to the magnetic field.

SECTION C - CASE STUDY BASED QUESTIONS

1. A galvanometer is a device that is used to detect small electric current or measure its magnitude. The current and its intensity is usually indicated by a magnetic needle's movement or that of a coil in a magnetic field that is an important part of a galvanometer. Some of the different types of galvanometer include Tangent galvanometer, astatic galvanometer, Mirror galvanometer and Ballistic galvanometer. However, today the main type of galvanometer that is used widely is the D'Arsonval/Weston type or the moving coil type.
A moving coil galvanometer is an instrument which is used to measure electric currents. It is a sensitive electromagnetic device which can measure low currents even of the order of a few microamperes. Moving-coil galvanometers are mainly divided into two types: Suspended coil galvanometer Pivoted-coil or Weston galvanometer Moving Coil Galvanometer. The moving coil galvanometer is a highly sensitive instrument due to which it can be used to detect the presence of current in any given circuit. The galvanometer can be used to measure; a) the value of current in the circuit by connecting it in parallel to low resistance. b) the voltage by connecting it in series with high resistance.
The general definition of the sensitivity experienced by a moving coil galvanometer is given as the ratio of change in deflection of the galvanometer to the change in current in the coil. The sensitivity of a galvanometer is higher if the instrument shows larger deflection for a small value of current. Sensitivity is of two types, namely current sensitivity and voltage sensitivity.



1. To convert a galvanometer into a voltmeter one should connect a
   (a) High resistance in series with the galvanometer
   (b) Low resistance in series with the galvanometer
   (c) High resistance in parallel with the galvanometer
   (d) Low resistance in parallel with the galvanometer
2. A galvanometer having a resistance of 9ohm is shunted by a wire of resistance 2 ohm. If the total current is 1 ampere, the part of it passing through the shunt will be
   (a) 0.2 A
   (b) 0.8 A
   (c) 0.25A
   (d) 0.5 A
3. To convert a galvanometer into an ammeter one should connect a
   (a) Low resistance in parallel
   (b) High resistance in parallel
   (c) Low resistance in series
   (d) high resistance in series
4. Current sensitivity of a moving coil galvanometer is 5div/mA and its voltage sensitivity is 20 div/volt. The resistance of the galvanometer is
   (a) 40 ohm
   (b) 25 ohm
   (c) 250 ohm
   (d) 500 ohm
5. The sensitivity of a galvanometer is higher if
   (a) Large deflection for large value of current
   (b) Small deflection for large value of current
   (c) Large deflection for small value of current
   (d) Small deflection for small value of current

2. The best glimpse yet of electrons moving in a magnetic field has revealed that the particles' behaviour differs strongly from what is predicted by classical physics but is consistent with quantum-mechanical theory. Instead of rotating uniformly at a particular frequency, an international team of researchers has found that electrons in a magnetic field are capable of rotating at three different frequencies, depending on their quantum properties.

Little is known about the behaviour of electrons in a magnetic field and scientists are keen to improve our understanding of the physical processes that are involved. All charged particles interact with electromagnetic fields via the Lorentz force. This interaction causes electrons in a magnetic field to move in a corkscrew pattern. The Lorentz force is the combined force on a charged particle due both electric and magnetic fields, which are often considered together for practical applications. If a particle of charge *q* moves with velocity *v* in the presence of an electric field *E* and a magnetic field *B*, then it will experience a force:

$F=q[E+vB\sin\theta]$

According to classical physics, electrons should rotate about the magnetic-field direction with a single frequency, called the "cyclotron frequency". But in their experiments, the researchers found that, contrary to what was predicted, they were able to induce a multitude of rotation frequencies in their moving electrons, namely the cyclotron frequency, zero frequency and the Larmor frequency (which is half the cyclotron frequency).

1. Ionised hydrogen atoms and alpha particles with same momenta enters perpendicular to a constant magnetic field B. The ratio of their radii of their paths R_h : Rα will be
   (a) 1:4
   (b) 2:1
   (c) 1:2
   (d) 4:1
2. Under the influence of a uniform magnetic field, a charged particle moves with a constant speed "v" in a circle of radius "R". The time period of rotation of the particle
   (a) Depends on R and not on v

(b) Independent of both v and R
(c) Depends on both v and R
(d) Depends on v and not on R

3. A charged particle moves in a magnetic field in a direction perpendicular to it. The
   (a) Speed of the particle remains unchanged
   (b) Direction of the particle remains unchanged
   (c) Acceleration remains unchanged
   (d) Velocity remains unchanged
4. A positively charged particle moving due east enters a region of uniform magnetic field directed vertically upwards. This particle will
   (a) Move in a circular path with decreased speed
   (b) Move in a circular path with uniform speed
   (c) Get deflected in vertically upward direction
   (d) Move in a circular path with increased speed
5. An electron having a mass *m* and kinetic energy E enter in a uniform magnetic field perpendicularly, then its frequency will be
   (a) $\frac{eE}{qvB}$
   (b) $\frac{2\pi m}{eB}$
   (c) $\frac{eB}{2\pi m}$
   (d) $\frac{2m}{eBE}$

ANSWERS

MCQs	ANS	A&R	ANS
1	b	1	a
2	a	2	d
3	c	3	b
4	c	4	c
5	d	5	a
6	b	6	a
7	b	7	b
8	d	8	d
9	a	9.	b
10	d	10.	c
11	d		
12	c	**Case Based Questions**	
13	b	1.(i)	a
14	a	(ii)	b
15	a	(iii)	a
16	b	(iv)	c
17	d	(v)	c
18	b		
19	d	2.(i)	b
20	a	(ii)	b
21	b	(iii)	a
22	a	(iv)	b
23	a	(v)	c
24	b		
25	d		
26	c		
27	c		
28	d		
29	c		
30	a		
31	c		
32	a		
33	c		
34	b		
35	c		
36	c		
37	a		
38	a		
39	a		
40	a		

CHAPTER -5 MAGNETISM AND MATTER

SECTION A- MULTIPLE CHOICE QUESTIONS

1. If a magnet is hanged with its magnetic axis, then it will stop in
   (a) Magnetic Meridian (b) Geographic Meridian
   (c) Angle of Dip (d) Angle of inclination
2. Earth's magnetic field always has a horizontal component except at
   a) Equator (b) Poles (c) Latitude 60^0 (d) None of the above
3. At the magnetic north pole of the earth the value of horizontal component B_H and the angle of dip $\boldsymbol{\theta}$ is
   (a) $B_H = 0$, $\boldsymbol{\theta} = 45^0$ (b) $B_H = 90^0$, $\boldsymbol{\theta} = 0$
   (c) $B_H = 0$, $\boldsymbol{\theta} = 90^0$ (d) $B_H = 0$, $\boldsymbol{\theta} = 0$
4. What are the values of the vertical component and total intensity of earth's field at a place where dip is 60^0 and horizontal component is 0.3G
   (a) 0.52G and 0.6G (b) 0.3G and 0.9G
   (c) 0.09G and 0.3G (d) 0.16G and 0.16G
5. An electron moving in a circular orbit of radius R and time period T has a magnetic dipole moment
   (a) $2\boldsymbol{\pi}Re/T$ (b) $\boldsymbol{\pi}eR/T$ (c)$e\boldsymbol{\pi}R^2/T$ (d) $\boldsymbol{\pi}R^2eT$
6. A current I flows in a wire of length l .It is turned into a circular coil of one turn . Its magnetic moment is
   (a) $I\,l^{\,2}/4\boldsymbol{\pi}$ (b) $I^2\,l\,/4\boldsymbol{\pi}$ (c) $I\,l\,/4\boldsymbol{\pi}$ (d) $\sqrt{I}\,l\,/4\boldsymbol{\pi}$
7. Two wires of same length are shaped into a square and a circle .If they carry the same currents the ratio of the magnetic moments
   (a) $2:\boldsymbol{\pi}$ (b) $\pi:2$ (c) $\boldsymbol{\pi}:4$ (d) $4:\boldsymbol{\pi}$
8. A dip needle in a plane perpendicular to the magnetic meridian will remain
   (a) At 45^0 (b) At 60^0 (c) Vertical (d) Horizontal
9. The earth's magnetic field at a certain place has horizontal component 0.3G and total strength 0.5G. The angle of dip is
   (a) $\tan^{-1}4/3$ (b) $\tan^{-1}3/4$ (c) $\tan^{-1}5/3$ (d) $\tan^{-1}3/5$
10. Which of the following is correct about magnetic monopole?
    (a) Magnetic monopole exist.
    (b) Magnetic monopole does not exist.
    (c) Magnetic monopole have constant value of monopole moment.
    (d) The monopole moment increases due to increase at its distance from the field.

11. An electron is revolving in an orbit of radius 5×10^{-11}m with a speed 2×10^{4}m/s. The magnetic moment of the atom will be

(a) $12 \times 10^{-26}Am^2$ (b) $8 \times 10^{-26}Am^2$ (c) $9 \times 10^{-26}Am^2$ (d) $6 \times 10^{-26}Am^2$

12. A dip needle arranged to move freely in the magnetic meridian dips by an angle $\boldsymbol{\theta}$ .If the vertical plane in which the needle moves is rotated through an angle $\boldsymbol{\alpha}$ to the magnetic meridian then the needle will dip by an angle

(a) $\boldsymbol{\theta}$ (b) $\boldsymbol{\alpha}$ (c) more than$\boldsymbol{\theta}$ (d) less than $\boldsymbol{\theta}$

13. A compass needle free to move in a horizontal plane is taken to a geomagnetic pole

(a) it will stay in east-west direction (b) will stay in any position
(c) Will stay in North-South direction (d) Will become rigid

14. At a certain place on earth $B_H = 1/\sqrt{3}\ B_V$,the angle of dip at this place is

(a) 60^0 (b) 45^0 (c) 30 (d) 90^0

15. The horizontal and vertical components of the earth's magnetic field are 0.22×10^{-4} G and 0.38×10^{-4}G at a place. The angle of dip is

(a) (a) $\tan^{-1}19/11$ (b) $\tan^{-1}11/19$ (c) 90^0 (d) 0

16. A circular coil of 300 turns and diameter 14cm carries a current of 15A .What is the magnitude of the magnetic moment associated with the coil ?

(a) 6.93J/T (b) 0.693 J/T (c) 0.0693 J/T (d) 69.3J/T

17. In a hydrogen atom the electron moves in an orbit of radius $0.5A^0$ making 10^6rotations per minute. The magnetic moment associated with the orbital motion of the electron is

(a) $2.09 \times 10^{-25}Am^{-2}$ (b) $2.09 \times 10^{-33}Am^{-2}$
(c) $200.9 \times 10^{-24}Am^{-2}$ (d) $0.029 \times 10^{-26}Am^{-2}$

18. Let V and H be the vertical and horizontal components of earth's magnetic field at a any point on earth . Near the north pole

(a) V >>H (b) V = H (c) V<<H (d) V = H = 0

19. Magnetic meridian is

(a) a point (b) a horizontal plane (c) a vertical plane (d) a line along NS

20. A dip circle is taken to the magnetic equator. The needle is allowed to move in a vertical plane perpendicular to the magnetic meridian .The needle will stay in

(a) Horizontal direction only (b) in vertical direction only
(c) in any direction except vertical and horizontal
(d) in any direction it is released

21. A horizontal circular loop carries a current that looks clockwise when looked from above It is replaced by an equivalent magnetic dipole consisting of a north N and south pole S

(a) The line SN should be along the diameter of the loop
(b) The line SN should not be perpendicular to the plane of the loop
(c) The south pole should be below the loop
(d) The north pole should be below the loop

22. The earth behaves as a magnet with magnetic field pointing approximately from the geographic
(a) North to South
(b) South to North
(c) East to West
(d) West to East

23. A moving charge produces

(a) an electric field only (b) A magnetic field only
(c) an electric as well as a magnetic field (d) No field

24. Intensity of earth's magnetic field at a point inside a hollow steel box is

(a) less than outside (b) more than outside (c) same (d) Zero

25. Which of the following quantities is not used to specify earth's magnetic field?

(a) Angle of declination
(b) Angle of dip
(c) Vertical component of earths field
(d) Horizontal Component of earths field

26. Magnetic moment for solenoid and corresponding bar magnet is
(a) equal for both
(b) more for solenoid
(c) more for bar magnet
(d) none of these

27. The net magnetic flux through any closed surface, kept in a magnetic field is
(a) zero
(b) $\mu 0/4\pi$
(c) $4\pi/\mu_0$
(d) $4\mu 0/\pi$

28. S.I. unit of magnetic flux is
(a) ohm
(b) weber
(c) tesla
(d) None of these

29. The dimensional representation of magnetic flux density is
    (a) $[MLT^{-2}]$
    (b) $[MLT^{-2}A^{-1}]$
    (c) $[MLT^{-2}A^{-2}]$
    (d) $[MT^{-2}A^{-1}]$
30. The neutral point in the magnetic field of a horizontally placed bar magnet is a point where the magnetic field due to that bar magnet is
    (a) zero
    (b) more than that of earth
    (c) less than that of earth
    (d) equal to that of earth
31. At a point A on the earth's surface angle of dip is $+60^0$ and at another point B the angle of dip is -60^0. We can interpret that

    (a) A and B are located in the northern hemisphere
    (b) A and B are located in the southern hemisphere
    (c) A is in northern and B is in southern hemisphere
    (d) A is in southern and B is in Northern hemisphere
32. The direction of the magnetic dipole moment that may be associated with a proton revolving anticlockwise is

    (a) parallel to the plane of revolution of proton
    (b) perpendicular to the plane and directed inwards
    (c) perpendicular to the plane and directed outwards
    (d) None of the above
33. An electron is revolving in the XY plane clockwise. The direction of magnetic dipole moment is

    (a) positive X axis (b) positive Y axis (c) positive Z axis (d) none of these
34. The strength of the earth's magnetic field is
    (a) constant everywhere.
    (b) zero everywhere.
    (c) having very high value.
    (d) vary from place to place on the earth's surface.
35. The angle of dip at a certain place where the horizontal and vertical components of the earth's magnetic field are equal is
    (a) 30°
    (b) 75°
    (c) 60°
    (d) 45°

Section B- Assertions & Reasons Questions

Directions

In each of the following questions, a statement of assertion is given followed by a corresponding statement of reason (R) just below it. Of the statements, mark the correct answer as :

a. Both assertion and reason are true and reason is the correct explanation of assertion.
b. Both assertion and reason are true and reason is not the correct explanation of assertion
c. Assertion is true but reason is false
d. Assertion is false and reason is true

1. **Assertion.** The magnetic poles of earth do not coincide with the geographic poles.

Reason: The discrepancy between the orientation of a compass and true north-south direction is known as magnetic declination.

2. **Assertion:** The magnetic moment of an electron revolving around the nucleus decreases with increasing principal quantum number n.

Reason: Magnetic moment of a revolving electron is directly proportional to the principal quantum number n.

3. **Assertion:** When radius of a circular loop carrying current is doubled, its magnetic moment becomes four times.

Reason: Magnetic moment depends on the area of the loop.

4. **Assertion :** In high latitudes one sees colorful curtains of light hanging down from high altitudes

Reason : The high energy charged particles from the sun are deflected to polar regions by the magnetic field of the earth.

5. **Assertion:** If a compass needle be kept at magnetic north pole of the earth, the compass needle may stay in any direction.

Reason: Dip needle will stay vertical at the north pole of the earth.

6. **Assertion:** The magnetic field produced by a current carrying solenoid is independent of its length and cross- sectional area.

Reason: The magnetic field inside the solenoid carrying current solenoid is uniform.

7. **Assertion:** A solenoid tends to expand, when current passes through it.

Reason: Two straight parallel metallic wires carrying current in the same direction repel each other.

8. **Assertion:** Poles of a magnet can never be separated.

Reason: Since each atom of a magnetic material is a tiny magnet in itself.

9. **Assertion:** The ratio of magnetic length and geometrical length of a bar magnet is nearly 0.84.

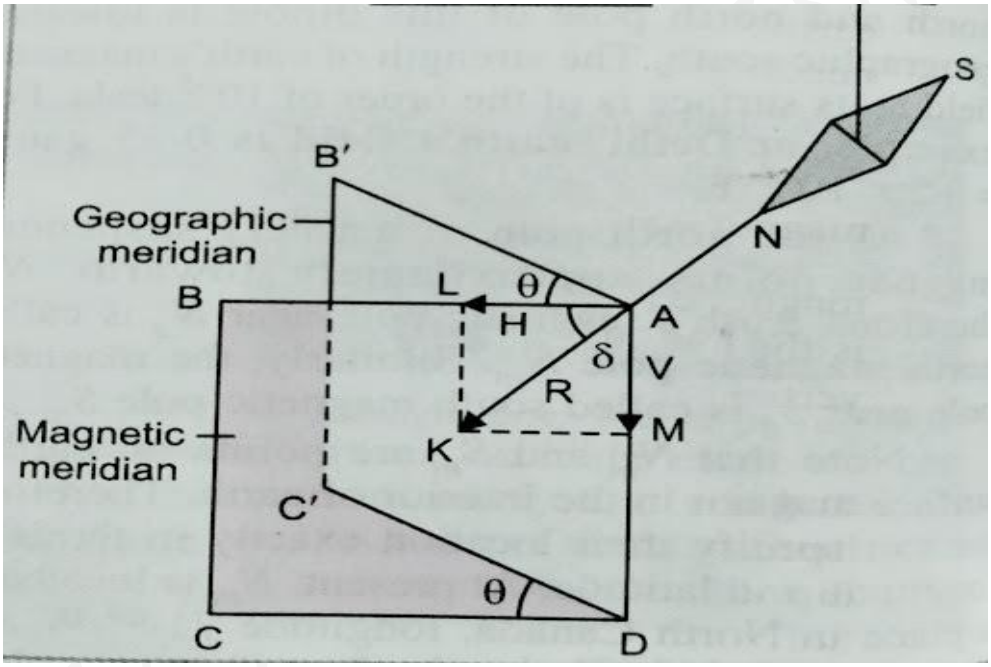
Reason: The two poles appear at points which are slightly inside the two ends.

10. **Assertion:** Cutting a bar magnet into two equal pieces perpendicular to its length produces magnets of same pole strength but half the dipole moment.

Reason: Work done in cutting the magnet reduces the dipole moment.

Section C-Case Study Questions

Q.1.The earth's magnetic field on its surface is characterised by three quantities: (a) declination (b)inclination of dip and (c) the horizontal component of earth's magnetic field. These are known as elements of earth's magnetic field. At a place the angle between the geographic meridian and the magnetic meridian is called the declination, whereas the angle between the earth's magnetic field with the horizontal in magnetic meridian is known as magnetic dip.



(i) In a certain place, the horizontal component of magnetic field is $\sqrt{3}$ times the vertical component. The angle of dip at this place is

(a) zero (b)$\pi/3$ (c)$\frac{\pi}{2}$ (d) $\frac{\pi}{6}$

(ii) The angle between the true geographic north and the earth shown by a compass needle is called as

(a) Inclination (b) Magnetic declination

(c) Dip (d) None of these

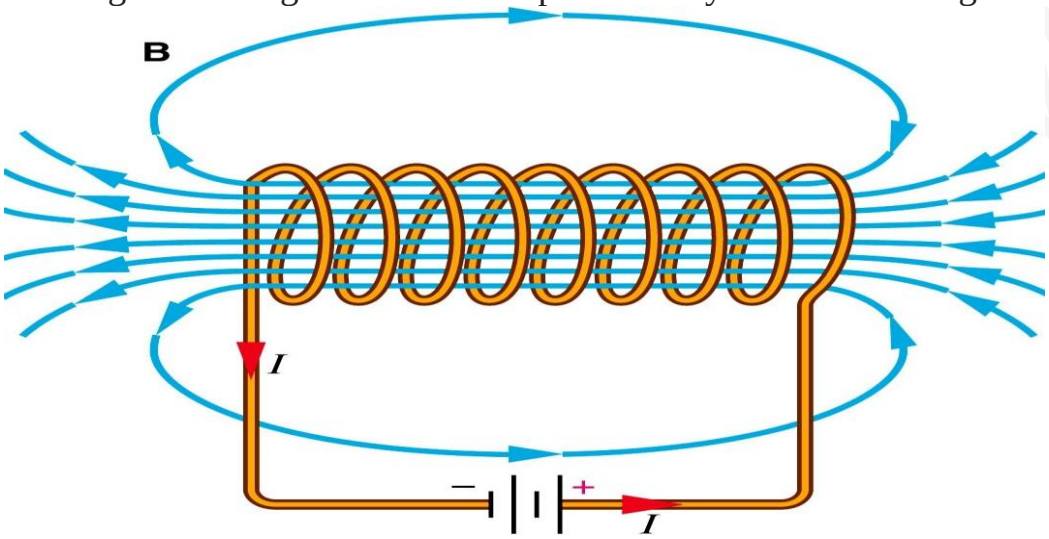
(iii) The angle of dip at the poles and the equator respectively are

(a) 30^0, 60^0 (b) 0^0,90^0 (c) 45^0,90^0 (d) 90^0,0^0

(iv) A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole. It

(a) will become rigid showing no movement.
(b) will stay in any position.
(c) will stay in north-south direction only.
(d) will stay in east-west direction only.

Q.2. A coil of many turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid. When current passes through it it behaves like a magnet. The diagram of magnetic field lines produced by the solenoid is given below



(i) When current passes through a solenoid it behaves like a

(a) Toroid (b) Circular magnet (c) Horse shoe magnet (d) Bar magnet

(ii) What is the strength of the magnetic field inside the solenoid when current passes through it .

(a) $\mu_0 nI$ (b) $\mu_0 nI/2$ (c) $\mu_0 nI^2$ (d) $2\mu_0 nI$

(iii) Find out the ratio of the magnetic field inside a toroid and a solenoid,when same current passes through them having the same number of turns per unit length.

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

(iv) Find out the strength magnetic field, when the air core solenoid is replaced by soft iron.

(a) $\mu_0\mu_r nI$ (b) $\mu_0\mu_r nI/2$ (c) $2\mu_0\mu_r nI$ (d) $1/3\mu_0\mu_r nI$

(v) On which factor does the magnetic north and South Pole produced in a solenoid depend?

(a) direction of current (b) Number of turns per unit length
(c) Number of turns. (d) Magnitude and direction of current.

ANSWERS
MCQ

1. (a) Magnetic Meridian
2. (b) Poles
3. (c) $B_H = 0$, $= 90^0$
4. (a) $B_V = 0.52G$, $B = 0.6G$;
   $B = B_H/\cos 60$, $B_V = B\sin 60$
5. (c) $\pi er^2/T$
6. (a) $Il^2/4\pi$; $m = I\pi r^2$, $r = 2\pi/l$
7. (c) π:4 ;area of square = $l^2/16$
   $m = Il^2/16$,
   For circle $m = Il^2/4\pi$
8. (c) Vertical
9. (a) $\tan^{-1}(4/3)$; $\theta = \tan^{-1}(B_V/B_H)$

$B_V = \sqrt{B^2 - BH^2}$

10. (b)
11. (b) $m = eVR/2$
12. (c)
13. (b)
14. (a)
15. (a)
16. (d) ; m= 300 x 15 x 3.14 x 49 x 10^{-4}
17. (b)
18. (a)
19. (c)
20. (d)
21. (d)
22. (b)
23. (c)
24. (d)
25. (c)
26. (a)
27. (a)
28. (b)
29. (d)
30. (d)
31. (c)
32. (c)
33. (c)
34. (d)
35. (d)

A& R

Answers

1 b 2. d 3.a 4. a 5. b 6. b 7.d 8.a 9. a 10.c

Answers

Case study 1

(i) d (ii) b (iii) d (iv) b

Case study 2.

(i) d (ii) a (iii) a (iv) a (v) a

CHAPTER -6 ELECTRO MAGNETIC INDUCTION

SECTION A- MULTIPLE CHOICE QUESTIONS

1. The unit henry can also be written as:

   $i.\ VsA^{-1}$ $ii.\ \Omega s$

   $iii.\ WbA^{-1}$ $iv\ .All$

2. A coil of resistance 20Ω is placed in a magnetic field. If the magnetic flux linked with the coil varies with time $t(s)$ as $\phi = (10t^2 + 4)\ Wb$, the current in the coil at $t = 4s$ is :

   $i.\ 4A$ $ii.\ 2A$

   $iii.\ 5A$ $iv.\ 8A$

3. A rectangular coil of wire is placed in a uniform magnetic field such that the plane of the coil is parallel to the magnetic field. The magnetic flux linked with the coil and the emf induced are respectively :

   i. Zero and zero ii. Zero and maximum

   iii. Maximum and zero iv. Maximum and maximum

4. The magnetic flux linked with a coil (in Wb) is given by the equation $\phi = (10t^2 + 6t + 8)$. The induced emf in the coil in the seventh second will be:

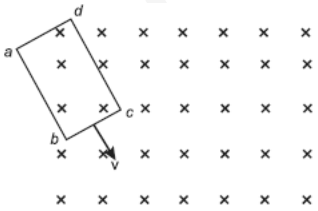
   i. 143V ii. 46V

   iii. 106V iv. 146V

5. Lenz's law is in accordance with the law of conservation of :

   i. Mass ii. Linear momentum

   iii. Energy iv. Charge

6. 

Predict the direction of induced current in the rectangular loop $abcd$ as it is moved into the region of a uniform magnetic field $\vec{B}$ directed normal to the plane of the loop.

   i. $Along\ \ bcdab$ ii. $Along\ \ adcba$

   iii. $Along\ \ bcdcb$ iv. $Along\ \ badab$

7. If L= $200mH$, current changes by 3A in 10s, find the emf induced?

   i. 1mV ii. 6mV

   iii. 60mV iv. 600mV

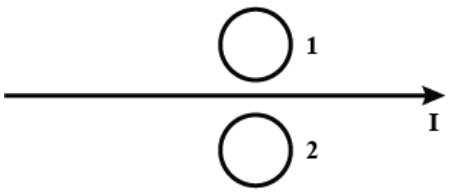
8. While keeping area of cross section of a solenoid same, the number of turns and length of a solenoid are both doubled. The self- inductance of the coil will be:

   i. Halved

   ii. Doubled

   iii. $\frac{1}{4}$ times the original value

   iv. Unaffected

9. 

What is the direction of currents in metal rings 1 and 2 when current in the straight wire is increasing steadily?

   i. Ring 1 clockwise, Ring 2 anticlockwise.

   ii. Ring 1 anticlockwise, Ring 2 clockwise

   iii. Both clockwise

   iv. Both anticlockwise

10. A metallic wire of length $210\ cm$ is moving normally across a field of $0.2T$ with a speed of $10ms^{-1}$. Find the emf between the ends of the wire.

   i. 0.42V ii. 4.2V

   iii. 42V iv. 420V

11. A glass rod of length 2m is moving normally across a field of 1.7T with a speed of 2m/s. Find the emf between the ends of the wire.

   i. 6.8V ii. 0V

   iii. 0.5V iv. 100V

12. An aircraft with a wing span of 40m flies with a speed of 1080km/h in the eastward direction at a constant altitude in the northern hemisphere, where the vertical component of the earth's magnetic field is $1.75 \times 10^{-5}T$. Fine the emf that develops between the tips of the wings.

    i. 21V ii. 0.021V

    iii. 0.21V iv. 2.1V

13. A circular coil of area $0.05m^2$ and 100 turns rotates about its vertical diameter with an angular speed of $90s^{-1}$ in a uniform horizontal magnetic field of magnitude $0.08T$. Obtain the maximum voltage induced in the coil.

    i. 40V ii. 46V

    iii. 4.6V iv. 36V

14. Choose the dimensions of self - inductance.

    i. $M^1L^2T^{-2}A^{-3}$ ii. $M^2L^2T^{-2}A^{-1}$

    iii. $M^1L^3T^4A^{-2}$ iv. $M^1L^2T^{-2}A^{-2}$

15. What is the self-inductance of a coil , in which magnetic flux of 70 milliweber is produced when 7A current flows through it?

    i. 0.01H ii. 0.02H

    iii. 0.1H iv. 0.002H

16. If a rate of change of current of $10As^{-1}$induces an emf of $50mV$ in a solenoid, what is the self - inductance of the solenoid?

    i. 50mH ii. 5mH

    iii. 20mH iv. 2mH

17. What is the self - inductance of an air core solenoid 50cm long and 2cm radius if it has 500 turns?

    i. $7.89 \times 10^{-4}H$

    ii. $8.79 \times 10^{-4}H$

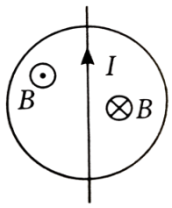
    iii. $9.87 \times 10^{-4}H$

    iv. $3.89 \times 10^{-4}H$

18. An emf of 0.9V is developed in the secondary coil, when current in the primary coil changes from 20A to 11A in 16s. Calculate the mutual inductance of the two coils.

i. 16H ii. 160H

iii. 0.16H iv. 1.6H

19. 

A current carrying infinitely long wire is kept along the diameter of a circular wire loop , without touching it. The correct statement is :

i. The emf induced in the loop is zero if the current is constant.
ii. The emf induced in the loop is finite if the current is constant.
iii. The emf induced in the loop is finite if the current is decreasing.
iv. The emf induced in the loop is finite if the current is increasing.

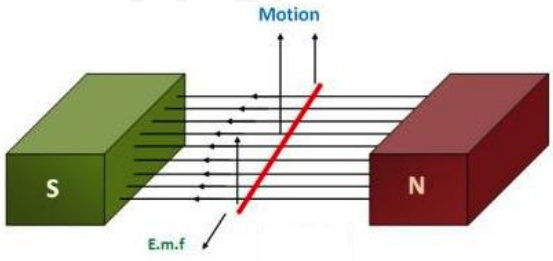
20. Motional emf can be derived using the concept of :

i. Faraday's Laws OR Newton's laws
ii. Fleming's Rule OR Newton's laws
iii. Faraday's Laws OR Lorentz force
iv. Edison loop OR Gravity fields

21. A circular copper disc $10cm$ in radius rotates at $20\pi\ rad\ s^{-1}$ about an axis through its centre and perpendicular to the disc. A uniform magnetic field of $0.2T$ acts perpendicular to the disc. Find the potential difference developed between the axis of the disc and the rim:

i. 0.0314V ii. 3.14V

iii. 6.28V iv. 0.0628V

22. 

This diagram indicates :

i. Fleming's left hand rule
ii. Fleming's right hand rule
iii. Faraday's law
iv. Stefan's law

23. Magnetic flux linked with a coil cannot be changed by :

i. Changing the magnetic field B. ii.

ii. Changing the area A of the coil.

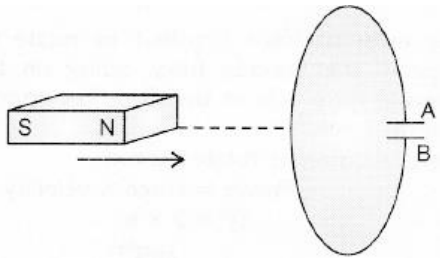
iii. Changing the relative orientation θ between B and A.

iv. Changing the colour of the coil.

24. A coil of wire has 700 turns a self - inductance of $245\ mH$. What will be the self-inductance of another similar coil with 200 turns?

i. 20mH ii. 25mH

iii. 75mH iv. 40mH

25. 

Predict the polarity of the plate A of the capacitor, when a magnet is moved towards it, as shown in fig:

i. Positive ii. Negative

iii. Neutral iv. Changing polarity

26. Pick up the correct word for inertia of electricity.

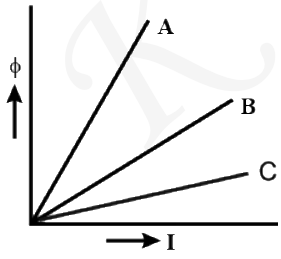
i. Magnetic flux ii.Induced emf

iii. Self- induction iv. Electric flux

27. Eddy currents are not used in:

i. Magnetic braking ii. Dead beat galvanometer

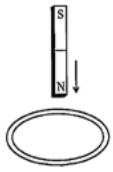
iii. Induction furnace iv.Cyclotron

28. 

A plot of magnetic flux (ϕ) versus current (I) is shown in figure for three conductors A, B and C. Which of the 3 has larger value of self - inductance?

i. Conductor B ii. Conductor A

iii. Conductor C iv. All have same self- inductance

29. 

A bar magnet falls from a height through a metal ring . What happens to its acceleration?

i. Acceleration is equal to $'g'$.

ii. Acceleration is less than $'g'$.

iii. Acceleration is more than $'g'$.

iv. Zero

30. An metal core solenoid has self - inductance 10H. When the core is removed, the self – inductance becomes 5mH. What is the relative permeability of the core material?

i. 1400 ii. 2000

iii. 2800 iv. 3984

31. The dimension $\frac{L}{R}$ is the same as that of :

i. Frequency ii. Length

iii. Time iv. Velocity

32. The two rails of a railway track insulated from each other and the ground are connected to a milli voltmeter. What is the reading of the meter, when a train passes at a speed of $180\ kmh^{-1}$ along the track, given that the vertical component of earth's magnetic field is $0.2 \times 10^{-4} Wbm^{-2}$ and rails are separated by 1m?

i. 10 mV ii. 1mV

iii. 100mV iv. 0.1mV

33. Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon :

i. Relative position and orientation of the two coils.

ii. The currents in the two coils.

iii. The material of the wires in the coils

iv. The rates at which currents are changing in the two coils.

Section B- Assertions & Reasons Questions

The questions given below consist of an ASSERTION and the REASON. Use the following key to choose appropriate answer:

i. If both assertion and reason are correct and reason is a correct explanation of the assertion.
ii. If both assertion and reason are correct but reason is not the correct explanation of assertion.
iii. If assertion is correct but reason is incorrect.
iv. If assertion is incorrect but reason is correct or if both assertion and reason are incorrect.

1 ASSERTION: Time varying magnetic field generates electric field.
REASON: Direction of electric field induced due to time varying magnetic field is not according to Lenz law.

2 ASSERTION: A metal object kept in time varying magnetic field gets cooled.
REASON: When metal object is kept inside time varying magnetic field, then due to electromagnetic induction electric current start flowing on the surface.

3 ASSERTION: There are two coaxial circular rings having different radii. Mutual inductance of this pair is maximum when the two coils are coplanar.
REASON: For two coaxial circular rings having different radii, magnetic flux linked with one due to current in other is maximum when the two loops are coplanar.

4 ASSERTION: A glowing bulb becomes dim when an iron bar is put in the inductor in the ac circuit.
REASON: Resistance of the circuit increases.

5 ASSERTION: When a magnet is made to fall freely through a closed coil, its acceleration is always less than acceleration due to gravity.
REASON: Current induced in the coil opposes the motion of the magnet, as per Lenz's law.

6 ASSERTION: Lenz's law is about violation of energy conservation in electromagnetic induction.
REASON: When magnetic flux linked with a coil changes then emf is induced in such a manner that it opposes the cause that has induced it.

7 ASSERTION: The induced emf and current will be same in two identical loops of copper and aluminium, when rotated with same speed in the same magnetic field.
REASON: Induced emf is inversely proportional to rate of change of magnetic field while induced current depends on resistance of wire.

8 ASSERTION: If the number of turns of a coil is increased, it becomes more difficult to push a bar magnet towards the coil.
REASON: The difficulty faced is according to Lenz's law.

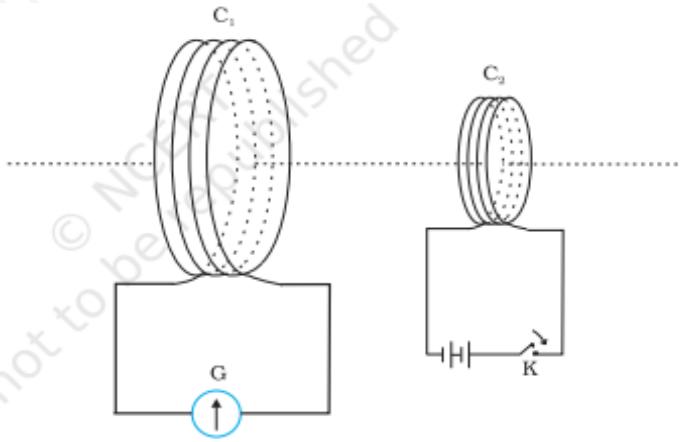
9 ASSERTION: When coil in galvanometer with metallic core oscillates, then electromagnetic damping occurs.
REASON: Eddy currents generated in the core oppose the motion and bring the coil to rest quickly.

10 ASSERTION: Generation of eddy currents depends on the principle of electromagnetic induction.
REASON: The heat generated in the operations of eddy currents depends on current and resistance

Section C-Case Study Questions

I. FARADAY'S EXPERIMENT OF EMI

Two coils C_1 and C_2 held stationary as shown in figure. Coil C_1 is connected to galvanometer G while the second coil C_2 is connected to a battery through a tapping key K. It is observed that the galvanometer shows a momentary deflection when the tapping key K is pressed. The pointer in the galvanometer returns to zero immediately. If the key is held pressed continuously, there is no deflection in the galvanometer. When the key is released, a momentary deflection is observed again, but in the opposite direction. It is also observed that the deflection increases dramatically when an iron road is inserted into the coils along their axis.



.1 Identify the device that works based on the principle explained in the above paragraph.

i. Electric motor
ii. Transformer
iii. Moving coil galvanometer
iv. None of these

:2 The phenomenon due to which there is an induced current in one coil due to the current in a neighbouring coil is?

i. Self Inductance
ii. Mutual inductance
iii. Polarisation
iv. None of these

:3 If the current in one coil becomes steady, the current in neighbouring coil is?

i. Doubles
ii. Zero
iii. Infinity
iv. Halves

:4 An emf of 0.5V is developed in the secondary coil, when current in primary coil changes from 5.0A to 2.0A in 300 milliseconds. Then the mutual inductance of two coils is

i. 2 H
ii. 5 H
iii. 0.5 H
iv. 10 H

:5 The flux linkage in coil 1 is 3Wb and it has x turns and the current in coil 2 is 2A, calculate the value of x if the mutual inductance is 750H.

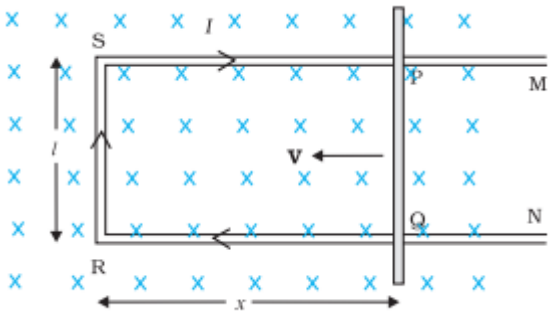
i. 200
ii. 500
iii. 300
iv. 700

II. MOTIONAL EMF

Figure shows a rectangular conductor PQRS in which the conductor PQ is free to move. The road PQ is moved towards the left with a constant velocity 'v' as shown in figure. Assume that there is no loss of energy due to friction. PQRS forms a closed circuit enclosing an area that changes as PQ moves. It is placed in a uniform magnetic field B which is perpendicular to the plane of this system. If the length RQ = x and RS = l, the magnetic flux ϕ_B enclosed by the loop PQRS will be

$$\varphi_B = Blx$$

Since x is changing with time, the rate of change of flux will induce an emf in the conductor.



1 Find the correct statement from the following.

i. Motional emf is inversely proportional to the speed of the conductor
ii. Motional emf is inversely proportional to the length of the conductor
iii. Motional emf is directly proportional to the magnetic field
iv. Motional emf is inversely proportional to the magnetic field

2 When the magnetic field is parallel to a surface, then the magnetic flux through the surface is:

i. Infinite
ii. Zero
iii. small but not zero
iv. large but not infinite

3 A wire of length 0.1 m moves with a speed of 10 m/s perpendicular to a magnetic field of induction 1 Wb/m^2. The emf induced will be

i. 10 V
ii. 0.01 V
iii. 0.1 V
iv. 1 V

4 A train is running on metre gauge at a speed of 36 km/hr. If the vertical component of the earth's magnetic field is 4×10^{-5} T, then the emf generated between the railway lines will be

i. 4 V
ii. 4 mV
iii. 4×10^{-4} V
iv. 144 V

5 Identify the correct statements from the following:

The magnetic flux linked with a loop does not change with time when

a) Magnet and loop are moving with the same velocity in the same direction,
b) Magnet is rotated around its axis without changing its distance from the loop
c) Loop is moved in a uniform magnetic field and the whole of the loop remains in the field.

i. (a) and (c)
ii. (a) and (b)
iii. All the three statements correct
iv. (b) and (c)

Key for MCQ Questions

1.	iv	11.	ii	21.	iv	31.	iii
2.	i	12.	iii	22.	ii	32.	ii
3.	ii	13.	iv	23.	iv	33.	i
4.	iv	14.	iv	24.	i		
5.	iii	15.	i	25.	i		
6.	i	16.	ii	26.	iii		
7.	iii	17.	i	27.	iv		
8.	ii	18.	iv	28.	ii		
9.	i	19.	i	29.	ii		
10.	ii	20.	iii	30.	ii		

assertion and reason type questions answer key

1	2	3	4	5	6	7	8	9	10
iii	iv	i	i	i	iv	iv	i	i	i

answer key for case study questions

i					i				
1	2	3	4	5	1	2	3	4	5
ii	ii	ii	iii	ii	iii	ii	iv	iii	iii

CHAPTER -7 ALTERNATING CURRENT

SECTION A- MULTIPLE CHOICE QUESTIONS

1 The shape of graph between capacitive reactance and capacitance (keeping source frequency constant) is a
(a) Straight line
(b) Parabola
(c) Rectangular hyperbola
(d) Circle

2 **In which of the following circuits the maximum power dissipation is observed?**
(a) Pure capacitive circuit
(b) Pure inductive circuit
(c) Pure resistive circuit
(d) None of these

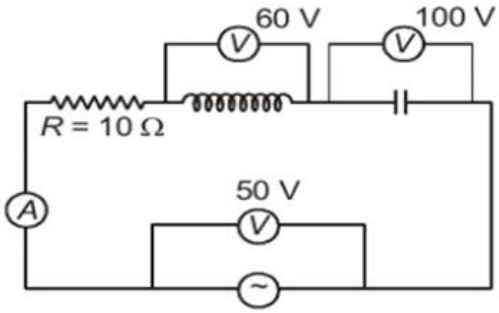
3 **If the frequency of an A.C. is made 4 times of its initial value, the power dissipation in circuit with inductor will be**
(a) be 4 times
(b) zero
(c) be half
(d) remain the same

4 **Of the following about capacitive reactance which is correct?**
(a) The reactance of the capacitor is directly proportional to its ability to store charge
(b) Capacitive reactance is inversely proportional to the frequency of the current
(c) Capacitive reactance is measured in farad
(d) The reactance of a capacitor in an A.C. circuit is similar to the resistance of a capacitor in a D.C. circuit

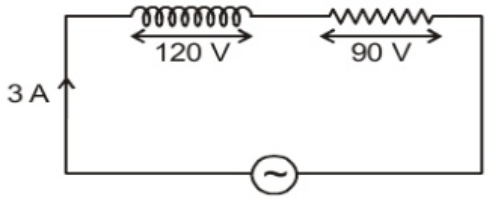
5 **The power factor in a circuit connected to an A.C. The value of power factor is**
(a) unity when the circuit contains an ideal inductance only
(b) unity when the circuit contains an ideal resistance only
(c) zero when the circuit contains an ideal resistance only
(d) unity when the circuit contains an ideal capacitance only

6 A bulb connected in series with a solenoid is lit by an AC source. If a soft iron core is introduced in the solenoid then,
(a) the bulb will glow brighter
(b) the bulb will glow dimmer
(c) there will be no effect on the light produced by the bulb
(d) bulb may glow more brighter or dimmer

7 In the circuit shown in figure the current measured by ammeter is
(a) 1A
(b)2 A
(c) 3 A
(d) Zero



8 Impedance of the circuit shown in the figure is
(a) 100
(B) 50
(C) 30
(D) 40



9 In an LCR-series ac circuit, the voltage across each of the component L, C and R is 50 V. The voltage across the LC-combination will be
(a) 50 V
(b) 50√2 V
(c) 100 V
(d) zero

10 In an LCR circuit, capacitance is charged from C to 2C. For resonant frequency to remain unchanged, the inductance should be changed from L to
(a) 4 L
(b) 2 L
(c) L/2
(d) L/4

11 The power factor varies between
(a) 2 and 2.5
(b) 3.5 to 5
(c) 0 to 1
d) 1 to 2

12 At resonance frequency the impedance in series LCR circuit is
(a) maximum
(b) minimum
(c) zero
(d) infinity

13 When a voltage measuring device is connected to AC mains, the meter shows the steady input voltage of 220 V.

(a) input voltage cannot be AC voltage, but a DC voltage.
(b) maximum input voltage is 220V.
(c) the meter reads not v but $< v^2 >$ and is . calibrated to read $\sqrt{< v^2 >}$.
(d) the pointer of the meter is stuck by some mechanical defect.

14 Which of the following combinations should be selected for better tuning of an LCR circuit used for communication? [NCERT Exemplar]
(a) R = 20, L= 1.5 H, C = 35 μF.
(b) R = 25 , L = 2.5 H, C = 45 μF.
(c) R = 15 , L = 3.5 H, C = 30 μF.
(d) R = 25 , L = 1.5 H, C = 45 μF.

15 When an AC voltage of 220 V is applied to the capacitor C
(a) the maximum voltage between plates is 220 V.
(b) the current is in phase with the applied voltage.
(c) the charge on the plates is not in phase with the applied voltage.
(d) power delivered to the capacitor is zero.

16 In a circuit L ,C, and R are connected in series with an alternating voltage source of frequency f .The current leads the voltage by 60 ^{o}. The value of $(X_C - X_L)$ is

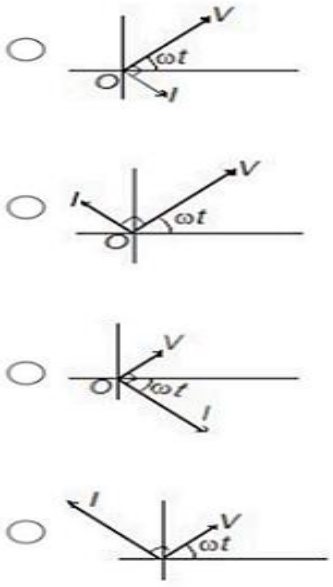
(a) $\sqrt{3}$ R

(b) $\sqrt{}$ 2R

(c) R/$\sqrt{3}$

(d) 2R

17 The correct phasor diagram for voltage and current for an AC source ($V = V_0 \sin\omega t$) applied to a purely inductive circuit is (where I is instantaneous current)



18. The peak voltage of 220V ac mains is
a.) 155.7V
b.)220.12V
c.)311.08V
d.)425V

19. The phase difference between the current and the voltage in series LCR circuit at resonance is
a.)π
b.)π/2
c.)π/3
d.)zero

20 Which quantity is increased in a step-down transformer?
a.)current
b.)voltage
c.)power
d.)frequency

21 What is the value of the inductance L for which the current is maximum in a series LCR circuit with C= 10μF and ω=1000rad/s?
a)100mH
b)1mH
c)10mH
d)Cannot be calculated with the given data.

22 In a series LCR circuit, the voltage across an inductor ,a capacitor and a resistor are 30V, 30V and 60V respectively. What is the phase difference between the applied voltage and the current in the circuit?

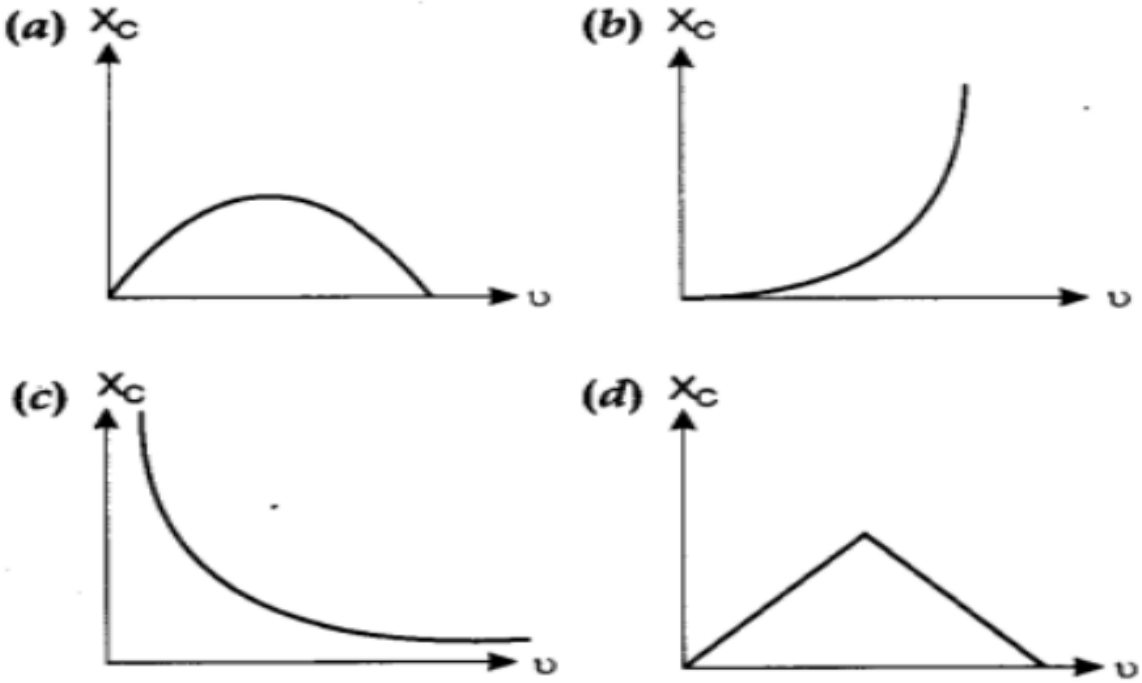
a.)π

b.)π/2

c.)π/3

d.)zero

23 Which of the following graphs represents the correct variation of capacitive reactance X_c with frequency ν?



24 The reactance of a capacitor is X. If both the frequency and the capacitance are doubled , the new reactance will be

a.) X

b.)2X

c.) 4X

d.)X/4

25. The correct formula to determine the Q factor of series resonance circuit is

(a) $Q = \frac{1}{R}\sqrt{\frac{C}{L}}$

(b) $Q = \frac{1}{2}\sqrt{\frac{C}{L}}$

(c) $Q = \frac{1}{C}\sqrt{\frac{R}{L}}$

(d) $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$

26. The dimensions of the ratio of Inductance to Resistance is same as the dimension of
(a) time
(b) capacitance
(c) capacitive reactance
(d) inductive reactance

27 An LCR series circuit, connected to an ac source E, is at resonance. Then the voltage across
(a) R is zero
(b) R equals applied voltage
(c) C is zero
(d) L equals applied voltage

28 With the increase in frequency of an A.C. supply, the impedance of an L-C-R series circuit connected to this supply
(a) remains constant (b) increases
(c) decreases (d) decreases at first, becomes minimum and then increases.

29 In an LCR circuit ,the resonating frequency is 500 kHz. If the value of L is doubled and the value of C is decreased to 1/8 times of its initial values , then the new resonating frequency in kHz will be
(a)250
(b)500
(c)1000
(d)2000A

30 In an ac circuit, the instantaneous value of emf and current are E = 200 sin 314 t(V) and I = 100sin (314t $+\pi/2$)A. The average power consumed is
(a)20kW
(b)2kW
(c)zero
(d)25kW

Section B- Assertions & Reasons Questions

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

31 **Assertion(A):** A capacitor blocks DC and offers an easy path to AC.
Reason (R): Capacitive reactance is inversely proportional to frequency.

32 Assertion(A):It is advantageous to transmit electric power at high voltage.
Reason(R): High voltage implies high current.

33 **Assertion(A):** In series LCR circuit,resonance occurs at one frequency only.
Reason(R): At resonance,the inductive reactance is equal to capacitive reactance.

34 **Assertion(A):** When the capacitive reactance is less than the inductive reactance in a series LCR circuit, the emf leads the current.
Reason(R): The angle by which the alternating voltage leads the alternating current in a series LCR circuit is given by $\tan\varphi=(X_L-X_C)/R$

35 **Assertion(A):** A transformer doesn't work on DC.
Reason(R): The magnitude and direction of DC keeps changing periodically.

36 **Assertion(A):** Most of the electrical energy sold by power companies is transmitted and distributed in the form of alternating voltage.
Reasoning(R): AC voltage cannot be easily and efficiently converted from one value to the other by means of transformers.

37 **Assertion(A):** An AC voltage source of variable angular frequency ω and fixed amplitude V_0 is connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When ω is increased, the bulb glows brighter.
Reason(R): When frequency is increased the inductive reactance increases.

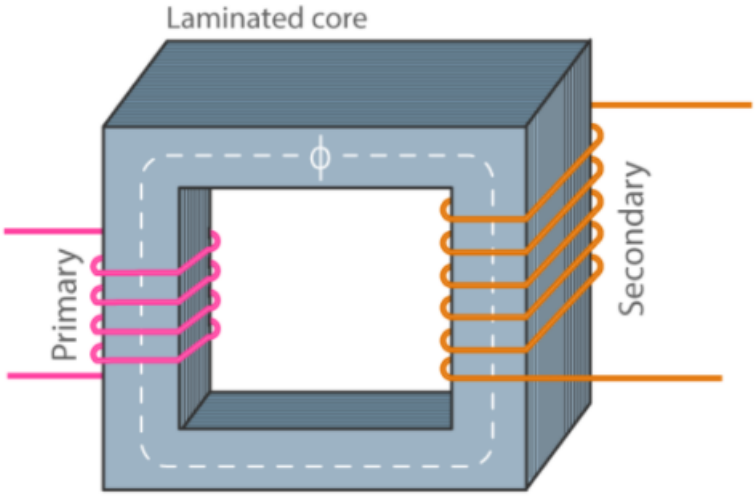
38 **Assertion(A) :** At resonant frequency the current amplitude in series LCR circuit is minimum.
Reasoning (R): The impedance of the circuit is maximum at resonant frequency.

39 **Assertion(A) :** An alternating current doesn't show any magnetic effect.
Reason (R): Alternating current doesn't vary with time.

40 **Assertion (A):** A bulb connected in series with a solenoid is connected to an ac source. If a soft iron core is introduced in the solenoid, the bulb will glow dimmer.
Reason (R) : On introducing soft iron core in the solenoid, the inductance decreases.

Section C-Case Study Questions

I



A transformer is a device used in the power transmission of electric energy. The transmission current is AC. It is commonly used to increase or decrease the supply voltage without a change in the frequency of AC between circuits. The transformer works on basic principles of electromagnetic induction and mutual induction.

41 The core of a transformer is laminated_____

(a) to increase the secondary voltage

(b) to reduce the eddy current losses

(c) to give strength and to increase the life of the core

(d) to avoid the short circulating between the primary and secondary windings

42 A transformer transforms_____

(a) Current

(b) Voltage

(c) Frequency

(d) Both voltage and current

43 In an ideal transformer, the primary and the secondary voltages always have_____

(a) equal magnitude

(b) the same phase

(c) a phase difference of 90°

(d) a phase difference of 180°

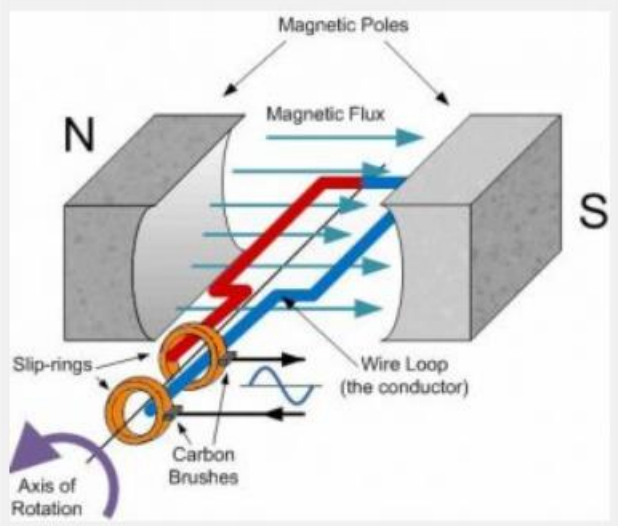
44 For an ideal-step-down transformer, the quantity which is constant for both the coils is

(a) current in the coils
(b) voltage across the coils
(c) resistance of coils
(d) power in the coils

45 A current of 5A is flowing at 220V in the primary of a transformer.If the voltage produced in the secondary coil is 2200V and 50% power is lost,then the current in the secondary will be

(a) 0.25 A
(b) 0.5 A
(c) 2.5 A
(d) 5A

II



Alternating current generator

46 The basic principle of AC generator is

(a) Conservation of momentum
(b) Lenz" s rule
(c) Electromagnetic Induction
(d) Energy conservation

47 An a.c. generator consists of a coil of 1000 turns and cross-sectional area of $3m^2$, rotating at a constant angular speed of 60 rad s^{-1} in a uniform magnetic field 0.04 T. The resistance of the coil is 500Ω. Calculate the maximum current drawn from the generator.

a) 2500 A
b) 1.44 A
c) 6.25 A
d) 0.55 A

48 An a.c. generator consists of a coil of 50 turns and an area 2.5 m^2 rotating at an angular speed of 60 rad s^{-1} in a uniform magnetic field of 0.3 T between two fixed pole pieces. What is the flux through the coil, when the current is zero?

a) Maximum
b) Minimum
c) Zero
d) Independent of current

49 If the coil is placed perpendicular to field lines then the number of lines passing through the coil is

(a) minimum
(b)maximum
(c) zero
(d)may be max. or min.

50 When a coil rotated in magnetic field the induced current in it

(a) continuously changes
(b)remains same
(c)becomes zero
(d)becomes maximum

ANSWERS

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

Sample question papers

Sample Question Paper 2021-22
Term 1
Subject: Physics (042)

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 any20 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 numberof questions are attempted, ONLY first 20 will be considered for evaluation.

Q1.Which of the following is NOT the property of equipotential surface?

(i) They do not cross each other.

(ii) The rate of change of potential with distance on them is zero.

(iii) For a uniform electric field they are concentric spheres.

(iv) They can be imaginary spheres.

Q2. Two point charges +8q and -2q are located at x=0 and x=L respectively. The point on x axis at which net electric field is zero due to these charges is-

(i) 8L

(ii) 4L

(iii) 2 L

(iv) L

Q3. An electric dipole of moment p is placed parallel to the uniform electric field. The amount of work done in rotating the dipole by 90^{o} is-

(i) 2pE

(ii) pE

(iii) pE/2

(iv) Zero

Q4. Three capacitors 2μF, 3μF and 6μF are joined in series with each other. The equivalent capacitance is-

(i) 1/2μF

(ii) 1μF

(iii) 2μF

(iv) 11μF

Q5. Two point charges placed in a medium of dielectric constant 5 are at a distance r between them, experience an electrostatic force 'F'. The electrostatic force between them in vacuum at the same distance r will be-

(i) 5F

(ii) F

(iii) F/2

(iv) F/5

Q6. Which statement is true for Gauss law-

(i) All the charges whether inside or outside the gaussian surface contribute to the electric flux.

(ii) Electric flux depends upon the geometry of the gaussian surface.

(iii) Gauss theorem can be applied to non-uniform electric field.

(iv) The electric field over the gaussian surface remains continuous and uniform at every point.

Q7.A capacitor plates are charged by a battery with 'V' volts. After charging battery is disconnected and a dielectric slab with dielectric constant 'K' is inserted between its plates, the potential across the plates of a capacitor will become

(i) Zero

(ii) V/2

(iii) V/K

(iv) KV

Q8.The best instrument for accurate measurement of EMF of a cell is-

(i) Potentiometer

(ii) metre bridge

(iii) Voltmeter

(iv) ammeter and voltmeter

Q9.An electric current is passed through a circuit containing two wires of same material, connected in parallel. If the lengths and radii of the wires are in the ratio of 3:2 and 2:3, then the ratio of the current passing through the wire will be

(i) 2:3

(ii) 3:2

(iii) 8:27

(iv) 27:8

Q10.By increasing the temperature, the specific resistance of a conductor and a semiconductor-

(i) increases for both.

(ii) decreases for both.

(iii) increases for a conductor and decreases for a semiconductor.

(iv) decreases for a conductor and increases for a semiconductor.

Q11.We use alloys for making standard resistors because they have

(i) low temperature coefficient of resistivity and high specific resistance

(ii) high temperature coefficient of resistivity and low specific resistance

(iii) low temperature coefficient of resistivity and low specific resistance

(iv) high temperature coefficient of resistivity and high specific resistance

Q12. A constant voltage is applied between the two ends of a uniform metallic wire, heat 'H' is developed in it. If another wire of the same material, double the radius and twice the length as compared to original wire is used then the heat developed in it will be-

(i) H/2

(ii) H

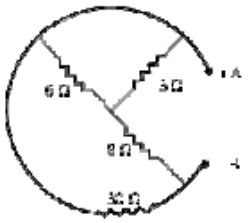
(iii) 2H

(iv) 4H

Q13.If the potential difference V applied across a conductor is increased to 2V with its temperature kept constant, the drift velocity of the free electrons in a conductor will -

(i) remain the same.
(ii) become half of its previous value.
(iii) be double of its initial value.
(iv) become zero.

Q14.The equivalent resistance between A and B is-



(i) 3 ohms

(ii) 5.5 ohms

(iii) 7.5 ohms

(iv) 9.5 ohms

Q15. The SI unit of magnetic field intensity is

(i) AmN^{-1}
(ii) $NA^{-1}m^{-1}$
(iii) $NA^{-2}m^{-2}$
(iv) $NA^{-1}m^{-2}$

Q16.The coil of a moving coil galvanometer is wound over a metal frame in order to

(i) reduce hysteresis
(ii) increase sensitivity
(iii) increase moment of inertia
(iv) provide electromagnetic damping

Q17.Two wires of the same length are shaped into a square of side 'a' and a circle with radius 'r'. If they carry same current, the ratio of their magnetic moment is

(i) $2 : \pi$
(ii) $\pi : 2$
(iii) $\pi : 4$
(iv) $4 : \pi$

Q18. The horizontal component of earth's magnetic field at a place is $\sqrt{3}$ times the vertical component. The angle of dip at that place is

(i) $\pi/6$
(ii) $\pi/3$
(iii) $\pi/4$
(iv) 0

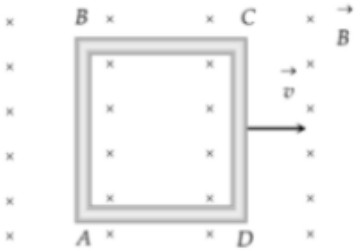
Q19. The small angle between magnetic axis and geographic axis at a place is-

(i) Magnetic meridian
(ii) Geographic meridian
(iii) Magnetic inclination
(iv) Magnetic Declination

Q20.Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon the

(i) rate at which current change in the two coils
(ii) relative position and orientation of the coils
(iii) rate at which voltage induced across two coils
(iv) currents in the two coils

Q21. A conducting square loop of side 'L' and resistance 'R' moves in its plane with the uniform velocity 'v' perpendicular to one of its sides. A magnetic induction 'B' constant in time and space pointing perpendicular and into the plane of the loop exists everywhere as shown in the figure. The current induced in the loop is



(i) BLv/R Clockwise
(ii) BLv/R Anticlockwise
(iii) 2BLv/R Anticlockwise
(iv)Zero

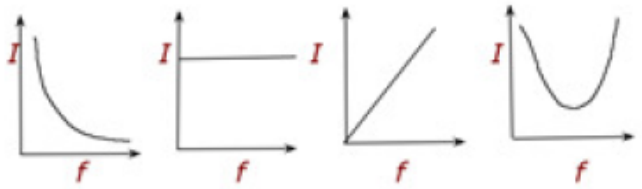
Q22. The magnetic flux linked with the coil (in Weber) is given by theequation –

$\Phi = 5t^2 + 3t + 16$

The induced EMF in the coil at time, t=4 will be-

(i) -27 V
(ii) -43 V
(iii) -108 V
(iv) 210 V

Q23. Which of the following graphs represent the variation of current(I) with frequency (f) in an AC circuit containing a pure capacitor?



(i) (ii) (iii) (iv)

Q24. A 20 volt AC is applied to a circuit consisting of a resistance and a coil with negligible resistance. If the voltage across the resistance is 12 volt, the voltage across the coil is-

(i) 16 V

(ii) 10 V

(iii) 8 V

(iv) 6 V

Q25. The instantaneous values of emf and the current in a series ac circuit are-

E = Eo Sin ωt and I= Io sin(ωt+π/3) respectively, then it is

(i) Necessarily a RL circuit

(ii) Necessarily a RC circuit

(iii)Necessarily a LCR circuit

(iv) Can be RC or LCR circuit

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.

Q26. A cylinder of radius r and length l is placed in an uniform electric field parallel to the axis of the cylinder. The total flux for the surface of the cylinder is given by-

(i) zero

(ii) πr^2

(iii) $E \pi r^2$

(iv))2 $E\pi r^2$

Q27. Two parallel large thin metal sheets have equal surface densities 26.4×10^{-12} C/m^2 of opposite signs. The electric field between these sheets is-

(i) 1.5N/C

(ii) 1.5×10^{-16} N/C

(iii) 3×10^{-10}N/C

(iv) 3N/C

Q28. Consider an uncharged conducting sphere. A positive point charge is placed outside the sphere. The net charge on the sphere is then,

(i) negative and uniformly distributed over the surface of sphere

(ii) positive and uniformly distributed over the surface of sphere

(iii) negative and appears at a point the surface of sphere closest to point charge.

(iv) Zero

Q29. Three Charges 2q, -q and -q lie at vertices of a triangle. The value of E and V at centroid of triangle will be-

(i) E#0 and V#0

(ii) E=0 and V=0

(iii) E#0 and V=0

(iv) E=0 and V#0

Q30. Two parallel plate capacitors X and Y, have the same area of plates and same separation between plates. X has air and Y with dielectric of constant 2 , between its plates. They are connected in series to a battery of 12 V. The ratio of electrostatic energy stored in X and Y is-

(i) 4:1

(ii) 1:4

(iii) 2:1

(iv) 1:2

Q31.Which among the following, is not a cause for power loss in a transformer-

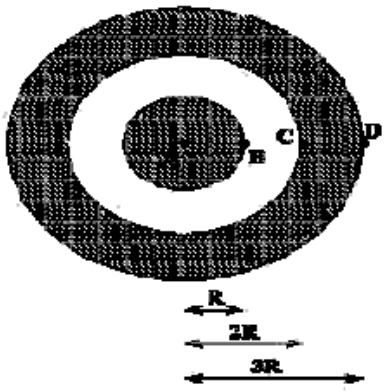
(i) Eddy currents are produced in the soft iron core of a transformer.
(ii) Electric Flux sharing is not properly done in primary and secondary coils.

(iii) Humming sound produed in the tranformers due to magnetostriction.
(iv) Primary coil is made up of a very thick copper wire.

Q32.An alternating voltage source of variable angular frequency 'w' and fixed amplitude 'V' is connected in series with a capacitance C and electric bulb of resistance R(inductance zero). When 'w' is increased-

(i) The bulb glows dimmer.
(ii) The bulb glows brighter.
(iii) Net impedance of the circuit remains unchanged.
(iv) Total impedance of the circuit increases.

Q33. A solid spherical conductor has charge +Q and radius R. It is surrounded by a solid spherical shell with charge -Q, innerradius 2R, and outer radius 3R. Which of the following statements is true?



(i)The electric potential has a maximum magnitude at C and the electric field has a maximum magnitude at A

(ii) The electric potential has a maximum magnitude at D and the electric field has a maximum magnitude at B.

(iii) The electric potential at A is zero and the electric field has a maximum magnitude at D.

(iv). Both the electric potential and electric field achieve a maximum magnitude at B.

Q34. A battery is connected to the conductor of non-uniform cross section area. The quantities or quantity which remains constant is-

(i) electric field only

(ii) drift speed and electric field

(iii)electric field and current

(iv) current only

Q35. Three resistors having values R_1, R_2, and R_3 are connected in series to a battery. Suppose R_1 carries a current of 2.0 A, R_2 has a resistance of 3.0 ohms, and R_3 dissipates 6.0 watts of power. Then the voltage across R_3 is-

(i) 1V

(ii) 2V

(iii) 3V

(iv) 4V

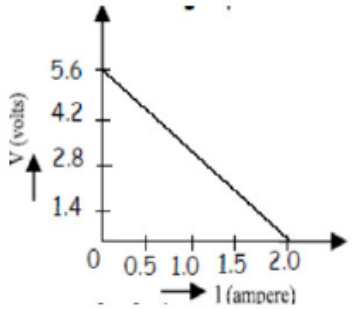
Q36.A straight line plot showing the terminal potential difference (V) of a cell as a function of current (I) drawn from it, is shown in the figure. The internal resistance of the cell would be then-

(i) 2.8 ohms

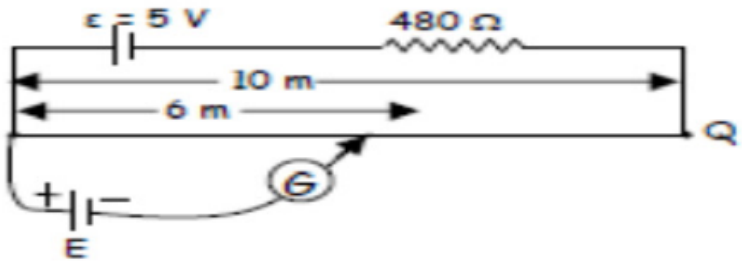
(ii) 1.4 ohms

(iii) 1.2 ohms

(iv) zero



Q37. A 10 m long wire of uniform cross-section and 20 Ω resistance is used in a potentiometer. The wire is connected in series with a battery of 5 V along with an external resistance of 480 Ω. If an unknown emf E is balanced at 6.0 m length of the wire, then the value of unknown emf is-



(i) 1.2 V

(ii) 1.02 V

(iii) 0.2 V

(iv) 0.12 V

Q38.The current sensitivity of a galvanometer increases by 20%. If its resistance also increases by 25%, the voltage sensitivity will

(i) decrease by 1%

(ii) increased by 5%

(iii) increased by 10%

(iv) decrease by 4%

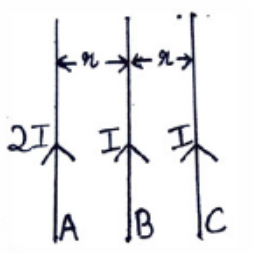
Q39. Three infinitely long parallel straight current carrying wires A, B and C are kept at equal distance from each other as shown in the figure . The wire C experiences net force F .The net force on wire C, when the current in wire A is reversed will be

(i) Zero

(ii) F/2

(iii) F

(iv) 2F



Q40. In a hydrogen atom the electron moves in an orbit of radius 0.5 A° making 10 revolutions per second, the magnetic moment associated with the orbital motion of the electron will be

(i) 2.512×10^{-38} Am^2

(ii) 1.256×10^{-38} Am^2

(iii) 0.628×10^{-38} Am^2

(iv) zero

Q41. An air-cored solenoid with length 30 cm, area of cross-section 25 cm^2 and number of turns 800, carries a current of 2.5 A. The current is suddenly switched off in a brief time of 10^{-3}s. Ignoring the variation in magnetic field near the ends of the solenoid, the average back emf induced across the ends of the open switch in the circuit would be

(i) zero

(ii)3.125 volts

(iii) 6.54 volts

(iv) 16.74 volts

Q42. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which R = 3 Ω, L = 25.48 mH, and C = 796 μF, then the power dissipated at the resonant condition will be-

(i)39.70 kW

(ii) 26.70 kW

(iii)13.35 kW

(iv)Zero

Q43. A circular loop of radius 0.3cm lies parallel to much bigger circular of radius 20 cm. The centre of the small loop is on the axis of the bigger loop. The distance between their centres is 15 cm. If a current of 2.0 A flows through the smaller loop, then the flux linked with the bigger loop is

(i) 3.3×10^{-11} weber

(ii) 6×10^{-11} weber

(iii) 6.6×10^{-9} weber

(iv) 9.1×10^{-11} weber

Q44.If both the number of turns and core length of an inductor is doubled keeping other factorsconstant, then its self-inductance will be-

(i) Unaffected
(ii) doubled
(iii) halved
(iv) quadrupled

45. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): To increase the range of an ammeter, we must connect a suitable high resistance in series to it.

Reason (R): The ammeter with increased range should have high resistance.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

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

46. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): An electron has a high potential energy when it is at a location associated with a more negative value of potential, and a low potential energy when at a location associated with a more positive potential.

Reason (R): Electrons move from a region of higher potential to region of lower potential.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

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

47. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A): A magnetic needle free to rotate in a vertical plane, orients itself (with its axis) vertical at the poles of the earth.

Reason (R): At the poles of the earth the horizontal component of earth's magnetic field will be zero.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

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

48. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A): A proton and an electron, with same momenta, enter in a magnetic field in a direction at right angles to the lines of the force. The radius of the paths followed by them will be same.

Reason(R): Electron has less mass than the proton.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

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

49. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): On Increasing the current sensitivity of a galvanometer by increasing the number of turns, may not necessarily increase its voltage sensitivity.

Reason(R): The resistance of the coil of the galvanometer increases on increasing the number of turns.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

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

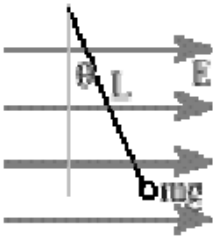
SECTION C

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.

Q50. A small object with charge q and weight mg is attached to one end of a string of length 'L' attached to a stationary support. The system is placed in a uniform horizontal electric field 'E', as shown in the accompanying figure. In the presence of the field, the string makes a constant angle θ with the vertical. The sign and magnitude of q-

(i) positive with magnitude mg/E

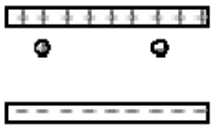
(ii) positive with magnitude (mg/E)tanθ



(iii) negative with magnitude mg/E tanθ

(iv) positive with magnitude E tanθ/mg

Q51.A free electron and a free proton are placed between two oppositely charged parallel plates. Both are closer to the positive plate than the negative plate.



Which of the following statements is true?

I. The force on the proton is greater than the force on the electron.

II. The potential energy of the proton is greater than that of the electron.

III. The potential energy of the proton and the electron is the same.

(i) I only

(ii) II only

(iii) III and I only

(iv)II and I only

Case study :

Read the following paragraph and answers the questions:

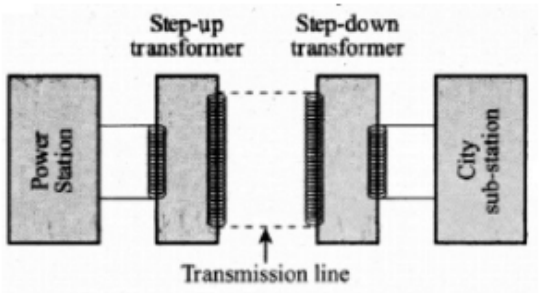


Figure: Long distance power transmissions

The large-scale transmission and distribution of electrical energy over long distances is done with the use of transformers. The voltage output of the generator is stepped-up. It is then transmitted over long distances to an area sub-station near the consumers. There the voltage is stepped down. It is further stepped down at distributing sub-stations and utility poles before a power supply of 240 V reaches our homes.

Q52. Which of the following statement is true?

(i) Energy is created when a transformer steps up the voltage

(ii) A transformer is designed to convert an AC voltage to DC voltage

(iii) Step–up transformer increases the power for transmission

(iv) Step–down transformer decreases the AC voltage

Q53. If the secondary coil has a greater number of turns than the primary,

(i) the voltage is stepped-up ($V_s > V_p$) and arrangement is called a step-up transformer

(ii) the voltage is stepped-down ($V_s < V_p$) and arrangement is called a step-down transformer

(iii) the current is stepped-up ($I_s > I_p$) and arrangement is called a step-up transformer

(iv) the current is stepped-down ($I_s < I_p$) and arrangement is called a step-down transformer

Q54. We need to step-up the voltage for power transmission, so that

(i) the current is reduced and consequently, the I^2R loss is cut down

(ii) the voltage is increased , the power losses are also increased

(iii) the power is increased before transmission is done

(iv) the voltage is decreased so V^2/R losses are reduced

Q55. A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. The number of turns in the secondary in order to get output power at 230 V are

(i) 4

(ii) 40

(iii) 400

(iv) 4000

Answer key

Q.NO	Ans	Q.NO	Ans	Q.NO	Ans	Q.NO	Ans	Q.NO	Ans	Q.NO	Ans
1	**iii**	11	**i**	21	**iv**	31	**iv**	41	**ii**	51	**ii**
2	**iii**	12	**iii**	22	**ii**	32	**ii**	42	**iii**	52	**iv**
3	**ii**	13	**ii**	23	**iii**	33	**iv**	43	**iv**	53	**i**
4	**ii**	14	**iii**	24	**i**	34	**iv**	44	**ii**	54	**i**
5	**i**	15	**ii**	25	**iv**	35	**iii**	45	**iv**	55	**iii**
6	**iv**	16	**iv**	26	**i**	36	**i**	46	**iii**		
7	**iii**	17	**iii**	27	**iv**	37	**iv**	47	**i**		
8	**i**	18	**i**	28	**iv**	38	**iv**	48	**ii**		
9	**iii**	19	**i**	29	**iii**	39	**i**	49	**i**		
10	**iii**	20	**ii**	30	**iii**	40	**ii**	50	**ii**		

Kendriya Vidyalaya Sangathan, Ernakulam Region
Sample question paper 1 (2021-22)
Term 1
Subject : Physics (042)

Time : 90Min **Max Mark : 35**

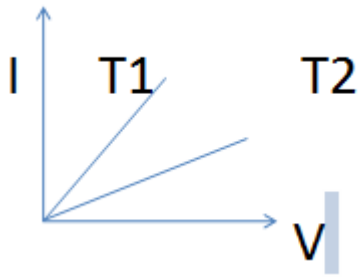
General Instructions :

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. An electric field of $2x10^{4}$N/C is required to just balance in air a liquid drop of mass $2x10^{-4}$kg.Thecharge on the drop is
   (a) $18.6x\ 10^{-8}$C (c) $4x10^{-8}$C
   (b) $9.8x10^{-8}$C (d) $15.4x10^{-8}$C
2. An electric dipole of moment 8×10^{-12}Cm is placed in an electric field of 10^{8} N/C. The work done in rotating the dipole through 60 degree is
   (a)$2x10^{-4}$J (c)$2.5x10^{-4}$J
   (b) $4x10^{-4}$J (d)$1.5x10^{-4}$J
3. Which of the following is higher temperature T1 or T2 and why?



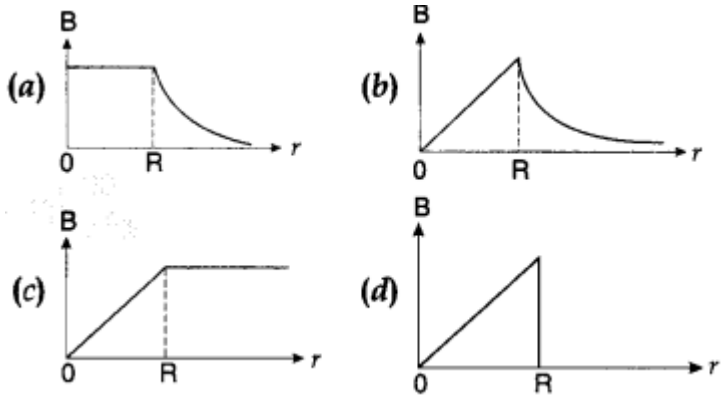
.

(a) T1 because it has more slope
(b) T2 because it has less slope
(c) T1&T2 are same because temperature is independent of the variations in V or I
(d) None of the above

4. An alternating current is given by I = 20sin(100πt+ 0.05π)A. The rms value and the frequency of the current respectively are

(a)10A and 100Hz
(b)10A and 50 Hz
(c) 10√2A and 50Hz
(d)10√2A and 100Hz

5. The correct plot of the magnitude of magnetic field $\vec{B}$ vs distance r from centre of the wire is, if the radius of wire is R



(a) **(a)**
(b) **(b)**
(c) **(c)**
(d) **(d)**

6. AB is a 1 meter long bridge wire. Initially with 6Ω in one gap and R in the other gap , the balancing length is 75cm. When an unknown resistance X connected in parallel to 6Ω the balancing point shifts by 25cm. Then X is

(a) 2 Ω
(b) 6Ω
(c) 3Ω
(d) 1Ω

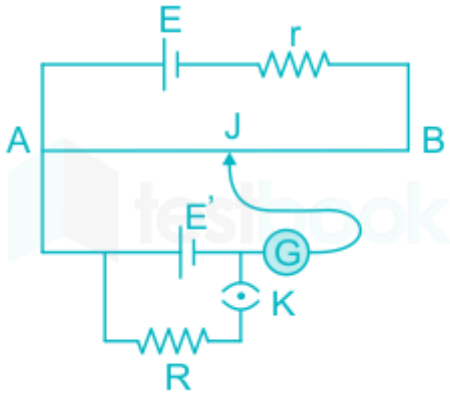
7. If a long hollow copper pipe carries a direct current , the magnetic field associated with the current will be

(a) Only inside the pipe
(b) Only outside the pipe
(c) Neither inside nor outside the pipe
(d)Both inside and outside of the pipe

8. A hollow metallic sphere of radius 10cm is given a charge of 3.2 x 10^{-9}C . The electric potential at a 4cm from the centre is

(a) 288V
(b) 2.88V
(c) $9x10^{-9}$V
(d)Zero

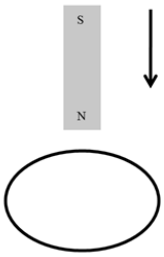
9. In a potentiometer how does the balancing point change when K is kept open and **r** is increased



(a) increases
(b) decreases
(c) remains the same
(d) No change

10.A capacitor of 50 μF Charged to 100 V is connected in parallel with another capacitor of 10 μF charged to 200V.The common potential would be
(a) 125V
(b) 132.3V
(c) 100V
(d)116.6V

11. A bar-magnet falls down through a conducting coil as shown in the figure given below. The acceleration of the bar magnet is



(a) less than g
(b) greater than g
(c) Equal to g
(d) Insufficient data

12.If the resistivity of the potentiometer is ρ and area of cross section is A, then the potential gradient along the wire is
(a) Iρ/A
(b) I/Aρ
(c) IA/ρ
(d)IAρ

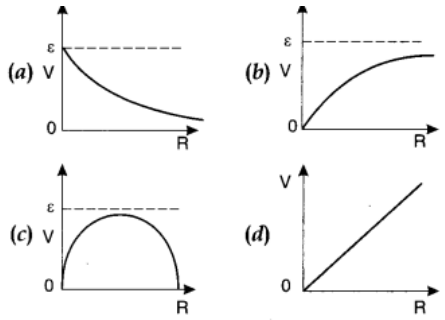
13.The power factor of an LCR circuit is unity then the phase relationship between voltage and current

(a) 180 degree
(b) Zero degree
(c) 90 degree
(d) 30 degree

14. An aircraft with a wing -span of 40m flies with a speed of 1080km/h in the eastward direction at a constant altitude in the northern hemisphere, where the vertical components of earth's magnetic field is 1.75×10^{-5}T. Then the emf that develops between the tips of the wings is

(a) 0.5V
(b) 0.35V
(c) 0.21V
(d)2.1V

15. A cell having an emf E and internal resistance r is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by



(a) **(a)**
(b) **(b)**
(c) **(c)**
(d) **(d)**

16. The sensitivity of a moving coil galvanometer can be increased by decreasing

(a) The number of turns in the coil
(b) The area of the coil
(c) The magnetic field
(d) The couple per unit twist of the suspension

17. An iron core transformer with a turns ratio of 8 : 1 has 120 V applied across the primary. The voltage across the secondary will be

(a) 15 V
(b) 120 V
(c) 180 V
(d) 960 V

18. A wire of resistance 3 Ω is cut into three pieces, which are then joined to form a triangle. The equivalent resistance between any corners of the triangle is

(a) 2/3 Ω
(b) 3/2 Ω
(c) 1/2 Ω
(d) 1/3 Ω

19 . The current passing through a choke coil of 5H is decreasing at the rate of 2ampere /sec.The emf developing across the coil is
(a) 10V
(b) -10V
(c) 2.5V
(d)-2.5V

20. Identify the physical quantity having the unit V/m .Is it scalar or vector
(a) Electrostatic potential , scalar
(b) Electric field intensity , vector
(c) Electric dipole moment , vector
(d)Electrostatic energy , scalar

21.With a cell of emf 2V a balancing point is obtained at 50cm of potentiometer wire .if the cell is shunted by 2Ω resistor the balancing point is 40cm , the internal resistance of the cell is
(a) 0.5Ω
(b) 0.25Ω
(c) 0.75Ω
(d)1Ω

22. In an AC circuit V and I are given by V=100Sin100t volts and I= 100 Sin(100t+π/3)mA respectively. What is the power dissipated in the circuit?
(a) 2000W
(b) 250W
(c) 2500W
(d)200W

23.A bar magnet is held perpendicular to a uniform magnetic field. If the couple acting on the magnet is to be halved by rotating it , then the angle by which it is to be rotated is
(a) 30^0
(b) 45^0
(c) 60^0
(d)90^0

24.The angle between the electric field intensity of an electric dipole along the axial point and the equatorial point is
(a) 0^0
(b) 90^0
(c) 180^0
(d) 45^0

25. The angle of dip at a certain place on Earth is 30^o and the magnitude of Earth's horizontal component of magnetic field is 0.35 G. Find the magnetic field at that place on Earth.

a) 0.35 G

b) 0.40 G

c) 0.45 G

d) 0.50 G

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. A set of n identical resistors each of resistance R ohm, when connected in series have effective resistance of X ohm and when connected in parallel the effective resistance is Y ohm .The relation between R, X and Y

(a) $R=\sqrt{XY}$

(b) $R =Y\sqrt{X}$

(c) $R=X\sqrt{Y}$

(d) $\sqrt{R}=XY$

27.Two long conductors separated by a distance d carry current I_1 and I_2 in the same direction . They exert a force F on each other .Now the current in one of them is increased to two times and its directions is reversed. The distance is also increases to 3d. The new value of the force between them

(a) -2F

(b) F/3

(c)-2F/3

(d) -F/3

28. If the angle of dip at two places are 30^0 and 45^0 respectively, then the ratio of horizontal components of earth's magnetic field at the two places will be

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

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

(c)$1:\sqrt{3}$

(d) 1:2

29. A metal conductor of length 1m rotates vertically about one of its ends at angular velocity 5rad/sec. If the horizontal component of earth's magnetic field is 0.2×10^{-4}T, then the emf developed between the two ends of the conductor is

(a) 5mV

(b)5×10^{-4}V

(c) 50mV

(d) 50μV

30When a dc voltage of 200V is applied to a coil of self inductance $(2\sqrt{3}/\pi)$H, a current of 1A flows through it.But by replacing dc source with ac source of 200V, the current in the coil is reduced to 0.5A.then the frequency of ac supply is

(a) 30Hz

(b) 60Hz

(c) 75Hz

(d) 50Hz

31. The magnetic field due to a current carrying circular loop of radius 3cm at a point on the axis at a distance 4cm from the centre is 54μT. What will be its value at the centre of the loop

(a) 250 μT

(b) 150 μT

(c) 125 μT

(d) 75 μT

32. A thin spherical conducting shell of radius R has a charge q .Another charge Q is placed at the centre of the shell.The electrostatic potential at a point p at a distance R/2 from the centre of the shell is

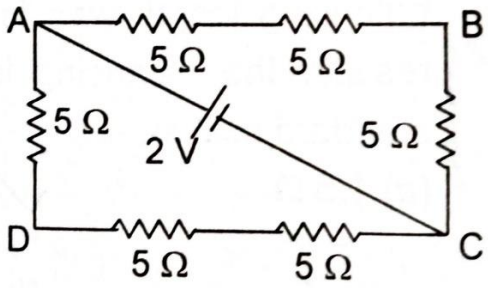
(a)$(q+Q)2/4\pi\epsilon R$

(b) $2Q/4\pi\epsilon R$

(c) $2Q/4\pi\epsilon R - 2q/4\pi\epsilon R$

(d) $2Q/4\pi\epsilon R + q/4\pi\epsilon R$

33. The potential difference between the points A and B of the given circuit is



(a) 2/3V

(b)8/9V

(c)4/3V

(d) 1/3V

34. A resistor 30Ω , inductor of reactance 10Ω and capacitor of reactance 10Ω are connected in series to an ac source voltage source $v =300\sqrt{2}\sin\omega t$. The current in the circuit is

(a) $10\sqrt{2}$A

(b) 10A

(c) $30\sqrt{11}$A

(d) 5A

35. Two Conducting circular loops of radii R1 and R2 are placed in the same plane with their centres coinciding .If R1 >>R2 , the mutual inductance M between them will be directly proportional to

(a) R1/R2

(b) R2/R1

(c) $R1^2/R2$

(d) $R2^2/R1$

36. Two similar coils are kept mutually perpendicular such that their centres coincides .At the centre , find the ratio of the magnetic fields due to one coil and the resultant magnetic field by both coils, if the same current is flown

(a)1:√2

(b) 1:2

(c) 2:1

(d) √3:1

37. A stepdown transformer reduces the voltage of a transmission line from 2200V to 220V. the power delivered by it is 880Wand its efficiency is 88%.The input current is

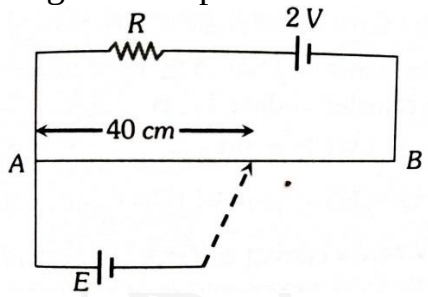
(a) 4.65mA

(b) 0.465mA

(c) 0.4545A

(d) 4.65A

38. AB is a potentiometer wire of length 100cm and its resistance is 10Ω. It is connected in series with a resistance R = 40 Ω and a battery of emf 2V and negligible internal resistance. If a source of unknown emf E is balanced by 40cm length of the potentiometer wire , the value of E is



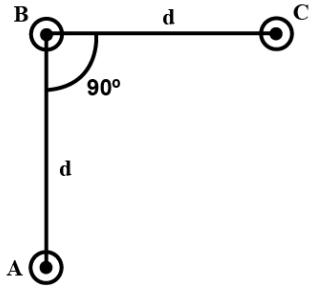
(a) 0.8V

(b) 1.6V

(c) 0.08V

(d) 0.16V

39. An arrangement of three parallel straight wires placed perpendicular to the plane of the paper carrying same current I along the same direction is shown in figure. Magnitude of force per unit length on the middle wire B is given by



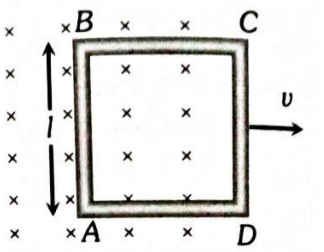
(a) $\mu_0 I^2/2\pi d$

(b)$2\ \mu_0 I^2/\pi d$

(c) $\sqrt{2}\ \mu_0 I^2/\pi d$

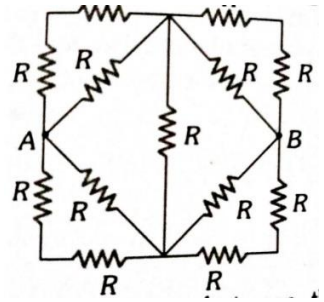
(d) $\mu_0 I^2/\sqrt{2}\pi d$

40. A conducting square loop of side l and resistance R moves in the plane with a uniform velocity v perpendicular to one of its side .A magnetic induction B constant in time and space , pointing perpendicular and into the plane of the loop exists everywhere with half of the loop outside the field , as shown in the figure . The induced emf is



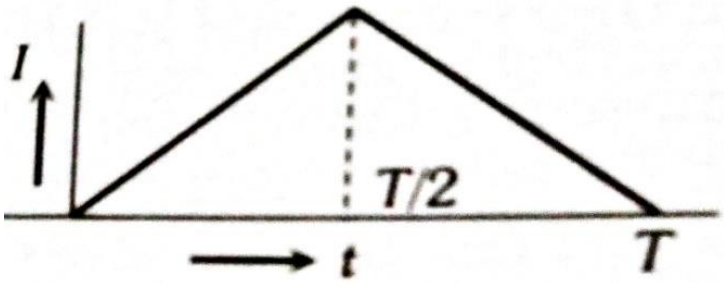
(a) zero
(b)RvB
(c)vBl /R
(d)vBl

41. Thirteen resistances each of resistance Rare connected in the circuit as shown in the figure below.The effective resistance between A and B is

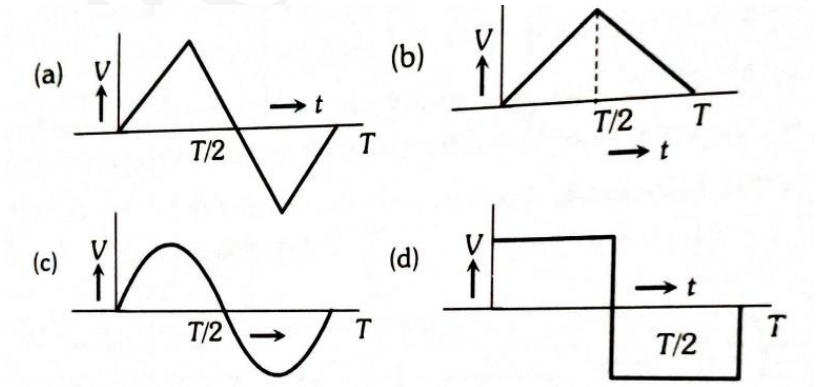


(a) 2R Ω
(b)4R/3 Ω
(c)2R/3 Ω
(d)RΩ

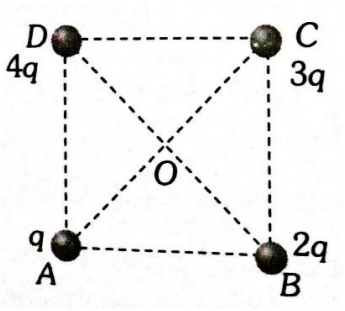
42. The current in the inductance is varying with time according to the plot shown in the figure



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



43 . Charges q , 2q , 3q and 4q are placed at the centres ABC and D of a square as shown. The direction of electric field at the centre of the square is along



(a) AB

(b) CB

(c) BD

(d) AC

44. A parallel plate capacitor with air as medium between the plates has a capacitance of 10μF. The area of capacitor is divided into two equal halves and filled with two media having dielectric constant k_1=2 and k_2 = 4 .the capacitance of the system will now be

(a) 10μF

(b)20 μF

(c)30 μF

(d)40 μF

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

(a)If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

45 Assertion (A): If an ammeter is connected in parallel with a resistor , it will show non zero reading , whether it is an ideal or non ideal ammeter

Reason : An ammeter will show the current through a resistor only if it is connected in series with it

46. Assertion : The electrostatic force between the plates of a charged isolated capacitor decreases when dielectric fills whole space between plates.

Reason :The electric field is zero between the plates of a charged isolated capacitance

47. Assertion : If a charged particle released from rest in a region of both uniform electric field E and uniform magnetic field B moves along a straight line , it must move /do so with uniform acceleration

Reason : Action of magnetic field on a charged particle cannot change its kinetic energy

48. Assertion : The induced emf and current will be same in two identical loops of copper and aluminium, when rotated with same speed in the same magnetic field.

Reason : Mutual induction does not depend on the orientation of the coils.

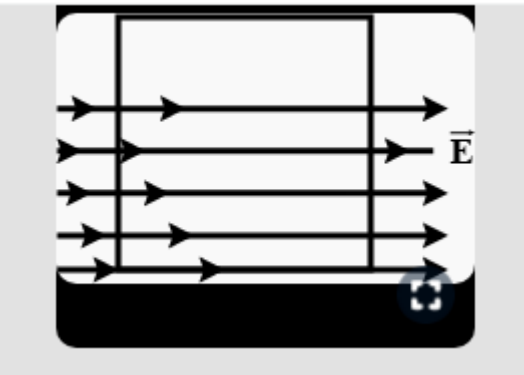
49. Assertion :The alternating current lags behind the emf by a phase angle of, $\pi/2$ when AC flows through an inductor.

Reason : The inductive reactance increases as the frequency of AC source increases

Section C

This section consists of 6 multiple choice questions with an over all 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 square surface of side L meter is in the plane of the paper .A uniform electric field E also in the plane of the paper , is limited only to the lower half of the square as shown in the diagram . the electric flux in SI units associated with the surface is



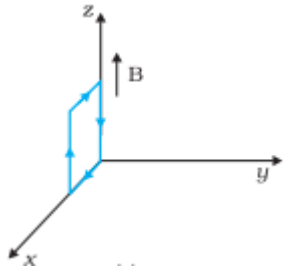
(a) zero

(b)EL^2

(c) $EL^2/2\epsilon_0$

(d) $EL^2/2$

51. A uniform magnetic field of 3000 G is established along the positive z-direction. A rectangular loop of sides 10 cm and 5 cm carries a current of 12 A. What is the torque on the loop



(a) – 0.018i

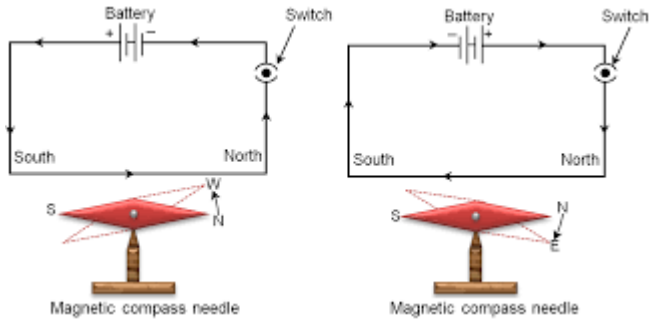
(b) 0.018 i

(c) 1.8 i

(d) zero

Case study : Read the following paragraph and answer the questions:

Both electricity and magnetism have been known for more than 2000 years .But their intimate relationship was discovered only 200 years ago .Oersted discovered in the year 1820 that a straight wire carrying current caused a noticeable deflection in a nearby magnetic compass needle



A moving charge can experience a force in magnetic field .The force acting on a moving charge depends on the direction of motion and the direction of the magnetic field . The path followed by the charge particle also depends on this. The charge can move in straight line , circular path and helical path according to the direction of motion and the direction of the magnetic field .

52.A proton and an alpha particle enters with same kinetic energy in to a uniform magnetic field with direction of motion perpendicular o the direction of the magnetic field.The ratio of the radii of the circular path
(a)1:1
(b) 1:2
(c) 2:1
(d) 1:4

53. Identify the physical quantity that remains the same when a charged particle enters perpendicular to a uniform magnetic field
(a) Velocity
(b) Momentum
(c) Kinetic energy
(e) Acceleration

54. An electron enters into a magnetic field perpendicular to the direction of the magnetic field . The magnetic field is directed along the positive x direction and the electron is moving along the positive y direction . The direction of magnetic Lorentz force is
(a) Along Z axis
(b) Along -Z axis
(c) Along Y axis
(d) Along -X axis
55. A proton moving with velocity v is acted upon by electric field E and magnetic field B The proton will move undeflected if
(a) E is perpendicular to B
(b) E is parallel to v and perpendicular to B
(c) E , B and v are mutually perpendicular and and v is E/B
(d) E and B both are parallel to v

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Kendriya Vidyalaya Sangathan, Ernakulam Region
Sample question paper 2 (2021-22)
Term 1
Subject : Physics (042)

Time : 90Min **Max Mark : 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 any20 questions.*
4. *Section C has 6 questions. Attempt any 5 questions.*
5. *All questions carry equal marks.*

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 There are two metallic sphere of same radii one is solid and the other is hollow, then

(a) solid sphere can be given more charge
(b) hollow sphere can be given more charge
(c)they can be charged equally(maximum)
(d) none of the above

2 Consider the situation of figure. The work done in taking a point charge from P to A is W_A, from P to B is W_B and from P to C is W

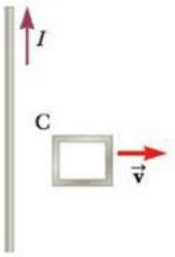
(a) $W_A < W_B < W_C$
(b) $W_A > W_B > W_C$
(c) $W_A = W_B = W_C$
(d) None of these.

3 A current of 10 ampere is flowing in a wire of length 1.5 m. A force of 15 N acts on it when it is placed in a uniform magnetic field of 2 T. The angle between the magnetic field and the direction of the current is
$(a)90^o \ (b)0^o \ (c)30^o \ (d)60^o$

4 A hollow insulated conducting sphere is given a charge of 20μC. What will be the electric field at the centre of the sphere if the radius of the sphere is 1m?
(a) 5N/C (b) 20N/C (c) 10N/C (d) zero

5 A current carrying rectangular coil is placed in a uniform magnetic field. In which orientation, the coil will not tend to rotate
(a) The magnetic field is parallel to the plane of the coil
(b) The magnetic field is perpendicular to the plane of the coil
(c) The magnetic field is at 45° with the plane of the coil
(d) Never in any orientation

6 A rectangular coil is moving away from a current carrying conductor as shown in the figure. Predict the direction of induced current in the coil



(a) Anticlockwise
(b) Clockwise
(c) No current is induced
(d) Current direction changes with time

7 Two cells of emf s E_1 and E_2 and internal resistance r_1 and r_2 are connected in parallel. Then the emf and internal resistance of the source is
(a) E_1+E_2 and $\frac{r_1 r_2}{r_1+r_2}$
(b) $E_1 - E_2$ and $\frac{r_1 r_2}{r_1+r_2}$
(c) $\frac{E_1 r_2+E_2 r_1}{r_1+r_2}$ and $\frac{r_1 r_2}{r_1+r_2}$
(d) $\frac{E_1 r_2+E_2 r_1}{r_1+r_2}$ and $r_1 + r_2$

8 When current in a coil changes from 5 A to 2 A in 0.1 s, average voltage of 30 V is produced. The self-inductance of the coil is
(a) 1 H (b) 1 mH (c) 10 H (d) 0.1 H

9 An electron and a proton are moving parallel to each other in a magnetic field. The magnetic force acting on the proton is:
(a) 1840 times that on electron
(b) $\frac{1}{1840}$ times that on electron
(c) same as that on electron
(d) slightly more than that on electron

10 A charge 3mC experiences a force of 30N when placed in a uniform electric field. The potential difference between 2 points separated by a distance of 1cm along the field line is

(a) 10 V
(b) 100 V
(c) 10^{-2} V
(d) 10^{4} V

11 A potentiometer experiment is set up to compare the e.m.f.s E_1, and E_2, of two cells. When the null point is obtained, the current is drawn from

(a) Only from cell E1
(b) Only from cell E2
(c) Only from driver cell
(d) Driver cell, E1 and E2

12 If the value of capacitance in a LCR series circuit is decreased, the resonant frequency

(a) Unaffected
(b) Increases
(c) Decreases
(d) Reduces to zero

13 **Select the correct statements from the following.**

I. The electric field due to a charge outside the Gaussian surface contributes zero net flux through the surface.
II. Total flux linked with a closed body, not enclosing any charge will be zero.
III. Total electric flux, if a dipole is enclosed by a surface is zero.

(a) I and II
(b) II and III
(c) I and III
(d) I, II and III

14 The angle of dip at a place on earth is 60^{o}. Then

(a) Vertical component of magnetic field is $\sqrt{3}$ times that of horizontal component
(b) Horizontal component of magnetic field is $\sqrt{3}$ times that of vertical component
(c) Vertical component of magnetic field is $\frac{1}{\sqrt{3}}$ times that of horizontal component
(d) Horizontal component of magnetic field is $\frac{1}{\sqrt{3}}$ times that of vertical component

15 An AC voltage source of variable angular frequency ω and fixed amplitude V_0 is connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When ω is increased then,

(a) The bulb glows dimmer

(b) The bulb glows brighter

(c) Total impedance of the circuit is unchanged

(d) Total impedance of the circuit increases.

16 Three charges each equal to 4μC is placed at the three vertices of an equilateral triangle. If the force acting between any pair is F , the net force acting on each charge will be

$(a)\sqrt{3}F$

$(b)\ F$

$(c)\sqrt{2}F$

$(d)\ 2\ F$

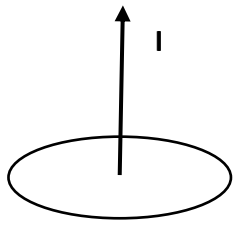
17 Two resistors of resistance 5 Ω and 20 Ω are connected parallel in the left arm of a metre bridge. If the null point is at 40cm from left end of the wire, the resistance connected in the right arm is

(a) 3 Ω (b) 6 Ω (c) 30 Ω (d) 8 Ω

18 The current 'I' in a wire passing normally through the centre of a conducting loop

is increasing at a constant rate in the direction . Then

a) Flux linked with the loop is always zero
b) Flux linked increases as current increases
c) The induced current will be anticlokwise
d) The current induced is clockwise



19 A parallel plate capacitor with air between the plates has a capacitance of 8 pF .What will be the capacitance if the distance between the plates be reduced to half and the space between them is filled with a substance of dielectric constant K= 5.

(a) 40pF (b) 80pF (c) 13pF (d) 20pF

20 A cell of internal resistance 3 ohm and emf 10 volt is connected to a uniform wire of length 500cm and resistance 3 ohm. The potential gradient in the wire is

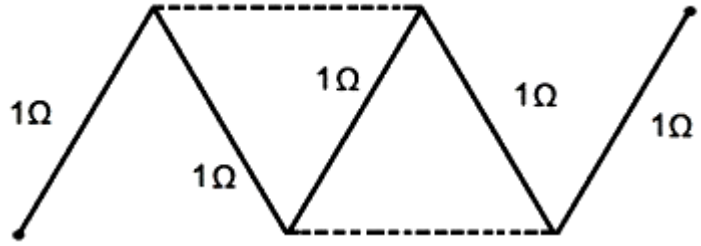
(a) 30 mV/cm (b) 10 mV/cm

(c) 20 mV/cm (d) 4 mV/cm

21 A hollow charged metal sphere has radius r. If the potential difference between its surface and a point at a distance 3r from the centre is V, then the electric field intensity at a distance 3r is

(a) $\frac{V}{2r}$ (b) $\frac{V}{3r}$ (c) $\frac{V}{6r}$ (d) $\frac{V}{4r}$

22 A circuit consists of five identical conductors as shown in figure.



Two similar conductors are added as indicated by dotted lines.The ratio of resistance before and after the addition will be

(a) 7/5 (b) 3/5 (c) 5/3 (d) 6/5

23 If a shunt of $\frac{1}{10}th$ of coil resistance is connected to a Moving coil galvanometer, its sensitivity becomes

$(a)10\ times$

$(b)11\ times$

$(c)\frac{1}{10}\ times$

$(d)\frac{1}{11}\ times$

24 A moving coil galvanometer has 150 equal divisions. Its current sensitivity is 10 div/milliampere and voltage sensitivity is2 div/millivolt. In order that each division to read 1volt, the resistance needed to be connected in series with the galvanometer is

(a)9995 Ω (b)10^3 Ω (c)99995 Ω (d)10^2 Ω

25 The phase difference between the flux linkage and emf induced in a rotating coil in a uniform magnetic field is

(a)$\frac{\pi}{6}$

(b)$\frac{\pi}{2}$

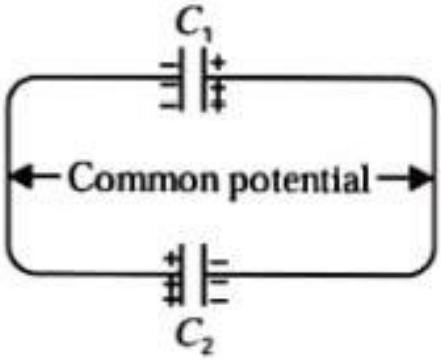
(c)$\frac{\pi}{4}$

(d)π

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 Two capacitors C_1 and C_2 are connected in parallel to a battery of V volt. After disconnecting from the battery, they are connected as shown in figure. The common potential difference is



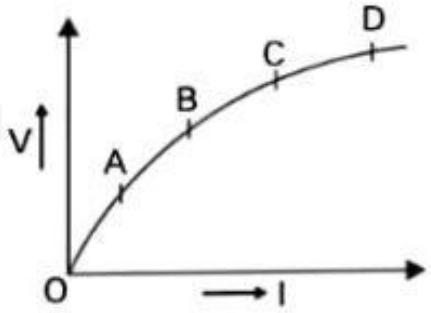
(a) $(Q_1 + Q_2)(C_1 + C_2)$

(b) $\frac{Q_1\, Q_2}{(C_1+C_2)}$

(c) $\frac{(Q_1+ Q_2)}{(C_1+C_2)}$

(d) $\frac{Q_1\, Q_2}{(C_1 C_2)}(C_1 + C_2)$

27 The current I versus Voltage V applied across the ends of a conductor is as shown. The resistance at



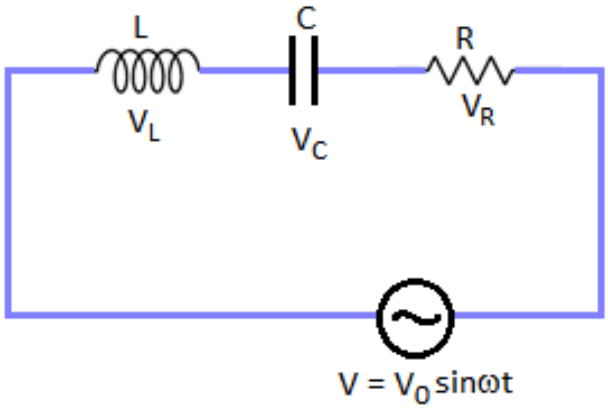
(a) B is greater than A

(b) C is smaller than D

(c) A is greater than B

(d) D is the highest value

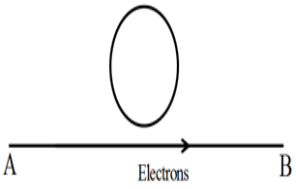
28 An inductor L, a capacitor C and a resistor R are connected in series to an AC source of potential difference V volts.



The p.d across L,C and R are 40V, 10V and 40V respectively. The amplitude of current flowing through the circuit is $10\sqrt{2}\ A$. The impedance of circuit is

(a) 5Ω (b) $4\sqrt{2}\ \Omega$ (c) $5\sqrt{2}\ \Omega$ (d) 4Ω

29 A stream of electrons is moving along the line AB lying in the same plane as a circular conducting loop. Select the correct options from the following.



.(a) A current will be induced in clockwise direction as seen from above

(b) A current will be induced in anticlockwise direction as seen from above

(c) No current will be induced in the coil

(d) A current will be induced and will change direction as electrons move towards and away from the coil

30 A power line lies along the east-west direction and carries a current of 10 ampere. The force per metre due to the earth's magnetic field of 10^{-4} T is

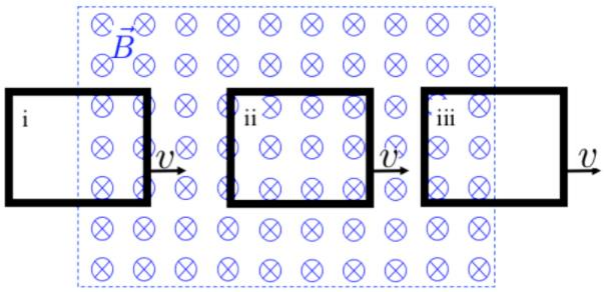
$(a) 10^{-5} N$

$(b) 10^{-4} N$

$(c) 10^{-3} N$

$(d) 10^{-2} N$

31 A rectangular metallic loop is moving through a uniform magnetic field with constant velocity 'v'. Three positions of the motion are shown here as (i) ,(ii) and (iii). Choose the correct statement



(a)Equal currents will be induced in the same direction for (i) and (iii)
(b)Greater current is induced in (ii) compared to positions (i) and (iii)
(c)No current is induced in case (ii)
(d)All the three cases equal currents will be induced

32 A transformer is used to light 100 W and 110 V lamp from a 220 V mains. If the main current is 0.5 A. Then the efficiency of the transformer is nearly
(a) 11%
(b) 50%
(c) 80%
(d) 90%

33 When the current *i* is flowing through a conductor, the drift velocity is *v* If 2*i* current is flowed through the same metal but having half the area of cross-section, then the drift velocity will be
(a) *v* / 4
(b) *v* / 2
(c) *v*
(d) 4*v*

34 When the current through a solenoid increases at a constant rate, the induced current:
(a) is a constant and is in the direction of inducing current.
(b) is a constant and is opposite to the direction of the inducing current.
(c) increases with time and is in the direction of the inducing current.
(d) increases with time and is opposite to the direction of the inducing current.

35 Two spheres of radii 12cm and 16cm have equal charges. The ratio of their energies
(a) 3:4
(b) 1:2
(c) 2:1
(d) 4:3

36 A straight wire carrying current I is turned into a circular loop. If the magnetic moment of the loop is M units, the length of the wire is

(a) $\frac{\sqrt{\pi M}}{4I}$

(b) $\sqrt{\frac{4\pi M}{I}}$

(c) $\frac{\pi M}{4I}$

(d) $\frac{M}{4\pi I}$

37 A cell can be balanced at 100cm and 110cm respectively on a potentiometer wire with and without being short circuited through a resistance 10 Ω. The internal resistance of the cell is

(a) 1 Ω (b) 0.5 Ω (c) 2 Ω (d) zero

38 Which of the following statements is/are correct ?

I. In LCR series ac circuit, as the frequency of the source increases, the impedance of the circuit first decreases and then increases.

II. If the net reactance of an LCR series ac circuit is same as its resistance, then the current lags behind the voltage by 45°.

III. Below resonance, voltage leads the current while above it, current leads the voltage.

(a) I only
(b) II only
(c) I and III
(d) I and II

39 Through two parallel wires A and B, 10 and 2 ampere of currents are passed respectively in opposite direction. If the wire A is infinitely long and the length of the wire B is 2 m, the force on the conductor B, which is situated at 10 cm distance from A will be

$(a) 8 \times 10^{-5} N$

$(b) 4 \times 10^{-7} N$

$(c) 4 \times 10^{-7} N$

$(d) 4\pi \times 10^{-7} N$

40 Potential at any point inside a charged hollow sphere

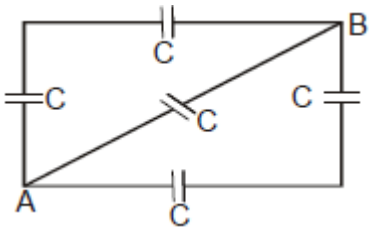
(a) increases with distance from the centre

(b) is a constant

(c) decrease with distance from the centre

(d) is zero at every point inside

41 The equivalent capacitance between the points A & B of five identical capacitors each of capacity 2 μ F



(a) 1μ F (b) 10μ F (c) $\frac{2}{5}\mu$ F (d) $4\mu F$

42 A small piece of metal wire is dragged across the pole pieces of a magnet in 0.4sec. If change in magnetic flux is $8x10^{-4}$ Wb, the magnitude of emf induced

(a) $3.2x10^{-4}$ V
(b) $4x10^{-4}$ V
(c) $2x10^{-4}$ V
(d) $2x10^{-3}$ V

43 The direction of magnetic field lines is

(a)Across the magnet
(b)From South pole to North pole
(c)From North to South pole
(d)From South to North pole inside the magnet and from North to South outside the magnet.

44 27 drops of same size are charged at 220V each. They are combined to form a bigger drop. The potential of the bigger drop is

(a) 1520V
(b) 1320V
(c) 660V
(d)1980V

45 Assertion: There may be an induced emf in a loop without induced current.

Reason : Induced current depends on the resistance of the loop as well.

(a) Both assertion and reason are correct and reason is the correct explanation of assertion
(b) Both assertion and reason are correct but the reason is not the correct explanation of assertion
(c) Assertion is correct and reason is false
(d) Both assertion and reason are false

46 Assertion : Electrons move away from the region of lower potential towards region of positive potential

Reason: Electrons are negatively charged.

(a) Both assertion and reason are correct and reason is the correct explanation of assertion

(b) Both assertion and reason are correct but the reason is not the correct explanation of assertion

(c) Assertion is correct and reason is false

(d) Both assertion and reason are false

47 Assertion : An inductor and a capacitor are called low pass filter and high pass filter respectively.

Reason : Reactance of an inductor is low for low frequency signals and that of a capacitor is high for high frequency signals.

(a) Both assertion and reason are correct and reason is the correct explanation of assertion

(b) Both assertion and reason are correct but the reason is not the correct explanation of assertion

(c) Assertion is correct and reason is false

(d) Both assertion and reason are false

48 Assertion: The resistivity of semiconductors increase with temperature

Reason : The electrons in semiconductors vibrate with more energy as compared to metals

(a) Both assertion and reason are correct and reason is the correct explanation of assertion

(b) Both assertion and reason are correct but the reason is not the correct explanation of assertion

(c) Assertion is correct and reason is false

(d) Both assertion and reason are false

49 Assertion : Potentiometer of longer length is suitable for accurate measurement.

Reason : The potential gradient is greater for potentiometer with greater length

(a) Both assertion and reason are correct and reason is the correct explanation of assertion

(b) Both assertion and reason are correct but the reason is not the correct explanation of assertion

(c) Assertion is correct and reason is false

(d) Both assertion and reason are false

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 The potentiometer of length 1m is connected in series with 490 Ω resistance and battery of 2V. If the potential gradient is 0.2mV/cm, the resistance of the potentiometer wire is

(a) 4.9 Ω

(b) 7.9 Ω

(c) 6.9 Ω

(d) 5.9 Ω

51 A uniform conducting wire of length '12a' and resistance R is wound up as a current carrying coil in the shape of

I) Equilateral triangle of side 'a'

II) Square of side 'a'

The magnetic dipole moment of the coil in each case respectively are (a) $4Ia^2$ and $3Ia^2$

$(b)\sqrt{3}$ Ia^2 and $3Ia^2$

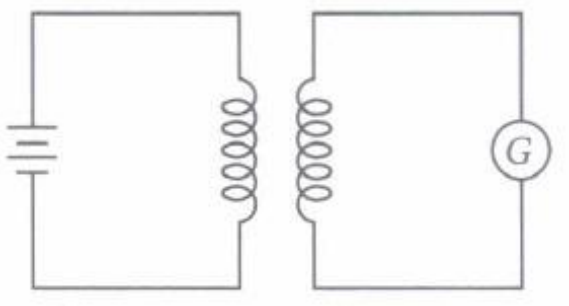
$(c)3$ Ia^2 and Ia^2

$(d)\sqrt{3}$ Ia^2 and $4Ia^2$

Case Study

Mutual inductance is the phenomenon of inducing 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 relative separation between them. Mutual inductance between the two coils increases $\mu_r$times if the coils are wound over an iron core of relative permeability μ_r

52



If a change in current of 0.01 A in one coil produces a change in magnetic flux of 2 x $l0^{-2}$ weber in another coil, then the mutual inductance between coils is

(a) 0.5 H (b) 1.0 H (c) 2.0 H (d) 3.0 H

53 Mutual inductance between a pair of coils can be increased by

(a) Increasing the number of turns of the coils
(b) Using ferromagnetic materials as core
(c) Increasing the length of the coils
(d) All the above

54 The mutual inductance between two coils is 1.25 H. If the current in the primary changes at 80amp/sec, what will be the magnitude of induced emf in the secondary?

(a) 64.0 V
(b) 0.016 V
(c) 100.0 V
(d) 1.25 V

55 Which of the following units can not be used for expressing Mutual inductance

(a) Wb/Amp
(b) Henry
(c) Vs/Wb
(d) Tm^2

Kendriya Vidyalaya Sangathan, Ernakulam Region
Sample question paper 3 (2021-22)
Term 1
Subject : Physics (042)

Time : 90Min **Max Mark : 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 any20 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 A charge q exerts some force on an identical charge q. A third charge 2q is placed at midpoint of line joining of charges. Then, force exerted by q on 2q will be :
(a) increase by 4 times
(b) decrease by 4 times
(c)remain unchanged
(d) increase by 8 times

2 Two positive charges of 10 μC and 20 μC are one m apart. The amount of work done in bringing them close to each other by 50 cm will be:
(a) 8.1J
(b) 1.8J
(c) 18
(d) 0.18 J

3 Two spheres have their surface charge densities in the ratio of 2 : 3 and their radii 3 : 2. The ratio of the charges on them is:
(a) 3:2
(b) 4:2
(c) 2:3
(d) 2:4

4 An electric dipole of moment p is placed parallel to the uniform electric field. The amount of work done in rotating the dipole by 90 degrees is-
(a) 2pE
(b) pE
(c) pE/2
(d)zero

5 An electric current is passed through a circuit containing two wires of same material, connected in parallel. If the lengths and radii of the wires are in the ratio of 3:2 and 2:3, then the ratio of the current passing through the wire will be
(a) 2:3
(b) 3:2
(c) 8:27
(d) 27:8

6 The filament of 60W and 100 W bulbs are of same length. Then:
(a) 60W filament is thicker
(b) 100W filament is thicker
(c) both are of same thickness
(d) both cannot have same length

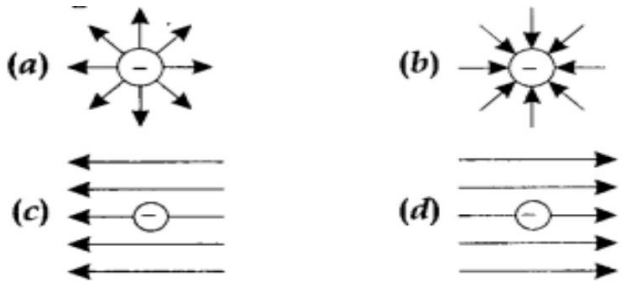
7 To send 10% of the main current through a moving coil galvanometer of resistance 99ohm the shunt required is
(a) 9.9 ohm
(b) 10ohm
(c) 11 ohm
(d) 9 ohm

8 . Where on the surface of Earth is the vertical component of Earth' s magnetic field zero?
(a) at north pole
(b) at South pole
(c) at Equator
(d) none of these

9 The magnetic flux linked with the coil (in Weber) is given by the equation: $\Phi = 5t^2 + 3t + 16$ The induced EMF in the coil at time, t=4 will be-
(a) -27 V
(b) -43 V
(c) -108 V
(d) 210 V

10 Which of the following statements is not correct?
(a) When the magnetic flux linked with a circuit change, an emf is induced in circuit.
(b) The induced emf lasts so long as the change in magnetic flux continues.
(c) The direction of induced emf is given by Lenz's law.
(d) Lenz's law is a consequence of the law of conservation of Charge

11 Which of the following figures represent the electric field lines due to a single negative charge?



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12 . Drift velocity of the free electrons in a conducting wire carrying a current i is v. If in a wire of the same metal, but of double the radius, the current be 2i then the drift velocity of the electrons will be
(a) v/4
(b) v/2
(c) v
(d) 4v

13 A cell of 2 V and internal resistance 0.1 ohm is connected to 93.9 ohm external resistance. The potential difference across the terminal of the cell is
(a) 19.5V
(b) 1.95V
(c) 0.195V
(d) 195 V

14 The magnetic field inside the solenoid is
(a) directly proportional to its length
(b) inversely proportional to number of turns
(c) inversely proportional to current
(d) directly proportional to current

15 To convert a galvanometer into a voltmeter,
(a) a high resistance is connected in parallel
(b) a low resistance is connected in parallel
(c) a high resistance is connected in series
(d) a low resistance is connected in series

16 A charge q is moving with a velocity parallel to a magnetic field B. Force on the charge due to magnetic field is
(a) zero
(b)B
(c)qvB
(d) qv/B

17 The current flows from A to B as shown in the figure. The direction of induced current in the loop is

(a) clockwise
(b) anticlockwise
(c) straight line
(d) none of these

18 Current in a circuit falls from 5.0 A to 0 A in 0.1 s. If an average emf of 200 V is induced, the self-inductance of the circuit is
(a) 4H
(b) 16 H
(c) 2H
(d) 8H

19 Alternate current cannot be measured by DC ammeter because
(a) AC cannot pass through DC ammeter
(b) AC changes direction
(c) Average value of current of complete cycle is zero
(d) DC ammeter will get damaged.

20 The angular frequency of AC at which a coil of inductance 1 mH has a reactance of 1ohm is
(a) 10^3
(b)10
(c) 10^{-3}
(d)1

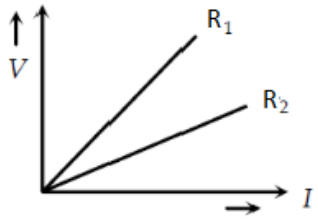
21 Current in a conductor is due to
(a) motion of positive ions
(b)motion of free electrons
(c) free electrons and protons
d) protons

22 A wire of length l is stretched to a length 2l; then its resistance
(a) increases four times
(b) decreases to1/4 of the original value
(c) increases two times
(d) does not change

23 Kirchhoff's first and second laws are respectively based on conservation of
(a) charge and energy
(b) force and velocity
(c) momentum and energy
d) mass and energy

24 At resonance the impedance of the circuit is
(a) Maximum
(b) Minimum
(c) Zero
(d) Depends on the frequency of circuit

25 The voltage V and current I graph for a two conductors A and B having resistance R_1 and R_2 is shown in the figure. The relation between R_1 and R_2 is



(a) $R_1 = R_2$
(b) $R_1 < R_2$
(c) $R_1 > R_2$
(d) $R_1 \approx R_2$

SECTION B

26 A 40 μF capacitor is connected to a 200 V, 50 Hz ac supply. The r.m.s value of the current in the circuit is, nearly
(a) 1.7 A
(b) 2.05 A
(c) 2.5 A
(d) 25.1 A

27 A capacitor of capacity *C* has reactance *X*. If capacitance and frequency become double then reactance will be
(a) 4*X*
(b) *X*/2
(c) *X*/4
(d) 2*X*

28 A bulb connected in series with a solenoid is lit by an AC source. If a soft iron core is introduced in the solenoid then,

(a) the bulb will glow brighter

(b) the bulb will glow dimmer

(c) there will be no effect on the light produced by the bulb
(d) bulb may glow more brighter or dimmer

29 The self inductance of long solenoid cannot be increased by

(a) increasing its area of cross section

(b) increasing its length

(c) changing the medium with greater permeability

(d) Increasing the current through it.

30 A bar magnet of dipole moment 'm' cut into two equal pieces transverse to its length. Dipole moment of each part is

a) Remain same

b) m/2

c) 2m

d) none of the above

31 Which of the following statements is true for two parallel conductors carrying currents?

a) The conductors repel each with unequal forces if currents are parallel

b) The conductors repel each with unequal forces if currents are antiparallel

c) The conductors attract each with unequal forces if currents are parallel

d) The conductors exert equal and opposite forces on each other irrespective of the directions of currents

32 A wire in the form of a circular loop, of one turn carrying a current, produces magnetic field B at the centre. If the same wire is looped into a coil of two turns and carries the same current, the new value of magnetic field at the centre is

(A) B

(B) 2 B

(C) 4 B

(D) 8 B

33 Two concentric coils each of radius 2π cm are placed at right angles to each other, 3A and 4 A are the currents flowing through them respectively anticlockwise. Find the magnetic field in Wb/m^2 at the centre of the coils.

(a) 10^{-5}

(b) 12×10^{-5}

(c) 7×10^{-7}

(d) 5×10^{-7}

34 The ratio of magnetic fields at the centre of a circular current carrying loop and on the axis at a distance equal to its radius is

(a) $2\sqrt{2}$

(b) $1/2\sqrt{2}$

(c) $\sqrt{2}$

(d) $1/\sqrt{2}$

35 An alpha particle and proton having same momentum enter into a region of uniform magnetic field and move in a circular path. The ratio of the radii of curvatures of their paths:

a) 1

b) ¼

c) ½

d) 4

36 A small magnet is pivoted to move freely in the magnetic meridian. At what place on the surface of the earth will the magnet be vertical?

(a) at pole

(b) at the place where angle of dip is 45^0

(c) at Equator

(d) none of these

37 Which one of the following statements is wrong?

(A) Eddy currents are produced in a steady magnetic field.

(B) Eddy current is used to produce braking force in moving trains.

(C) Eddy currents is minimized by using laminated core.

(D) Induction furnace uses eddy current to produce heat

38 . In an ideal transformer, the voltage is stepped down from 11 kV to 220 V. If the primary current be 100 A, the current in the secondary should be

a) 5 kA

b) 1 kA

c) 0.5 kA

d) 0.1 KA

39 A generator produces a voltage that is given by $V = 240 \sin 120\, t$, where t is in seconds. The frequency and *r.m.s.* voltage is

(a) 60 *Hz* and 240 V

(b) 19 *Hz* and 120 V

(c) 19 *Hz* and 170 V

(d) 754 *Hz* and 70 V

40 In meter bridge, the balancing length from left end when standard resistance of 1 Ω is in right gap is found to be 20 cm. The value of unknown resistance is

(a) 0.25 Ω

(b) 0.4 Ω

(c) 0.5 Ω

(d) 4 Ω

41 Equal potentials are applied on an iron and copper wire of same length. In order to have same current flow in the wire, the ratio of their radii must be [Given that specific resistance of iron = 1.0×10^{-7} Ωm and that of copper = 1.7×10^{-8} Ωm]

(a) About 1.2

(b) About 2.4

(c) About 3.6

(d) About 4.8

42 For a cell of e.m.f. 2 V, a balance is obtained for 50 cm of the potentiometer wire. If the cell is shunted by a 2 ohm resistor and the balance is obtained across 40 cm of the wire, then the internal resistance of the cell is :

(A) 1 ohm (B) 0.5 ohm (C) 1.2 ohm (D) 2.5 ohm

43 The temperature coefficient of resistance for a wire is0. 00125 /°C . At 27°*C* its resistance is 1 *ohm*. The temperature at which the resistance becomes 2 *ohm* is

(A) 1154 *K*

(B) 1100 *K*

(C)1400 *K*.

(D) 1127 *K*

44 Twenty-seven drops of mercury are charged simultaneously to the same potential of 10 volts. What will be potential if all the charged drops are made to combine to form one large drop ?

(a) 180 V
(b) 90 V
(c) 120 V
(d) 45 V

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 (A):** A proton is placed in a uniform electric field, it tend to move along the direction of electric field.

Reason(R): A proton is placed in a uniform electric field it experiences a force

46 **Assertion**: A balance point is obtained on the potentiometer wire if the fall of potential along the potentiometer wire due to driving cell is greater than the EMF of the cell to be balanced.

Reason: It measures the EMF of a cell very accurately.

47 **Assertion:** No force is exerted on stationary charge in magnetic field.

Reason: A stationary source does not produce any magnetic field to interact with an external magnetic field

48 **Assertion :** Acceleration of a magnet falling through a long solenoid decreases.

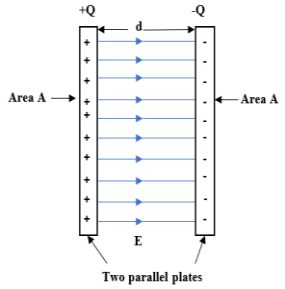
Reason : The induced current produced in a circuit always flow in such direction that it opposes the change to the cause that produced it

49 **Assertion**: Power transmission is carried at high voltage, low current

Reason: As voltage is increases, the power loss in transmission increases

SECTION C

50 A parallel plate air capacitor has a capacitance 18μF. If the distance between the plates is tripled and a dielectric medium is introduced, the capacitance becomes 72μF. The dielectric constant of the medium is



(a) 4
(b) 9
(c) 12
(d) 2

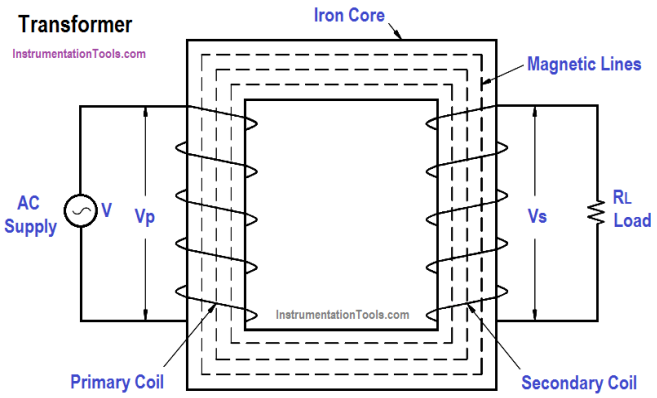
51 The charges on two spheres are +7mC and –5mC respectively. They experience a force F. If each of them is given an additional charge of –2mC, the new force of attraction will be

(A)F

(B) F/2

(C) F/3
(D)2F

CASE STUDY



A transformer is essentially an a.c. device. It cannot work on d.c. It changes alternating voltages or currents. It does not affect the frequency of a.c. It is based on the phenomenon of mutual induction. A transformer essentially consists of two coils of insulated copper wire having different number of turns and wound on the same soft iron core. For a step up transformer, K>1 and for a step down transformer, K<1, K being the turns ratio .

52 In a step up transformer , if ratio of turns of primary to secondary is 1:10 and primary voltage is 230 *V*. If the load current is 2*A*, then the current in primary is

(a) 20 *A*

(b) 10 *A*

(c) 2 *A*

(d) 1 *A*

53 Voltage across the secondary of transformer is

A. 23V

B. 230V

C. 2300V

D. 23KV

54 Find the output power, provided the transformer is 80% efficient

A. 368W

B. 3.68KW

C. 3680W

D. None of these

55 Before transmission, the voltage of a.c. is _____ with the help of a _____ transformer.

A. Reduced, Step down

B. Reduced, Step up

C. Increased, Step down

D. Increased, Step up

Kendriya Vidyalaya Sangathan, Ernakulam Region
Sample question paper 4 (2021-22)
Term 1
Subject : Physics (042)

Time : 90Min **Max Mark : 35**

GENERALINSTRUCTIONS

- The Question paper contains three sections
- SectionAhas25questions.Attemptany20questions.
- SectionBhas24questions.Attemptany20questions.
- SectionChas6questions.Attemptany5questions.
- All questions carry equal marks.
- There is no negative marking.

SECTIONA

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. The flux is zero inside a gaussian surface means

   A. No charge present inside the gaussian surface
   B. Uniform electric field inside the gaussian surface
   C. Discontinuous field inside the surface
   D. Some charge present inside the gaussian surface

2. An electric dipole of moment p is placed parallel to the uniform electric field. The amount of work done in rotating the dipole by 90 degree.

   A. 2 PE
   B. PE
   C. PE/2
   D. ZERO

3. Which of the following charges is not possible?

   A. 1.6×10^{-18}
   B. 1.6×10^{-19}
   C. 1.6×10^{-20}
   D. None of the above

4. A battery with negligible internal resistance is connected with 10 m long wire. A standard cell gets balanced on 600 cm length of this wire. On increasing the length of potentiometer wire by 2 m, the null point will be displaced by

   A. 200cm
   B. 120 cm
   C. 720 cm
   D. 600cm

5. If a wire is stretched to make it 0.1% longer, its resistance will be

   A. A Increase by 0.2%
   B. decrease by 0.2%
   C. decrease by 0.5%
   D. increase by 0.5%

6. The electrostatic force on a small sphere of charge o.4microcoulumb due to another charge -o.8microcolumb in air is 0.2N. what is the distance between two sphres?

   A. 12cm
   B. 0.12mm
   C. 0.12cm
   D. 12mm

7. The horizontal component of earth's magnetic field at a place is $\sqrt{3}$ times the vertical component. The angle of dip at that place is

   A. $\pi/6$
   B. $\pi/3$
   C. $\pi/4$
   D. 0

8. Two coils are placed closed to each other. The mutual inductance of then pair of coils depends on

   A. A Rate at which current changes in the two coils
   B. Relative position and orientation of the coils
   C. Rate at which voltage induced across two coils
   D. Currents in the two coils

9. A coil of resistance 300 ohm and self-inductance 1.5 henry is connected to an AC source of frequency 100/π Hz. The phase difference between voltage and current

   A. 0°
   B. 30°
   C. 45°
   D. 60°

10. A transformer having efficiency of 90% is working on 200 v and 3 Kw power supply. If the current in the secondary coil is 6 A, the voltage across the secondary coil and the current in the primary coil respectively are

   A. 300 v, 15 A
   B. 450 V, 15 A
   C. 450 V, 13.5 A
   D. 600 V, 15 A

11. The instantaneous value of the current in an AC circuit is $i = 2\sin(100\pi t + \pi/3)$A. The current at the beginning (t=0) will be

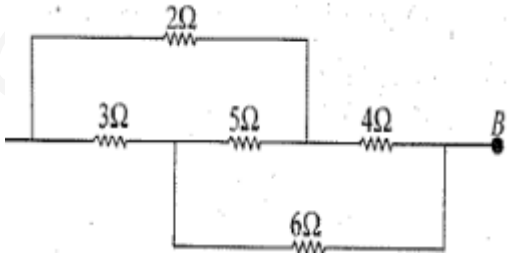
   A. $2\sqrt{3}$A

   B. $\sqrt{3}$A

   C. $\sqrt{3}/2$ A

   D. Zero

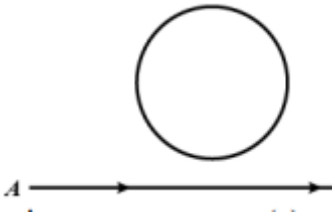
12. In the circuit shown in figure ,some potential difference is applied between A and B. The equivalent resistance between A and B is R, then



   A. R= 20Ω
   B. R=12.5Ω
   C. C R=15Ω
   D. R=3.6Ω

13. The output of a step-down transformer is measured to be 24V when connected to a 12watt light bulb. The value of peak current is

    A. 1/√2 A
    B. B √2A
    C. 2A
    D. 2√2A

14. Near a circular loop of conducting wire as shown in the figure, an electron moves along a straight line. The direction of induced current if any in the loop is 

    A. variable
    B. clock wise
    C. anti clock wise
    D. zero

15. A straight wire of mass 200g and length 1.5m carries a current of 2A. It is suspended in mid-air by uniform horizontal magnetic field B. The magnitude of B (*in Tesla) is (take* $g=9.8m/s^2$*)*

    A. 2
    B. 1.5
    C. 0.55
    D. *0.65*

16. The angle between the true geographic north and the north shown by compass needle is defined as

    A. Inclination
    B. magnetic declination
    C. angle of meridian
    D. magnetic pole.

17. A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole, it

    A. will become rigid showing no movement
    B. will stay in any position
    C. will stay in north-south direction only.
    D. will stay in east-west direction only.

18. If a dipole of moment $\vec{P}$ is placed in a uniform electric field $\vec{E}$, then torque acting on it is given by

A. $\tau = p \,.\vec{E}$
B. $\tau = p \times \vec{E}$
C. $\tau = p + \vec{E}$
D. $\tau = p - \vec{E}$

19. The electric field near a conducting surface having a uniform surface charge density is given by

A. σ /ε0 and is parallel to the surface
B. σ/ ε0 and is normal to the surface
C. 2σ/ ε0 and is parallel to the surface
D. 2σ/ ε0 and is normal to the surface

20. Dimensional formula of electric dipole moment is

A. [M^0LTA]
B. [ML^0TA]
C. [MLT^0A]
D. [$MLTA^0$]

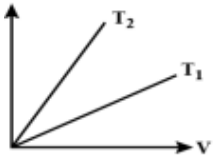
21. A charged particle of mass m and charge q travels on a circular path of radius r that is perpendicular to a magnetic field B. The time taken by the particle to complete one revolution is

A. $2\pi q\ 2\ B/m$
B. $2\pi mq/B$
C. $2\pi m/qB$
D. 2πqB/M

22. A point charge +q, is placed at a distance d from an isolated conducting plane. The field at a point P on the other side of the plane is

A. directed perpendicular to the plane and away from the plane.
B. directed perpendicular to the plane but towards the plane.
C. directed radially away from the point charge.
D. D. directed radially towards the point charge.

23. The voltage V and current I graphs for a conductor at two different temperature T1 and $T2$ are shown in the figure. The relation between $T1$ and $T2$ is



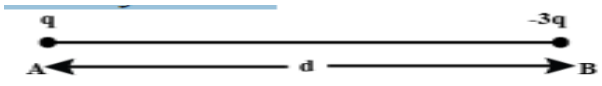
A. $T1 > T2$
B. $T1 < T2$
C. $T1 = T2$
D. $T1 = 1/ T2$

24. If an LCR circuit contains L=8 henry, C=0.5 micro farad , R= 100Ω in series. Then the resonant frequency will be
    A. A 600rad/s
    B. B 500rad/s
    C. 600Hz
    D. 500Hz
25. Two capacitors of capacitances $3\mu F$ and $6\mu F$ are charged to a potential of 12V each. They are now connected to each other, with the positive plate of each joined to the negative plate of the other. The potential difference across each will be
    A. zero
    B. 4V
    C. 6V
    D. 12V

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. Two charges q and -3q are placed fixed on x-axis separated by a distance d. Where should a third charge 2q be placed such that it will not experience any force?



A. $(-\sqrt{3}d)/2$
B. $(d+\sqrt{3}d)/ 2$
C. $(d+3d)/2$
D. $(d-3d)/2$

27. Two metal spheres are separately charged and then brought in contact, so

    A. A total charge on the two spheres is conserved.
    B. total energy of the two spheres is conserved.
    C. Both (a) and (b)
    D. None of the above

28. A proton and an Alpha-particle with the same kinetic energy are moving in circular trajectories in a constant magnetic field. If rp and ra denote respectively the radii of the trajectories of these particles,

    A. rp> ra
    B. rp = ra
    C. rp< ra
    D. Insufficient data.

29. A circular loop of area 1cm2 , carrying a current of 10A is placed in a uniform magnetic field of 0.1T perpendicular to the plane of the loop. The force on the loop due to magnetic field is

    A. Zero
    B. 10^{-4}N
    C. 10^{-2}N
    D. 1 N

30. Two long conductors separated by a distance d carry currents I1 and I2 in the same direction. They exert a force F on each other. Now the current in one of them is increased to two times and its direction is reversed. The distance is also increased to 3d. The new value of the force between them is

    A. 2F
    B. F/3
    C. 2F/3
    D. F/3

31. A circular coil of one turn with radius R carrying a current I has a dipole moment M. Now the coil is opened and rewound to have two turns without altering the current. The new dipole moment of the coil is

    A. M/2
    B. 2M
    C. M
    D. 4M

32. If the rate of change of current of 2A/s induces an emf of 10mV in a solenoid, the self-inductance of the solenoid is

A. $5 \times 10^{-3}H$
B. $8 \times 10^{-3}H$
C. $25 \times 10^{-6}H$
D. 55×10^{-12}H

33. The potential difference across the resistance , capacitance and inductance are 80 V, 40 V, and 100 V respectively in an L C R circuit , the Power factor for this circuit is

A. 0.4
B. 0.5
C. 0.8
D. 1.0

34. AB is a wire of potentiometer with increase in value of resistance R which is connected in series with AB,the shift in the balance point J will be

A. towards B
B. towards A
C. remains constant
D. first towards B then back towards A

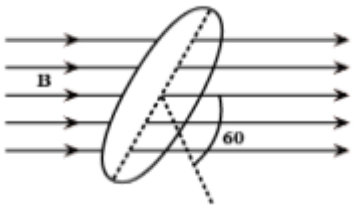
35. Which of the following does not use the application of eddy current?

A. Electric power meters
B. Induction furnace
C. LED lights
D. Magnetic brakes in trains

36. SI unit of magnetic flux

A. weber
B. tesla x meter
C. tesla
D. Gauss

37. Fig shown below represents an area A= 0.5 m^2 situated in a uniform magnetic field B=2.0 weber/ m^2 and making an angle of 60 degree with respect to magnetic field. The value of the magnetic flux through the area equals



A. 2.0weber
B. $\sqrt{3}$ weber
C. $1\sqrt{3}/2$ weber
D. 0.5 weber

38. In a series LCR Series circuit, the voltages across Inductor, capacitor and Resistances are 20V,20V,40V respectively. The phase difference between the supplied voltage and current in the circuit is

A. 30 degree
B. 60 degree
C. 90 degree
D. 0 degree

39. High Voltage transmission line is preferred as

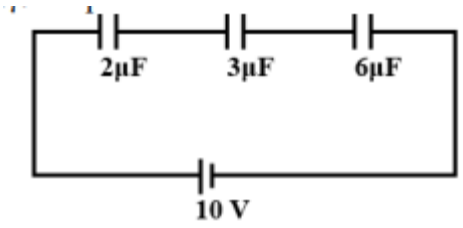
A. its electric appliances are less costly
B. Thin power cables are required
C. Idle current is low
D. Power losses is low

40. A magnet is dropped with its north pole towards a closed circular coil placed on a table then looking from above

A. the induced current in the coil will be anti-clock wise.
B. the magnet will fall with uniform acceleration.
C. the induced current in the coil will be clock wise
D. No current will be induced in the coil.

41. A cell of emf ε and internal resistance r gives a current of 0.5A with an external resistance of 12 Ω and a current of 0.25A with an external resistance of 25Ω. What is the value of internal resistance of the cell?

A. 5Ω
B. 1Ω
C. 7Ω
D. 3Ω

42. 

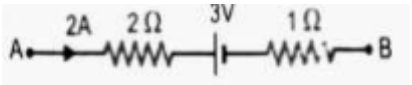
In the given figure, the charge on $3\mu F$ capacitor is

A. 10 μC
B. 15 μC
C. 30 μC
D. 5 μC

43. A circular loop of area $1cm^2$, carrying a current of 10A is placed in a magnetic field of 0.1T perpendicular to the plane of the loop. The torque on the loop due to the magnetic field is

A. Zero
B. $10^{-4}Nm$
C. $10^{-2}Nm$
D. 1Nm

44. The figure shown represents part of a closed circuit. The potential difference between points A and B,



A. +9V
B. -9V
C. +3V
D. +6V
E.

Given below are two statements labelled a

Assertion (A) and Reason (R)

Select the most appropriate answer from the option given below:

(A) Both A and R are true and R is the correct explanation of A Page 6 of 7

(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 (A): The charge given to a metallic sphere does not depend on whether it is hollow or solid.

    Reason (R): Since the charges resides only on the surface of the conductor.

46. Assertion (A): A potentiometer of longer length is used for accurate measurement.

    Reason (R): The potential gradient for a potentiometer of longer length with a given source of e.m.f becomes small.

47. Assertion (A): The magnetic field at the end of a very long current carrying solenoid is half of that at the centre.

    Reason (R): If the solenoid is sufficiently long, the field within it is uniform.

48. Assertion (A): Magnetic moment of an atom is due to both the orbital motion and spin motion of every electron.

    Reason (R): A charged particle produces magnetic field.

49. Assertion (A): 200V AC is more dangerous than 200V D.C

    Reason (R): For 200 V AC, the corresponding peak value is $200\sqrt{2}$. But for 200V DC, peak value is 200V only.

SECTIONC

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

50. A galvanometer is converted into an ammeter. It has a resistance of 60 ohm and shows full scale deflection when a current of 1.0 ampere passes through it. It can be converted into an ammeter to read currents up to 5.0 ampere by

A. Putting a series resistance of 15 ohm
B. Putting in series a resistance of 24 ohm
C. Putting in parallel a resistance of 15ohm
D. Putting in parallel a resistance of 24 ohm

51. Current sensitivity of a Galvanometer can be increased by

A. By decreasing the no of turns
B. By decreasing the area of the coil
C. By decreasing the magnetic field
D. By decreasing the torsional constant

Case Study

Read the following paragraph and answers the questions

Resonant Series LCR Circuit When the frequency of ac supply is such that the inductive reactance and capacitive reactance become equal, the impedance of the series LCR circuit is equal to the ohmic resistance in the circuit. Such a series LCR circuit is known as resonant series LCR circuit and the frequency of the ac supply is known as resonant frequency. Resonance phenomenon is exhibited by a circuit only if both L and C are present in the circuit. We cannot have resonance in a RL or RC circuit. A series LCR circuit with L=0.12H, C=480nF, R=23Ω is connected to a 230 V variable frequency supply.

52. Find the value of source frequency for which current amplitude is maximum.

A. 222.32Hz
B. 550.52Hz
C. 663.48Hz
D. 770Hz.

53. The value of maximum current is

A. 14.14A
B. 22.52A
C. 50.25A
D. 47.41A

54. What is the Q-factor of the given circuit?

A. 25
B. 42.21
C. 35.42
D. 21.74

55. At resonance which of the following physical quantity is maximum?

A. Impedance
B. Current
C. Both (a) & (b)
D. Neither A or B.

Kendriya Vidyalaya Sangathan, Ernakulam Region
Sample question paper 5 (2021-22)
Term 1
Subject : Physics (042)

Time : 90Min **Max Mark : 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 any20 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

1. A charge Q is supplied to a metallic conductor. Which is true?

   (a) Electric field inside it is same as on the surface.

   (b) Electric potential inside is zero.

   (c) Electric potential on the surface is zero

   (d) Electric potential inside it is constant

2. If two conducting spheres are connected after charging separately then:

   (a) Electrostatic energy sphere energy will remain conserved

   (b) Electrostatic energy charges remain conserved

   (c) Electrostatic energy decreases and charge remains conserved

   (d) None

3. The dielectric constant of a metal is:

   (a) 0

   (b) 1

   (c) ∞

   (d) -1

4. Charge on a body is integral multiple of +e. It is given by the law of -

(a) Conservation of charge (c) Conservation of energy

(b) Conservation of mass (d) Quantization of charge

5. Four charges + 8Q, - 3Q +5Q and -10Q are kept inside a closed surface. What will be the outgoing flux through the surface?

(a) 26 V-m (c) 10 V-m

(b) 0 V-m (d) 8 V-m

6. The net torque on a dipole in a uniform electric field is Zero, When the angle between the dipole movement and magnetic field is -

(a) 30^0 (c) 90^0

(b) 60^0 (d) 0^0

7. Gauss theorem gives the relation between

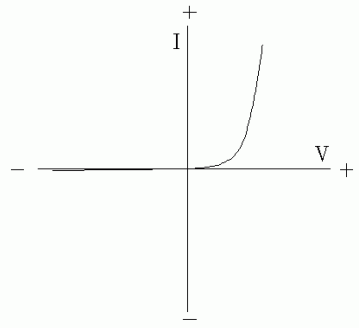
(a) Charge and flux

(b) Charge and field

(c) Force and flux

(d) Dipole movement and electric field.

8. The I-V characteristics shown in figure represents



(a) ohmic conductors

(b) non-ohmic devices

(c) insulators

(d) superconductors

9. When there is an electric current through a conducting wire along its length, then an electric field must exist

(a) outside the wire but normal to it.

(b) outside the wire but parallel to it.

(c) inside the wire but parallel to it.

(d) inside the wire but normal to it.

10. Which of the following is wrong? Resistivity of a conductor is

(a) independent of temperature.

(b) inversely proportional to temperature.

(c) independent of dimensions of conductor.

(d) less than resistivity of a semiconductor

11. For measurement of potential difference, a potentiometer is preferred over voltmeter because

(a) potentiometer is more sensitive than voltmeter.

(b) the resistance of potentiometer is less than voltmeter.

(c) potentiometer is cheaper than voltmeter.

(d) potentiometer does not take current from the circuit.

12. An electric heater is connected to the voltage supply. After few seconds, current gets its steady value then its initial current will be

(a) equal to its steady current

(b) slightly higher than its steady current

(c) slightly less than its steady current

(d) zero

13. A charged particle is moving with velocity v under the magnetic field B. The force acting on the particle will be maximum if:-

(a) v and B are in same direction

(b) v and B are in opposite direction

(c) v and B are perpendicular

(d) None

14. A charged particle moves through a magnetic field perpendicular to its direction. Then

(a) kinetic energy changes but the momentum is constant

(b) the momentum changes but the kinetic energy is constant

(c) both momentum and kinetic energy of the particle are not constant

(d) both momentum and kinetic energy of the particle are constant.

15. A galvanometer can be changed into voltmeter by providing

(a) low resistance in series

(b) low resistance in parallel

(c) high resistance in series

(d) high resistance in parallel

16. S I unit of resistivity is

(a) Ohm

(b) mho

(c) ohm-m

(d) mho-m^{-1}

17. In a Wheatstone bridge if the battery and galvanometer are interchanged then the deflection in galvanometer will

(a) change in previous direction

(b) not change

(c) change in opposite direction

(d) none of these.

18. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is doubled and the number of turns per cm is halved, the new value of the magnetic field is:-

(a) B/2

(b) B

(c) 2B

(d) 4B

19. If the number of turns in a moving coil galvanometer is increased, its current sensitivity

(a) increases

(b) remains same

(c) decreases

(d) may increase or decrease

20. A uniform electric field and a uniform magnetic field are acting along the same direction in a certain region. If an electron is projected along the direction of the fields with a certain velocity, then

(a) its velocity will decrease

(b) its velocity will increase

(c) it will turn towards right of direction of motion

(d) it will turn towards left of direction of motion.

21. Magnitude of angular magnetic moment associated with a revolving electron in a hydrogen atom will be

(a) $\mu_l = e^2/m_e$

(b) $\mu_l = -el^2/2m_e$

(c) $\mu_l = -e/4m_e$

(d) $\mu_l = -el/2m_e$

22. The magnetic field is now thought to arise due to electrical currents produced by convective motion of metallic fluids (consisting mostly of molten iron and nickel) in the outer core of the earth. This is known as the

(a) dynamo effect

(b) Tindal effect

(c) both (a) and (b)

(d) Neither (a) nor (b)

23. Which of the following statements is not correct?

(a) Whenever the amount of magnetic flux linked with a circuit change, an emf is induced in circuit.

(b) The induced emf lasts so long as the change in magnetic flux continues.

(c) The direction of induced emf is given by Lenz's law.

(d) Lenz's law is a consequence of the law of conservation of momentum.

24. The relation between the direction of induced emf and the direction of motion of the conductor is?

(a) Parallel (c) Not related

(b) Equal (d) Perpendicular

25. The instantaneous current in an ac circuit is I=2.0 sin314t, what is its frequency?

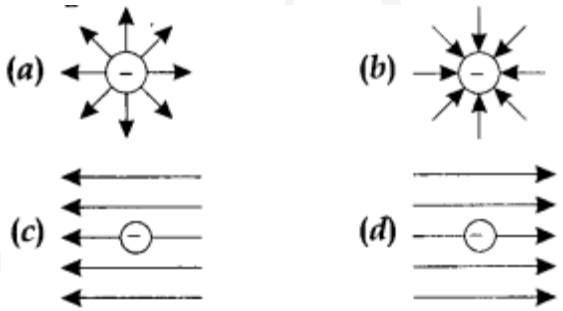
(a) 100 Hz (b) 60 Hz (c) 50 Hz (d) 2π

Section B

26. What amount of charge we place at corner of the cube of sides a so that the total flux through the faces of the cube is $q/8\varepsilon_0$.

(a) q (b) q/2 (c) 2q (d) q/8

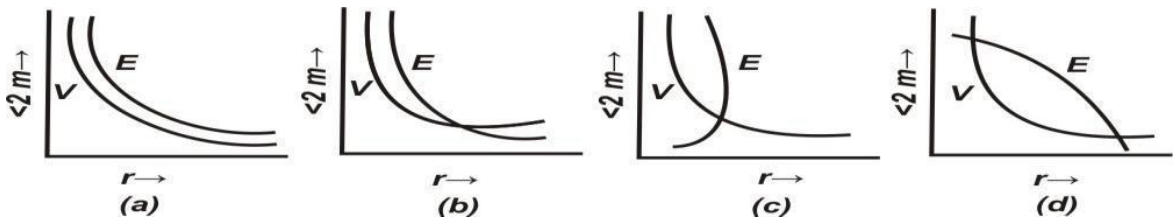
27. Which of the following figures represent the electric field lines due to a single negative charge?



28. The value of electric field inside a conducting sphere having radius R and charge Q will be

(a) KQ/R^2 (b) KQ/ R (c) Zero (d) $2\ KQ^2 / R$

29. The variation potential V with r & electric field E with r for a point charge is correctly shown in the graphs



30. A capacitor is charged by using a battery which is then disconnected. A dielectric slab then slipped between the plates, which results in

(a) reduction of charge on the plates and increase of potential difference across the plates

(b) increase in the potential difference across the plate, reduction in stored energy, but no change in the charge on the plates

(c) decrease in the potential difference across the plates, reduction in the stored energy, but no change in the charge on the plates.

(d) none of these

31. 64 drops each having the capacity C and potential V are combined to form a big drop. If the charge on the small drop is q, then the charge on the big drop will be

(a) 2q (b) 4q (c) 16q (d) 64q

32. Condenser A has a capacity of 15 μF when it is filled with a medium of dielectric constant 15. Another condenser B has a capacity of 1 μF with air between the plates. Both are charged separately by a battery of 100 V. After charging, both are connected in parallel without the battery and the dielectric material being removed. The common potential is now:

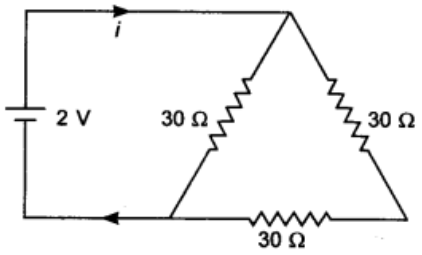
(a) 400 V (b) 800 V (c) 1200 V (d) 1600 V

33. Drift velocity vd varies with the intensity of electric field as per the relation

(a) $v_d \propto E$ (c) v_d = constant

(b) $v_d \propto 1/E$ (d) $v_d \propto E^2$

34. The current in the given circuit will be _____ .



(a) 1A (b) 0.1A (c) 0.2 A (d) 10A

35. Temperature dependence of resistivity ρ(T) of semiconductors, insulators and metals is significantly based on the following factors:

(a) number of charge carriers can change with temperature T.

(b) length of material can be a function of T.

(c) mass of carriers is a function of T.

(d) All the above

36. For a cell of e.m.f. 2 V, a balance is obtained for 50 cm of the potentiometer wire. If the cell is shunted by a 2 Ω resistor and the balance is obtained across 40 cm of the wire, then the internal resistance of the cell is

(a) 1 Ω (c) 1.2 Ω

(b) 0.5 Ω (d) 2.5 Ω

37. In a potentiometer of 10 wires, the balance point is obtained on the 7th wire. To shift the balance point to 9th wire, we should

(a) decrease resistance in the main circuit.

(b) increase resistance in the main circuit.

(c) decrease resistance in series with the cell whose emf is to be measured.

(d) increase resistance in series with the cell whose emf is to be determined.

38. A proton and an α-particle moving with the same velocity and enter into a uniform magnetic field which is acting normal to the plane of their motion. The ratio of the radii of the circular paths described by the proton and a-particle respectively: -

(a) 1 : 2 (c) 1 : 16

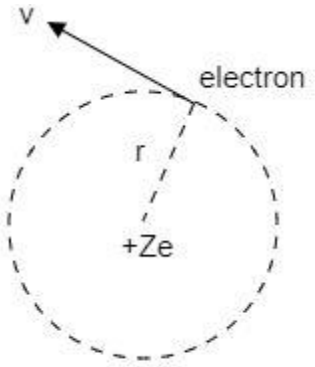
(b) 1 : 4 (d) 4 : 1

39. If resistance of a galvanometer is 6 Ω and it can measure a maximum current of 2 A. Then required shunt resistance to convert it into an ammeter reading up to 6 A, will be

(a) 2 Ω (c) 4 Ω

(b) 3 Ω (d) 5 Ω

40. For an atom shown in the figure, the direction of magnetic moment related to revolving electron is,



(a) Vertically upwards

(b) Vertically downwards

(c) along the velocity of electron

(d) none of these

41. At Geo-magnetic poles, the angle of dip is:-

(a) 45°

(b) 30°

(c) zero

(d) 90°

42. In a coil of self-induction 5 H, the rate of change of current is 2 A/s. Then emf induced in the coil is

(a) 10 V

(b) -10 V

(c) 5 V

(d) -5 V

43. Choose the correct statement.

(a) The capacitor can conduct in a dc circuit but not an inductor

(b) In dc circuit the inductor can conduct but not a capacitor

(c) In dc circuit both the inductor and capacitor cannot conduct

(d) The inductor has infinite resistance in a dc circuit

44. In a transformer, the no. of turns of primary and secondary coil are 500 and 400 respectively. If 220 V is supplied to the primary coil, then ratio of currents in primary and secondary coils is

(a) 4:5

(b) 5:4

(c) 5:9

(d) 9:5

45. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Electric field lines are continuous curves in free space.

Reason (R): Electric field lines start from negative charge and terminate at positive charge.

Select the most appropriate answer from the options given below:

i. Both A and R are true and R is the correct explanation of A

ii. Both A and R are true but R is not the correct explanation of A

iii. A is true but R is false

iv. A is false and R is also false.

46. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Direct current is more dangerous than alternating current of same value.

Reason (R): An electrocuted person sticks to direct current line. While alternating current repels the person from the line.

Select the most appropriate answer from the options given below:

i. Both A and R are true and R is the correct explanation of A

ii. Both A and R are true but R is not the correct explanation of A

iii. A is true but R is false

iv. A is false and R is also false.

47. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): A series resonant circuit is also known as an acceptor circuit.

Reason (R): For large value of Ohmic resistance, the quality factor of a series resonant circuit is high.

Select the most appropriate answer from the options given below:

i. Both A and R are true and R is the correct explanation of A

ii. Both A and R are true but R is not the correct explanation of A

iii. A is true but R is false

iv. A is false and R is also false.

48. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): When an electric motor is started, a variable resistance (that decreases with time) is used in series. This resistance is known as motor starter.

Reason (R): The back-emf in the beginning, when motor starts, is very small.

Select the most appropriate answer from the options given below:

i. Both A and R are true and R is the correct explanation of A

ii. Both A and R are true but R is not the correct explanation of A

iii. A is true but R is false

iv. A is false and R is also false.

49. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Current density is a vector quantity.

Reason (R): Electric current, passing through a given area is the flux of current density through that area.

Select the most appropriate answer from the options given below:

i. Both A and R are true and R is the correct explanation of A

ii. Both A and R are true but R is not the correct explanation of A

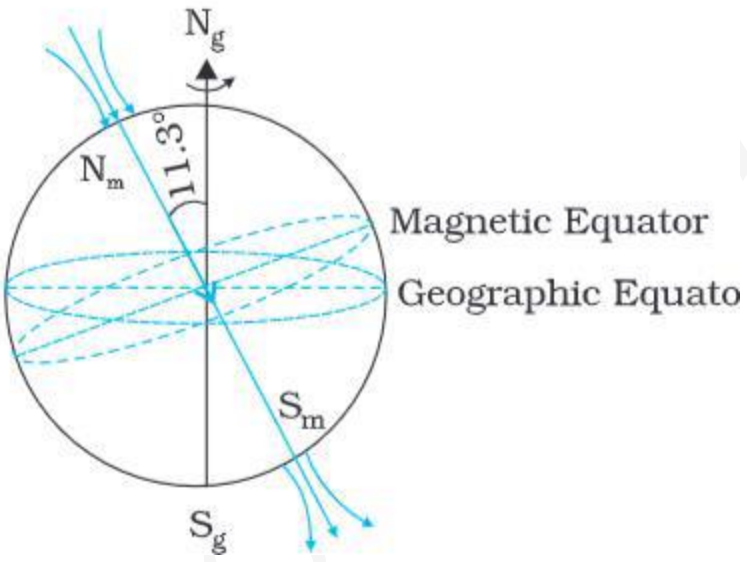
iii. A is true but R is false

iv. A is false and R is also false.

Section C

Earth's Magnetic Field:

The magnetic field lines of the earth resemble that of a hypothetical magnetic dipole located at the centre of the earth. The axis of the dipole is presently tilted by approximately 11.3° with respect to the axis of rotation of the earth.



The pole near the geographic North Pole of the earth is called the North magnetic pole and the pole near the geographic South Pole is called South magnetic pole.

50. A bar magnet is placed North-South with its North-pole due North. The points of zero magnetic field will be in which direction from the centre of the magnet?
    (a) North-South
    (b) East-West
    (c) North-East and South-West
    (d) None of these.

51. The value of angle of dip is zero at the magnetic equator because
    (a) V and H are equal
    (b) the values of V and H zero
    (c) the value of V is zero
    (d) the value of H is zero.

Concept of Electric Field: Electric field is an elegant way of characterizing the electrical environment of a system of charges. Electric field at a point in the space around a system of charges tells you the force a unit positive test charge would experience if placed at that point (without disturbing the system). Electric field is a characteristic of the system of charges and is independent of the test charge that you place at a point to determine the field.

52. Which of the following statement is correct? The electric field at a point is
    (a) always continuous.
    (b) continuous if there is a charge at that point.
    (c) discontinuous only if there is a negative charge at that point.
    (d) discontinuous if there is a charge at that point

53. The force per unit charge is known as…
    (a) Electric Field
    (b) Electric Flux
    (c) Electric Current
    (d) Electric potential.

54. The SI unit of electric field is…
    (a) N/C
    (b) V/m
    (c) V m
    (d) both (a) and (b)

55. A proton of mass ‘m’ placed in electric field region remains stationary in air then magnitude of electric field is…
    (a) mge
    (b) mg/e
    (c) e/mg
    (d) e^2g/m^2

ANSWER KEY FOR SAMPLE QUESTION PAPERS

SAMPLE PAPER 1

Q.NO	Ans	Q.NO	Ans	Q.NO	Ans	Q.NO	Ans	Q.NO	Ans	Q.NO	Ans
1	B	11	A	21	B	31	A	41	C	51	A
2	B	12	A	22	A	32	D	42	D	52	A
3	B	13	B	23	C	33	C	43	B	53	C
4	C	14	C	24	A	34	B	44	C	54	A
5	B	15	B	25	C	35	D	45	B	55	C
6	C	16	D	26	A	36	A	46	C		
7	D	17	D	27	C	37	C	47	A		
8	A	18	A	28	A	38	D	48	C		
9	A	19	B	29	D	39	D	49	B		
10	D	20	B	30	D	40	D	50	A		

SAMPLE PAPER 2

Q. No	Ans	Q. No	Ans
1	(c)they can be charged equally(maximum)	29	(b)A current will be induced in anticlockwise direction as seen from above
2	(c) $W_A = W_B = W_C$	30	$(c) 10^{-3} N$
3	$(c) 30^o \quad F = BIl\ sin\theta$	31	(c)No current is induced in case (ii)No rate of change of flux
4	(d) zero	32	(d) 90% $\eta = \frac{output\ power}{input\ power} \times 100 = \frac{100}{110} \times 100 = 90.9\%$
5	(b) The magnetic field is perpendicular to the plane of the coil	33	(d) 4v $v_d = \frac{I}{neA}$
6	(b)Clockwise	34	(b) is a constant and is opposite to the direction of the inducing current.
7	$(c) \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}$ and $\frac{r_1 r_2}{r_1 + r_2}$	35	4:3
8	(a) 1 H	36	$(b) \sqrt{\frac{4\pi M}{I}}$
9	(c) same as that on electron	37	(a)1 Ω
10	(b) 100V	38	(d) I and II

11	(c)Only from driver cell	39	$(a) 8 \times 10^{-5} N$
12	(b)Increases	40	(b)is a constant
13	(d) I, II and III	41	(d) $4\mu F$
14	(a)Vertical component of magnetic field is $\sqrt{3}$ times that of horizontal component	42	(d) 2×10^{-3} V
15	(b) The bulb glows brighter	43	(d) From South to North pole inside the magnet and from North to South outside the magnet.
16	$(a)\sqrt{3}F$ $F = \sqrt{F^2 + F^2 + 2F^2\, cos60°} = \sqrt{3}F$	44	(d)1980V
17	(b)6 Ω	45	(b)Both assertion and reason are correct but the reason is not the correct explanation of assertion
18	(a) Flux linked with the loop is always zero	46	(a)Both assertion and reason are correct and reason is the correct explanation of assertion
19	(b) 80pF	47	(c)Assertion is correct and reason is false
20	(b) 10 mV/cm	48	(d)Both assertion and reason are false
21	$(c)\frac{V}{6r}$ $V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}\left(1 - \frac{1}{3}\right) = \frac{1}{4\pi\varepsilon_0}\frac{2q}{3r}$ $E = \frac{1}{4\pi\varepsilon_0}\frac{q}{9r^2}$ $E = \frac{V}{6r}$	49	(c)Assertion is correct and reason is false
22	(c)5/3 $R_1 = 5\Omega$ $R_2 = 3\ \Omega$ (balanced bridge is formed by the central network)	50	4.9 Ω
23	$(d)\frac{1}{11}\ times$ $s = \frac{G}{10} = \frac{I_g G}{I - I_g}$; $I = 11I_g$; $I_s = \frac{\theta}{I_g}$; $I_s' = \frac{\theta}{11\, I_g}$	51	$(b)\sqrt{3}$ Ia^2 and $3Ia^2$
24	(a)9995 Ω	52	(c)2.0 H
25	$(b)\frac{\pi}{2}$	53	(d)All the above
26	$(c)\frac{(Q_1 + Q_2)}{(C_1 + C_2)}$	54	(c)100.0 V
27	(c)A is greater than B	55	(d)Tm^2
28	(a) 5Ω $Z = \frac{V_{rms}}{I_{rms}}$; $V_{rms} = 50V$; $I_{rms} = 10A$		

SAMPLE PAPER 3

Q.	Ans	Q.	Ans
1	Force depends only on the magnitude of charges and distance between them, $F= kq^2/r^2$ .Ans. force become 8 times	29	D, $L = \mu_0\mu_r n^2 Al$
2	Potential is V=KQ/r Ans. work done in bringing the charge q from B to C will be given by $=9x10^9x10x10^{-6}x20x10^{-6}=1.8J$	30	B, $m = 2lq_m$
3	Charge density =Q/A Ans. 3:2	31	D
4	U=P.E Ans. Zero	32	C, $B = \mu_0 nI/2a$
5	R is proportional to l/A Ans. 8/27	33	D, $B= \mu_0 I/2a$, $B^2= B_1^2+ B_2^2$ Type equation here.
6	Power inversely proportional to R. So low P will have bigger R. Also R is proportional to l/A . Ans. 100W is thicker	34	A, $B= \mu_0 a^2 I/ 2(a^2+ r^2)^{3/2}$
7	Shunt=ratio of current x G=9.9ohm	35	C, r = mv/ qb
8	Equitorial	36	A
9	Induced emf=dφ/dt Ans. -43V	37	A
10	conservation of energy Ans. D	38	A, $V_p/V_s = I_s/ I_p$
11	B	39	C, $V= V_0 Sin\omega t$
12	I=nAeV Ans. V/2	40	A, X/R = l/ 100- l
13	E=V+Ir Ans. 1.95V	41	B, $R= \rho l/A$
14	B is proportional to I	42	B, $r = R(l_1 – l_2)/ l_2$
15	High R in series	43	B, $\infty = R_2 – R_1/ R_1(T_2- T_1)$
16	F=qvbsinϴ Ans. when they are parallel F is zero	44	B, New potential = $n^{2/3}$x V
17	Steady current , no change , None of these	45	B
18	e=-LdI/dt Ans. 4 H	46	B
19	Average value becomes zero	47	A
20	$X_L=1/wL$ Ans. 10^3 rad per second	48	A
21	Free electrons.	49	C
22	increases.4 times	50	C, $C= \epsilon_0\epsilon_r A/ d$
23	Charge and energy	51	A, $F = kq_1q_2/ r^2$
24	Minimum	52	A, $N_s/ N_p = I_p/ I_s$
25	C	53	C, $V_s/ V_p = N_s/ N_p$
26	C, Irms = Vrms/ Xc	54	B, Output power = 80/100 x $V_p I_p$
27	C, $X = 1/C\omega$	55	D
28	B, L increases, I decreases		

SAMPLE PAPER 4

Q.NO	Ans	Q.NO	Ans	Q.NO	Ans	Q.NO	Ans	Q.NO	Ans	Q.NO	Ans
1	A	11	B	21	C	31	A	41	A	51	D
2	B	12	D	22	A	32	A	42	D	52	C
3	C	13	A	23	A	33	B	43	D	53	A
4	B	14	A	24	B	34	B	44	D	54	D
5	A	15	D	25	B	35	C	45	A	55	B
6	A	16	B	26	B	36	A	46	B		
7	A	17	B	27	A	37	A	47	A		
8	B	18	B	28	B	38	C	48	A		
9	C	19	B	29	A	39	A	49	A		
10	B	20	A	30	C	40	C	50	C		

SAMPLE PAPER 5

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

Section B

26. A
27. B
28. C
29. B
30. C
31. D
32. B
33. A
34. C
35. A
36. B
37. D
38. A
39. B
40. B
41. D
42. B
43. B
44. A
45. iii
46. iv
47. iii
48. i
49. ii

Section C

50. B
51. A
52. B
53. A
54. B
55. B