	INDIAN SCHOOL AL WADI AL KABIR

FIRST ASSESSMENT (2023 - 24)

Class: XII Sub: PHYSICS (042) Max Marks: 70

Date:19.09.2023 Set - 1 Time : 3 hours

General Instructions

(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, **Section B** contains five questions of two marks each, **Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and **Section E** contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever necessary
   i. $c = 3 \times 10^8$ m/s
   ii. $m_e = 9.1 \times 10^{-31}$ kg
   iii. $e = 1.6 \times 10^{-19}$ C
   iv. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A^{-1}}$
   v. $h = 6.63 \times 10^{-34}$ Js
   vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
   vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

SECTION A [1 x 16 = 16]

[1] If $\oint \vec{E} \cdot d\vec{S} = 0$ over a surface, then

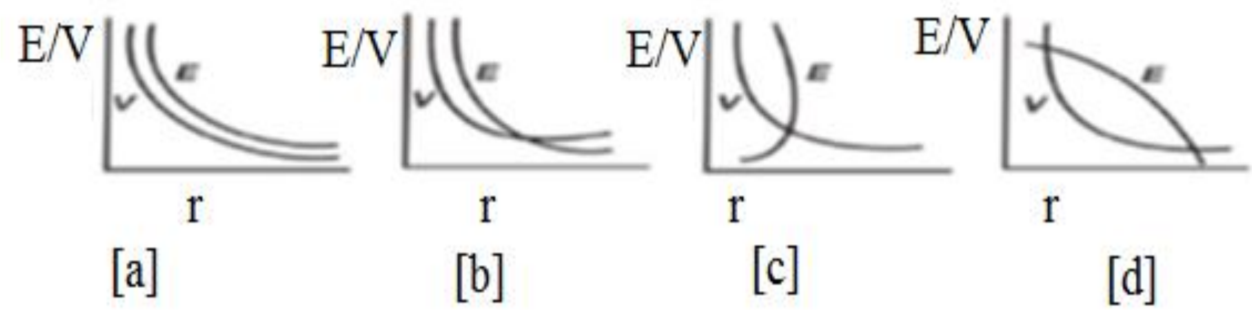
(a) the electric field inside the surface and on it is zero.

(b) the electric field inside the surface is necessarily uniform.

(c) the number of flux lines entering the surface must be equal to the number of flux lines leaving it.

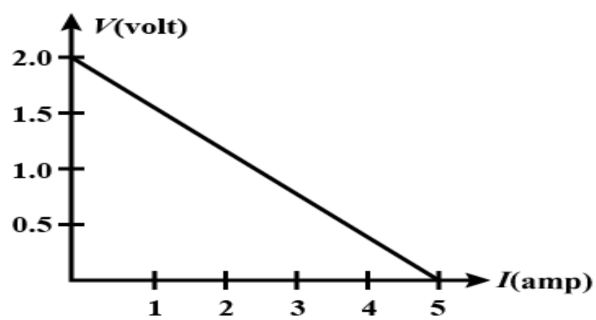
(d) all charges must necessarily be inside

[2] The variation of potential V with r & electric field with r for a point charge is correctly shown in the graphs



(3)A positively charged particle is released from rest in a uniform electric field. The electric potential energy of the charge
(a) remains constant because the electric field is uniform.
(b) increases because charge moves along the electric field.
(c) decreases because charge moves along the electric field.
(d) decreases because charge moves opposite to the electric field.

(4) For a cell, a graph is plotted between the potential difference V across the terminals of the cell and the current I drawn from the cell (see Figure). The emf and the internal resistance of the cell are E and r, respectively. Then:



(a) 2V,0.5Ω

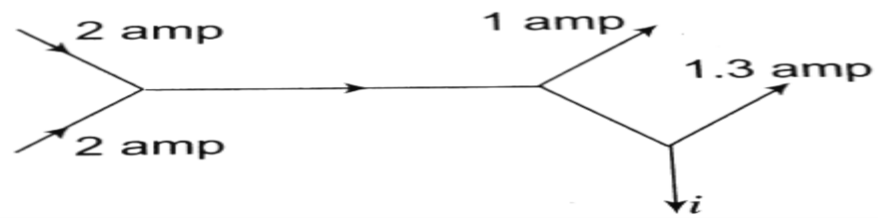
(b) 2V,0.4Ω

(c) >2V,0.5Ω

(d) >2V,0.4Ω

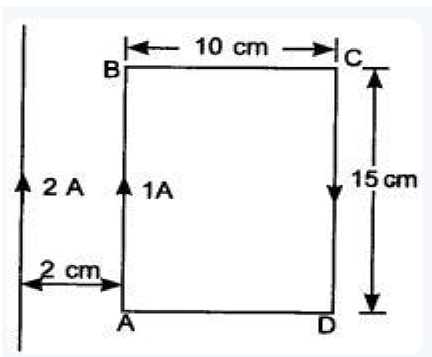
(5) In the equation AB = C, A is the current density, C is the electric field, Then B is
(a) resistivity
(b) conductivity
(c) potential difference
(d) resistance

(6) The figure below shows currents in a part of electric circuit. The current i is



(a) 4 A (b) 1.3A (c) 2.3 A (d) 1.7 A

(7) What is the net force on the rectangular coil



(a) 25×10^{-7} N moving towards wire

(b) 25×10^{-7} N moving away from wire

(c) 35×10^{-7} N moving towards wire

(d) 25×10^{-7} N moving away from wire

(8) Two particles of equal charges after being accelerated through the same potential difference enter in a uniform transverse magnetic field and describe circular paths of radii R1 and R2. Then the ratio of their respective masses (M1/M2) is

(a) (R1/R2)

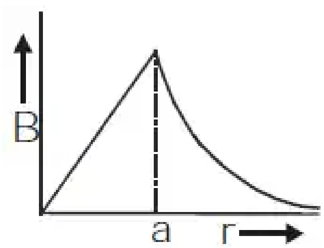
(b) $(R1/R2)^2$

(c) (R2/R1)

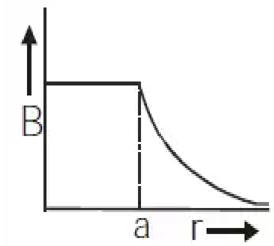
(d) $(R2/R1)^2$

(9) The magnetic field due to a straight conductor of uniform cross section of radius a and carrying a steady current is represented by

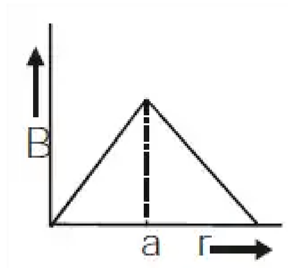
(a)



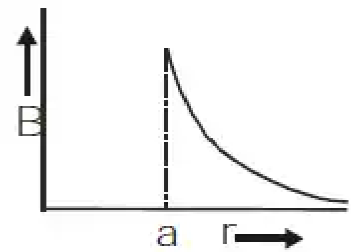
(b)



(c)



(d)



(10) Name the physical quantity having unit A m^2

(a) Magnetic flux

(b) Magnetic dipole moment

(c) Intensity of magnetic field

(d) Pole strength

(11) A magnetic needle is kept in a non-uniform magnetic field. It experiences
(a) a torque but not a force.
(b) neither a force nor a torque.
(c) a force and a torque.
(d) a force but not a torque.

(12) The polarity of induced emf is given by
(a) Ampere’s circuital law
(b) Biot -Savart law
(c) Lenz’s law
(d) Fleming’s right-hand rule

For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.

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

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

c) If Assertion is true but Reason is false.

d) If both Assertion and Reason are false.

13)**Assertion:** Electric field lines form closed loops.

Reason: Direction of electric field is from negative to positive charge.

14) **Assertion:** Capacitance of a parallel plate capacitor increases when distance between the plates is decreased.

Reason: Capacitance of a parallel plate capacitor is inversely proportional to the distance between them.

15) **Assertion:** Magnetic moment of an atom is due to both, the orbital motion and spin motion of every electron.
Reason: A charged particle at rest produces a magnetic field.

16) **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.

SECTION-B [2 x 5 = 10]

(17) Two fixed point charges +4e and +e units are separated by a distance 'a'. Where should the third point charge be placed for it to be in equilibrium?

OR

A charge q is placed at the centre of the line joining two equal charges Q. Show that the system of three charges will be in equilibrium if q = -Q/4.

(18) For what position of an electric dipole in a uniform electric field its potential energy is (a) minimum (b) maximum. Explain.

(19) Define mobility of electron in a conductor. How does electron mobility change when (i) temperature of the conductor is decreased and (ii) applied potential difference is doubled at constant temperature?

(20) The resistance of a galvanometer is 10Ω. It gives full-scale deflection when 1 mA current is passed.

What is the resistance connected in series for converting it into a voltmeter of 2.5 V?

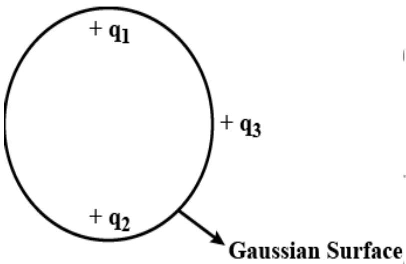
(21) A coil of wire of radius r has 600 turns and a self-inductance of 108 mH. Find the self-inductance of a coil with same radius and 500 turns.

SECTION- C [3 x 7 = 21]

(22) a) State Gauss's theorem. b) Using Gauss's theorem, show mathematically that for any point outside the shell, the field due to a uniformly charged thin spherical shell is the same as if the entire charge of the shell is concentrated at the centre.

OR

Three charges q_1, q_2 and q_3 are placed inside and outside a closed Gaussian surface as shown in the figure



Answer the following

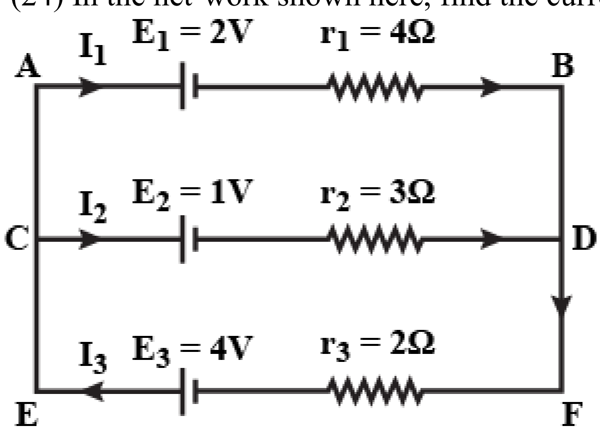
(a) Which charges contribute to the electric field at any point on the Gaussian surface?

(b) Which charges contribute to the net flux through this surface?

(c) If $q_1 = -q_2$, will electric field on the surface be zero? Give reason.

(23) An electron moves a distance of 6.0 cm when accelerated from rest by an electric field of strength 2×10^4 N/C. Calculate the time of travel.

(24) In the net-work shown here, find the currents I_1, I_2, I_3.



(25) (a)What is drift velocity. Obtain an expression between drift velocity and electric field.
(b)Two Nichrome wires are connected in series with a battery.

The lengths of Nichrome wires are in the ratio of 1:2 whereas their resistances are in the ratio 2:1. Find the ratio of drift velocity of free electrons in them.

(26) Derive an expression for the force per unit length between two long straight parallel current carrying conductors. Hence define SI unit of current(ampere).

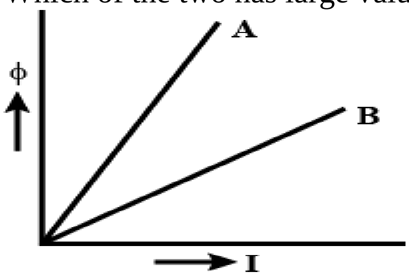
(27) The horizontal component of the earth's magnetic field at a certain place is 3.0 x 10^{-5}T and the direction of the field is from the geographic south to geographic north. A very long straight conductor is carrying a steady current of 1A. What is the force per unit length on it when it is placed on a horizontal table and the direction of the current is (a) East to West (b) South to North?

(28) (a) How does the mutual inductance of a pair of coils change when

(i) distance between the coils is increased and

(ii) number of turns in the coil is increased?

(b) A plot of magnetic flux (φ) verses current (I) is shown in the figure for two inductors A and B. Which of the two has large value of self-inductance? Justify



(c) How is the mutual inductance of a pair of coils affected when a thin iron sheet is placed between the coils. Justify your answer.

SECTION- D [4 x 2 = 8]

(29) Read the passage given below and answer the questions

An inductor is simply a coil or a solenoid that has a fixed inductance. It is referred to as a choke. The usual circuit notation for an inductor is as shown.

Let a current i flows through the inductor from A to B. Whenever electric current changes through it, a back emf is generated. If the resistance of inductor is assumed to be zero (ideal inductor) then induced emf in it is given by $e = V_B - V_A = -L\, di/dt$ Thus, potential drops across an inductor as we move in the direction of current. But potential also drops across a pure resistor when we move in the direction of the current. The main difference between a resistor and an inductor is that while a resistor opposes the current through it, an inductor opposes the change in current through it.

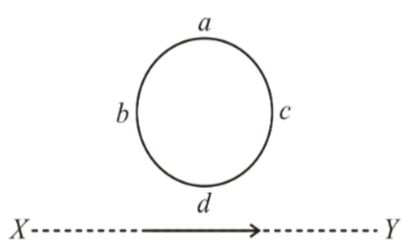
(i) How does inductor behave when a steady current flow through it?

(a) the inductor behaves as a capacitor
(b) the inductor behaves as a resistor

(c) the inductor behaves as an insulator.
(d) the inductor behaves as short circuit.

(ii)How does inductor behave when a steadily increasing, current flows through it?
(a) back EMF is generated that supports the increase in current.
(b) back EMF is generated that opposes the increase in current.
(c) no EMF is generated.
(d) the inductor behaves as short circuit.

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



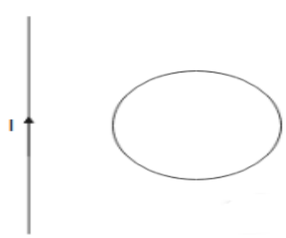
(a) The induced current in the coil will be first anticlockwise and will reverse its direction (i.e. will become clockwise) as the electron goes past the coil.

(b) The induced current in the coil will be first clockwise and will reverse its direction (i.e. will become anticlockwise) as the electron goes past the coil.

(c) No current is induced
(d) The induced current in the coil will be anticlockwise throughout the motion of the electron.

OR

Find the direction of induced current in the coil if current 'I' is increasing with respect to time.



(a) In the clockwise direction
(b)In the anticlockwise direction
(c)First in the clockwise direction and then in the anticlockwise direction
(d)First in the anticlockwise direction and then in the clockwise direction

(iv) Lenz's law is the consequences of
(a) Law of conservation of charge
(b)Law of conservation of induced current
(c) Law of conservation of energy
(d)Law of conservation of momentum

(30) Magnetic materials can be classified as ferromagnetic, paramagnetic, and diamagnetic. Ferromagnetic materials possess a permanent magnetic moment, which means that they are always magnetized in one direction. Paramagnetic materials are attracted or repelled by a magnetic field, but the amount of change in their position is dependent on the strength of the magnet. Diamagnetic materials feel no direct force from a magnetic field and have zero net magnetic moment.

(i) Magnetic materials which align against the magnetic field are known a

a) Diamagnetic
b) Ferromagnetic
c) Paramagnetic
d) None of the options

(ii) The capacity of a material to retain magnetization is known as ______

a) Anti-Magnetism
b) Retentivity
c) Coercivity
d) Permeability

(iii)The permeability of a magnetic material is 0.9983. Name the type of magnetic materials it represents.

a) Diamagnetic
b) Paramagnetic
c) Ferromagnetic
d) Antimagnetic

OR

The susceptibility of a magnetic material is 1.9×10^{-5}. Name the type of magnetic materials it represents.

a) Diamagnetic
b) Paramagnetic

c) Ferromagnetic
d) Antimagnetic

(iv)Capacity of the material to resist the external magnetic field without becoming demagnetized is known as ______

a) Anti-Magnetism
b) Retentivity
c) Coercivity
d) Permeability

SECTION E [5 x 3 = 15]

(31) (a) What is an electric dipole? Derive an expression for electrostatic potential energy of an electric dipole in an external electric field of strength E.

(b) Show that the normal component of electrostatic field has a discontinuity from one side of a charged surface to another given by

$$(\overline{E_2} - \overline{E_1}).\hat{n} = \frac{\sigma}{\epsilon_0}$$

Where $\hat{n}$ is a unit vector normal to the surface at a point and σ is the surface charge density at that point. (The direction of $\hat{n}$ is from side 1 to side 2).

OR

(i)What is a dielectric material and explain dielectric polarization.

(ii) Derive a formula for the capacitance of a parallel plate capacitor with and without a dielectric slab.

(32)] [i] With the help of diagram, explain the principle, theory and working of a moving coil galvanometer. [ii] What is the function of uniform radial field and how is it produced?

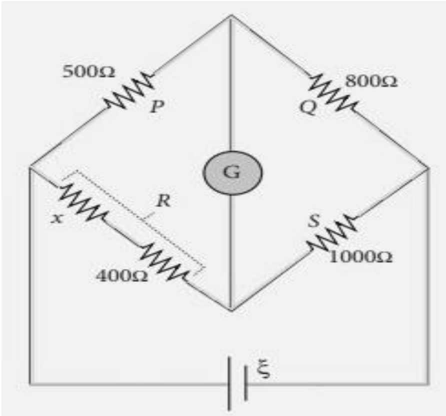
OR

[i] Define current sensitivity and voltage sensitivity of a galvanometer. How is current sensitivity increased?
(ii)How can we convert galvanometer to an ammeter and to a voltmeter? Draw the diagram also.

(33) What is Wheatstone bridge? State the Wheatstone bridge principle. Derive the condition for balance of a Wheatstone's bridge using Kirchhoff's rules.

(ii)What is the value of x when the Wheatstone's network is balanced?

P = 500 Ω, Q = 800 Ω, R = x + 400, S = 1000 Ω

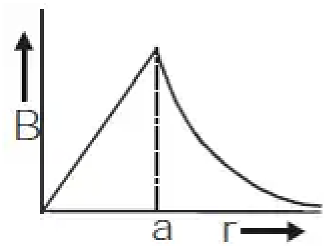


OR

(i) What is the internal resistance of a cell? Derive an expression for the Equivalent emf and equivalent internal resistance of two or more cells connected in series.

(ii) A 10Ω resistance is connected in series with a cell of emf 10V. A voltmeter is connected in parallel to a cell, and it reads 9.9V. Find the internal resistance of the cell.

SL.NO	ANSWER KEY-SECTION A	
1.	(c) the number of flux lines entering the surface must be equal to the number of flux lines leaving it.	1
2.	(b)	1
3.	C. decreases because charge moves along the electric field.	1
4.	(b)2V,0.4Ω	1
5.	(a) resistivity	1
6.	(d) 1.7 A	1
7.	(a) 25×10-7 N moving towards wire	1
8.	(b) $(R_1/R_2)^2$	1

9.	(a) 	1
10.	[a] Magnetic dipole moment	1
11.	(c) a force and a torque.	1
12.	(c) Lenz's law	1
13.	d) Both Assertion and Reason are false	1
14.	a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.	1
15.	c) Assertion is true but Reason is false.	1
16.	a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.	1
	SECTION B	

17.

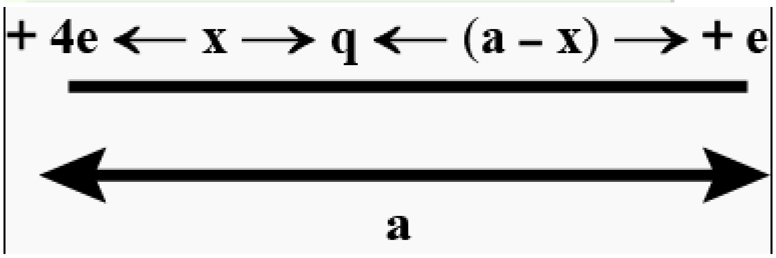
The third charge q is in equilibrium only when force on it due to +4e = force due to +e — 1/2

i.e $\frac{k(4e)q}{x^2} = \frac{k(e)q}{(a-x)^2}$ — 1/2

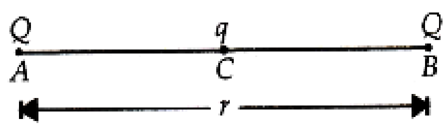
or $4(a-x)^2 = x^2$ — 1/2

or $2(a-x) = x$

or $2a - 2x = x \Rightarrow x = \frac{2a}{3}$ — 1/2



OR



Let two equal charges Q each placed at points A and B at a distance r apart. C is the centre of AB where charge q is placed.

For equilibrium, net force on charge Q= 0 — 1/2

$$\therefore \quad \frac{1}{4\pi\varepsilon_0}\frac{QQ}{r^2} + \frac{1}{4\pi\varepsilon_0}\frac{Qq}{(r/2)^2} = 0$$ — ½

$$\frac{1}{4\pi\varepsilon_0}\frac{Q^2}{r^2} = -\frac{1}{4\pi\varepsilon_0}\frac{4Qq}{r^2}$$ — ½

or $Q = -4q$ or $q = -\frac{Q}{4}$ — 1/2

18.	(*i*) Potential energy of dipole in external field is minimum when $\vec{p}$ and $\vec{E}$ are parallel, i.e. $\theta = 0°$. $\therefore \quad U = -pE\cos\theta \Rightarrow U_{min} = -pE$ (*ii*) The potential energy of dipole in the external field is maximum when $\vec{p}$ and $\vec{E}$ are anti-parallel, i.e. $\theta = 180°$ and $U_{max} = +pE$.	1/2 1/2 1/2 1/2
19.	Electron mobility in a conductor is given by $\mu = \frac{v_d}{E} = \frac{\frac{eE}{m}\tau}{E} = \frac{e\tau}{m}$ (i) When temperature of the conductor decreases, the relaxation time τ of the electrons in the conductor increases, so mobility μ increase. (ii) Mobility μ is independent of applied potential difference.	1 1
20.	Let G be the resistance of a galvanometer and is equal to 10Ω. I_g be the current through the galvanometer for full scale deflection and is 1 mA. Now, to convert galvanometer into an voltmeter a large resistance R should be connected in series with galvanometer. Hence, current through the circuit is $i_g = \frac{V}{G+R}$ $10^{-3} = \frac{2.5}{10+R}$ R = 2490Ω	

21.	Given : $N = 600$ $L = 108\ mH$ $N' = 500$ Self inductance of the coil $L = \frac{\mu_o N^2 A}{l}$ where $A = \pi r^2$ $\Rightarrow L \propto N^2$ $(\because A = \text{constant})$ $\Rightarrow \frac{L'}{L} = \frac{N'^2}{N^2}$ $\therefore \frac{L'}{108} = \frac{(500)^2}{(600)^2}$ OR $L' = 108 \times \frac{25}{36}$ $\Rightarrow L' = 75\ mH$	
	SECTION C	
22.	Statement Diagram	1 1/2 1/2 1/2 1/2

	electric flux through Gaussian surface. $\oint S = \vec{E}_0 \cdot d\vec{S}$ $\oint = E_0 dS \cos 0 = E_0 \cdot 4\pi r^2$ Now, Gaussian surface is outside the given charged shell, so charge enclosed by Gaussian surface is Q. Hence, by Gauss's theorem $\oint s = \vec{E}_0 \cdot d\vec{S} = \frac{1}{\epsilon_0} \times$ charged enclosed $\Rightarrow E_0 \cdot 4\pi r^2 = \frac{1}{\epsilon_0} \times Q \Rightarrow E_0 = \frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$ Thus, electric field outside a charged thin spherical shell is the same as if the whole charge Q is concentrated at the centre.	
	OR	
	(a) All the charges will contribute to the electric field. (b) Only the enclosed charges q1 and q2. (c) No, the electric field will exist on the surface.	1 1 1
23	$F = qE$ $\Rightarrow ma = qE$ $\Rightarrow a = \frac{qE}{m}$ $\Rightarrow a = \frac{1.6 \times 10^{-19} \times 2 \times 10^{-4}}{9.1 \times 10^{-31}}$ $\Rightarrow a = \frac{32 \times 10^{7}}{9.1} m/s^2$	1/2 1/2 1/2 1/2

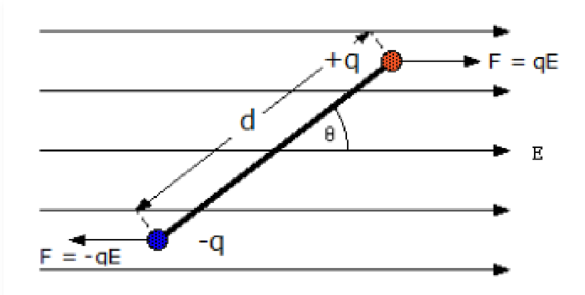
	$s = ut + \frac{at^2}{2}$ $6 \times 10^{-2} = 0t + \frac{32 \times 10^7 t^2}{2 \times 9.1}$ $\Rightarrow t^2 = \frac{2 \times 6 \times 9.1 \times 10^{-9}}{32}$ $\Rightarrow t^2 = 11.375 \times 10^{-10}$ $\Rightarrow t = 3.372 \times 10^{-5} s$	1/2 1/2

24.	Applying Kirchhoff's junction Law at C $I_3 = I_1 + I_2$ Applying KVL to mesh ABDC $-2 - 4I_1 + 3I_2 + 1 = 0$ $\Rightarrow 4I_1 - 3I_2 = -1$ ....(2) Applying KVL to mesh CDFE $-1 - 3I_2 - 2I_3 + 4 = 0$ $-3I_2 - 2I_3 = -3$ ....(3) **Step 4: Solving the equations** Using equation (1) the equation (3) becomes $-3I_2 - 2(I_1 + I_2) = -3$ $\Rightarrow -5I_2 - 2I_1 = -3$ ....(4) Solving (2) and (4), we get $I_1 = \frac{2}{13}A, I_2 = \frac{7}{13}A$ So, $I_3 = I_1 + I_2 = \frac{9}{13}A$	1/2 1/2 1/2 1/2 1/2 1/2

25.	Definition of drift velocity Derivation $$v_d = \frac{eV}{ml}\tau = \frac{eIR}{ml}\tau$$ $$\frac{v_{d_1}}{v_{d_2}} = \frac{R_1}{R_2}.\frac{l_2}{l_1}$$ $$= \frac{2}{1} \times \frac{2}{1} = 4:1$$	1 1 ½ ½
26.	Derivation with diagram Definition of ampere-An ampere is that much current which when flowing through each of the two infinitely long straight conductors placed in vacuum 1 meter apart results in a force of 2×10^{-7} Nm^{-1} on each of the conductors.	1 1/2 DIAGRAM½ 1
27.	(a) As, $F = I\vec{l} \times \vec{B}$, $F = IlB \sin\theta$ The force per unit length is, $f = \frac{F}{l} = IB \sin\theta$ When the current is flowing from east to west, $\theta = 90°$, hence, $f = IB = 1 \times 3 \times 10^{-5} = 3 \times 10^{-5} Nm^{-1}$ (b) When the current is flowing from south to north, θ = 0o *f* = 0 Hence there is no force on the conductor.	1 ½ 1/2 1/2 1/2
28.	(a) (I) decreases (ii) increases	½ + ½

	(b) Slope of the graph gives the self inductance. Slope is more for A. (c) Here the mutual inductance increases because M is directly proportional to permeability. Permeability increases.	1 ½ + ½
	SECTION D	
29.	(I) (d) the inductor behaves as short circuit. (II) (b) back EMF is generated that opposes the increase in current. (iii) (a)The induced current in the coil will be first anticlockwise and will reverse its direction (i.e. will become clockwise) as the electron goes past the coil. OR (b)In the anticlockwise direction (iv)(c) Law of conservation of energy	1 1 1 1
30.	(i) (a) **Diamagnetic** (ii) **(b)** (iii) **a)Diamagnetic** **OR** **b)Paramagnetic** **(iv) a)Coercivity**	1 1 1 1
	SECTION E	
31.	An electric dipole is defined as a couple of opposite charges "q" and "–q" separated by a distance "d.	1

Potential energy of a dipole



½ -diagram

Consider a dipole with charges q1 = +q and q2 = -q placed in a uniform electric field as shown in the figure above. The charges are separated by a distance d and the magnitude of electric field is E. The force experienced by the charges is given as −qE and +qE, as can be seen in the figure.

As we know that, when a dipole is placed in a uniform electric field, both the charges as a whole do not experience any force, but it experiences a torque equal to τ which can be given as,

$$\tau = p \times E$$

This torque rotates the dipole unless it is placed parallel or anti-parallel to the field. If we apply an external and opposite torque, it neutralizes the effect of this torque given by τ_{ext} and it rotates the dipole from the angle Θ_0 to an angle Θ_1 at an infinitesimal angular speed without any angular acceleration. ½

The amount of work done by the external torque can be given by 1/2

$$W = \int_{\theta_0}^{\theta_1} \tau_{ext}(\theta)d\theta = \int_{\theta_0}^{\theta_1} pE\sin\theta\, d\theta$$

$$= pE(\cos\theta_0 - \cos\theta_1)$$

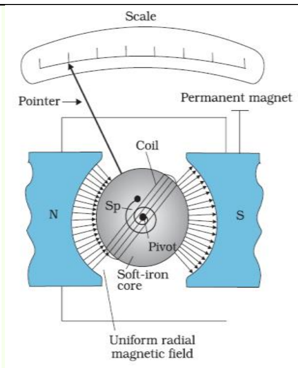
As we know that the work done in bringing a system of charges from infinity to the given configuration is defined as the potential energy of the system, hence the potential energy U(Θ) can be associated to the inclination Θ of the dipole using the above relation. ½

$$U(\theta) = pE(\cos\theta_0 - \cos\theta_1)$$

½

½

	(ii) Electric field on one side of a charged body is E_1 and electric field on the other side of the same body is E_2. If infinite plane charged body has a uniform thickness, then electric field due to one surface of the charged body is given by, $\overline{E_1} = -\frac{\sigma}{2 \epsilon_0}\hat{n}$ ...(i) Where, $\hat{n}$ = Unit vector normal to the surface at a point σ =Surface charge density at that point Electric field due to the other surface of the charged body, $\overline{E_2} = \frac{\sigma}{2 \epsilon_0}\hat{n}$ ...(ii) Electric field at any point due to the two surfaces, $\overline{E_2} - \overline{E_1} = \frac{\sigma}{2 \epsilon_0}\hat{n} + \frac{\sigma}{2 \epsilon_0}\hat{n} = \frac{\sigma}{\epsilon_0}\hat{n}$ $(\overline{E_2} - \overline{E_1}).\hat{n} = \frac{\sigma}{\epsilon_0}$ ...(iii)	1/2 1/2
	OR . (i) Definition of dielectric material • IN THE PRESENCE OF AN EXTERNAL ELECTRIC FIELD, NON-POLAR DIELECTRIC BEHAVES AS A GROUP OF ELECTRIC DIPOLES OF MOMENTS 'p', WHICH PRODUCES A SECONDARY ELECTRIC FIELD Ei OF THEIR OWN. THEN THE DIELECTRIC IS SAID TO BE POLARIZED AND THE PHENOMENON IS CALLED POLARIZATION. Derivation of the capacitance of a parallel plate capacitor with and without dielectric.	1 1 1 2
32.	A galvanometer is an electromechanical instrument which is used for the detection of electric currents through electric circuits. It is a sensitive instrument and cannot be used for the measurement of heavy currents. Principle: a current carrying coil in presence of an external magnetic field experiences a torque, the magnitude of which depend on the strength of the current.	1 1

	 Working and theory (ii) In uniform radial field sinα = 1, so the torque acting on the coil will always be τ = nIBA (maximum). To produce radial magnetic field pole pieces of permanent magnets are made cylindrical and a soft iron core is placed between them. The soft iron core helps in making the field radial.	1 2 1
	OR **<u>(i) CURRENT SENSITIVITY</u> [ϕ/I]** **IT IS THE DEFLECTION PRODUCED PER UNIT CURRENT** **WE HAVE** $\phi=\frac{BANI}{K}$ **OR** $\frac{\Phi}{I}=\frac{BAN}{K}$ **<u>VOLTAGE SENSITIVITY</u> [ϕ/V]** **IT IS THE DEFLECTION PRODUCED PER UNIT VOLTAGE** **WE HAVE,** $\phi=\frac{BANI}{K}$ **----[11] OR** $\phi=\frac{BANV}{KR}$ (ii) By increasing the number of turns in the coil and taking soft iron core. (iii) a galvanometer can be converted into an ammeter by connecting a low resistance [shunt] in parallel. Diagram A galvanometer can be converted into a voltmeter by connecting a high resistance in series (Diagram)	1 1 1 1 1
33.	An application of Kirchhoff's rules and designed by Wheatstone in the form of a bridge is named as Wheatstone bridge. Diagram The bridge has four resistors R1, R2, R3 and R4, connected in a circuit with a Galvanometer. When galvanometer shows zero deflection (Ig = 0), bridge is said to be balanced and R2/R1 = R4/R3. this is known as principle of Galvanometer. It is used to find unknown resistance of a wire. The Kirchhoff's junction rule applied to junctions D and B immediately gives us the relations I1 = I3 and I2 = I4.	1 1/2 1

	Applying Kirchhoff's loop rule for the 1ST loop ADBA, $-I1\ R1 + 0 + I2\ R2 = 0$ ($Ig = 0$) $I1/I2 = R2/R1$ ----------------(i) Applying Kirchhoff's loop rule for 2ND loop CBDC, using $I3 = I1$, $I4 = I2$ $I2\ R4 + 0 - I1\ R3 = 0$ $I1/I2 = R4/R3$ ----------------(ii) Comparing equation(i) and (ii) $$\frac{R2}{R1} = \frac{R4}{R3}$$ This equation relating the four resistors is called the balance condition for the galvanometer to give zero or null deflection. $P/Q = R/S$ $$\frac{500}{800} = \frac{x+400}{1000}$$ $$\frac{x+400}{1000} = \frac{500}{800}$$ $$x+400 = \frac{500}{800} \times 1000$$ $$x+400 = \frac{5}{8} \times 1000$$ $x + 400 = 0.625 \times 1000$ $x + 400 = 625$ $x = 625 - 400$ $x = 225\ \Omega$	1 1/2 1
	OR	
	Definition of internal resistance Diagram Derivation of equivalent emf and internal resistance of cells in series. $R = 10\Omega; E = 10V; V = 9.9V; r = ?$ $$r = \left(\frac{E - V}{V}\right) R$$ $$= \left(\frac{10 - 9.9}{9.9}\right) \times 10 = 0.101\Omega$$	1 1/2 1 1/2 1 1/2 1/2