BRAIN INTERNATIONAL SCHOOL

SESSION 2024-25

CLASS: XII **REVISION SHEET** **SUBJECT: PHYSICS**

CH-1 ELECTRIC CHARGES AND FIELDS

1. **Assertion (A):** Acceleration of charged particle in non-uniform electric field does not depend on velocity of charged particle.
   Reason(R): Charge is an invariant quantity. That is the amount of charge on particle does not depend on frame of reference.

2. **Assertion (A):** If a dielectric is placed in external field, then field inside dielectric will be less than applied field
   Reason(R): Electric field will induce dipole moment opposite to field direction.

3. There are two charges $+1\ \mu$C and $+5\ \mu$C. The ratio of the forces acting on them will be
   (a) 1 : 5 (b) 1 : 5 (c) 1 : 1 (d) 2 : 5
4. Which of the following statement is correct?
   If $\int$ E. ds = 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 not necessarily be outside the surface.
5. Given a uniform electric field $\vec{E}$ = 5 × 10^3 $\hat{\imath}$ N/C, find the flux of this field through a square of 10 cm on a side whose plane is parallel to the y-z plane. What would be the flux through the same square if the plane makes 30^0angle with the x-axis?
6. Two large parallel thin metallic plates are placed close to each other. The plates have surface charge densities of opposite signs and of magnitude 20 × 10^{-12} C/m^2. Calculate the electric field intensity (a) in the outer region of the plates, and (b) in the interior reason between the plates.
7. (a) Two insulated charged copper spheres A and B have their centers separated by a distance of 50 cm. What is the actual mutual force of electrostatic repulsion if the charge on each is 6.5 × 10^{-7} C? The radii of A and B are negligible compared to the distance of separation.
   (b) What is the force of repulsion if each spare is charged doubled and above amount, and the distance between them is halved?
8. A system has two charges q_A = 2.5 × 10^{-7} C and q_B = -2.5 × 10^{-7} C located at points A: (0, 0, - 15 cm) and B: (0, 0, + 15 cm), respectively. What are the total charge and electric dipole moment of the system?
9. The electrostatic force on a small sphere of charge 0.4 μC due to another small sphere of charge -0.8 μC in air is 0.2 N.
   (a) What is the distance between the two spheres?
   (b) What is the force on the second square due to the first?

CH-2 ELECTROSTATIC POTENTIAL AND CAPACITANCE

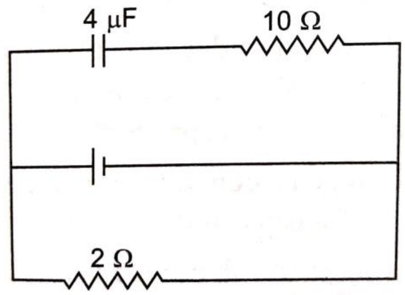
1. **Assertion (A):** In the absence of an external electric field, the dipole moment per unit volume of a polar dielectric is zero.

   Reason (R): The dipoles of a polar dielectric are randomly oriented.

2. **Assertion (A):** When a dielectric slab is gradually inserted between the plates of an isolated parallel-plate capacitor, the energy of the system decreases.

   Reason (R): The force between the plates decreases.

3. A capacitor of 4 μF is connected as shown in the circuit. The internal resistance of the battery is 0.5Ω. the amount of charge on the capacitor plates will be



   (a) 0 (b) 4 μF (c) 16 μF (d) 8 μF

4. A metallic sphere has a charge of 10 μC. A unit negative charge is brought from A to B both 100 cm away from the sphere but A being east of it while B being on waste. The net work done is

   (a) zero (b) 2/10 joule (c) −2/10 joule (d) −1/10 joule

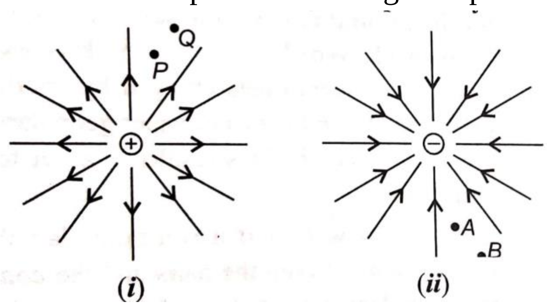
5. Two uniformly large parallel thin plates having charge densities $+\sigma$ and $-\sigma$ are kept in the X-Z plane at a distance d apart. Sketch and equipotential surface due to electric field between the plates. If a particle of mass m and charge $-q$ remains stationary between the plates, what is the magnitude and direction of this field?

6. Two point charges 2 μC and -2 μC are placed at point A and B, 6 cm apart.

   (a) Draw the equipotential surface of the system

   (b) Why do the equipotential surfaces get closer to each other near the point charges?

7. Figures (i) and (ii) show the field lines of the positive and negative point charges respectively.



   (a) Give the sign of the potential difference $V_P - V_Q, V_B - V_A$.

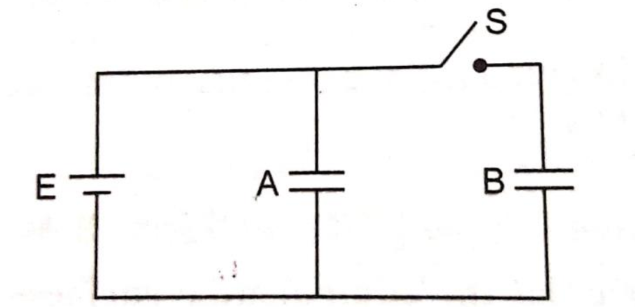
   (b) Give the sign of the potential energy difference of a small negative charge between the points Q and P, A and B.

   (c) Give the sign of the work done by the field in moving a small positive charge from Q to P.

   (d) Give the sign of the work done by the external agency in moving a small negative charge from B to A.

   (e) Does the kinetic energy of a small negative charge increase or decrease in going from B to A?

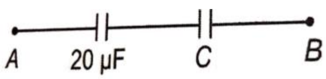
8. Two identical parallel plate capacitor A and B are connected to a battery of V volts with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant K. Find the ratio of the total electrostatic energy stored in both capacitors before and after the introduction of the dielectric.



9. (a) A parallel plate capacitor is charged by a battery to a potential. The battery is disconnected and a dielectric slab is inserted to completely fill the space between the plates. How will (i) its capacitance, (ii) electric field between the plates, and (iii) energy stored in the capacitor be affected? justify your answer giving necessary mathematical expression for each case.

(b) Sketch the pattern of electric field lines due to (i) a conducting sphere having negative charge in it,(ii) and electric dipole.

10. The equivalent capacitance of the combination between A and B in the given figure is 4 μF.



(i) Calculate capacitance of the capacitor C.
(ii) Calculate charge on each capacitor if a 12V battery is connected across terminals A and B.
(iii) What will be the potential drop across each capacitor?

CH-3 CURRENT ELECTRICITY

1. **Assertion:** In a simple battery circuit, the point of the lowest potential is positive terminal of the battery.
   Reason: The current flows towards the point of the higher potential, as it does in such a circuit from the negative to the positive terminal.

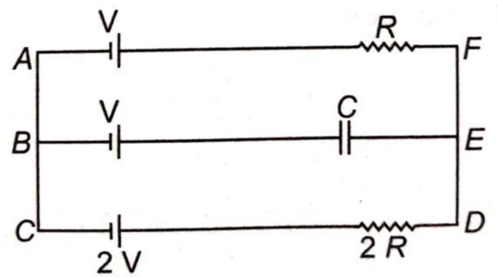
2. **Assertion:** Voltmeter is connected in parallel with the circuit.
   Reason: Resistance of a voltmeter is very large.

3. Drift velocity v_d varies with the intensity of electric field as per the relation
   (a) $v_d \propto$ E (b) $v_d \propto \frac{1}{E}$ (c) v_d = constant (d) $v_d \propto E^2$

4. 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.

5. Explain the term ‘drift velocity’ of electrons in a conductor. Hence obtain the expression for the current through a conductor in terms of ‘drift velocity’.
6. Plot a graph showing temperature dependence of resistivity for a typical semiconductor. How is this behavior explained?
7. Define relaxation time of the free electrons drifting in a conductor. How is it related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material.
8. In the given circuit in the steady state, obtain the expression for
   (a) the potential drop
   (b) the charge and
   (c) the energy stored in the capacitor, C.



9. (i) Derive an expression for drift velocity of electrons in a conductor. Hence deduce Ohm's law.
   (ii) A wire whose cross-sectional area is increasing linearly from its one end to the other, is connected across a battery of V volts. Which of the following quantities remain constant in the wire?
   (a) Drift speed (b) current density (c) electric current (d) electric field
   Justify your answer.
10. (a) State the two Kirchhoff’s laws. Explain briefly how these rules are justified.
    (b) The current is drawn from a cell of emf E and internal resistance r connected to the network of resistors each of resistance r as shown in the figure. Obtain the expression for (i) the current drawn from the cell and (ii) the power consumed in the network.∝

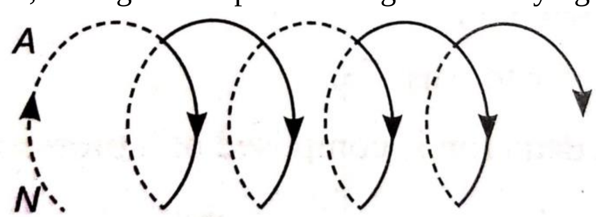
CH-4 MOVING CHARGES AND MAGNETISM

1. **Assertion:** In electric circuits, wires carrying currents in opposite directions are often twisted together
   Reason: If the wires are not twisted together, the combination of the wires forms a current loop, the magnetic field generated by the loop might affect adjacent circuits or components.
2. **Assertion:** To convert a galvanometer into an ammeter a small resistance is connected in parallel with it.
   Reason: The small resistance increases the combined resistance of the combination.
3. **Assertion:** Free electrons always keep on moving in a conductor even then no magnetic force act on them in magnetic field unless a current is passed through it.
   Reason: The average velocity of free electron is zero.

4. Two charged particles traverse identical helical paths in a completely opposite sense in a uniform magnetic field B $=B_0\hat{k}$.

(a) They have equal z-components of momenta.
(b) They must have equal charges.
(c) They necessarily represent a particle-antiparticle pair.
(d) The charge to mass ratio satisfies:

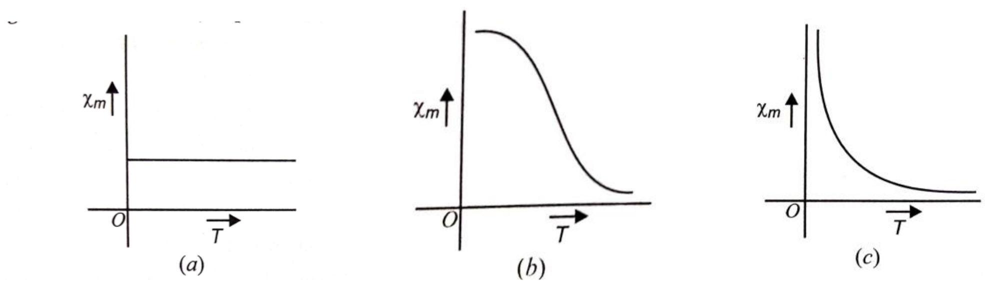
5. An electron is projected with uniform velocity along the axis of a current carrying long solenoid. Which of the following is true?
   (a) The electron will be accelerated along the axis.
   (b) The electron path will be circular about the axis.
   (c) The electron will experience a force at 45° to the axis and hence execute a helical path.
   (d) The electron will continue to move with uniform velocity along the axis of the solenoid.
6. Write the expression for Lorentz magnetic force on a particle of charge q moving with velocity $\vec{v}$ in a magnetic field$\vec{B}$. Show that no work is done by this force on the charged particle.
7. Find the condition under which the charged particles moving with different speeds in the presence of electric and magnetic field vectors can be used to select charged particles of a particular speed.
8. (a) Write the expression for the force $\vec{F}$ acting on a particle of mass m and charge q moving with velocity $\vec{v}$ in a magnetic field$\vec{B}$. Under what condition will it move in (i) a circular path and (ii) a helical path?
   (b) Show that the kinetic energy of the particle moving in a magnetic field remains constant.
9. An iron ring of relative permeability μ_r has windings of insulated copper wire of n turns per metre. When the current in the windings is I, find the expression for the magnetic field in the ring.
10. (a) State Ampere's circuital law. Use this law to obtain the expression for the magnetic field inside an air cored toroid of average radius r, having n terns per unit length and carrying a steady current I.



   (b) An observer to the left of a solenoid of N turns each of cross-section area A observes that a steady current I in it flows in the clockwise direction. Depict the magnetic field lines due to the solenoid specifying its polarity and show that it acts as a bar magnet of magnetic moment m = NIA.
11. (a) A long straight wire of a circular cross-section. Apply Ampere's circuital law to calculate the magnetic field at a point r in the region for (i) $r < a$ and (ii) $r > a$. Plot a graph showing the nature of tis variation.
   (b) Calculate the ratio of magnetic field at a point a/2 above the surface of the wire to the at a point a/2 below its surface. What is the maximum value of the field of this wire?

CH-5 MAGNETISM AND MATTER

12. The magnetic field of Earth can be modelled by that of a point dipole placed at the centre of the Earth . The dipole axis makes an angle of 11.3° with the axis of Earth. At Mumbai, declination is nearly zero. Then,
    (a) The declination varies between 11.3° W to 11.3° E.
    (b) The least declination is 0°.
    (c) The plane defined by dipole axis and Earth axis passes through Greenwich.
    (d) Declination over Earth must be always negative.
13. In a permanent magnet at room temperature
    (a) Magnetic moment of each molecule is zero.
    (b) The individual molecules have non-zero magnetic moment which are all perfectly aligned.
    (c) Domains are partially aligned.
    (d) Domains are all perfectly aligned.
14. (a) Name the three elements of the earth's magnetic field.
    (b) Where on the surface of the earth is the vertical component of earth's magnetic field is zero?
15. The susceptibility of a magnetic material is -2.6×10^{-5}. Identify the type of magnetic material and state its two properties.
16. Two identical thin bar magnets, each of length L and pole strength m are placed at right angles to each other, with the north pole of one touching the south pole of one touching the south pole of the other. Find the magnetic moment of the system.
17. Three curves are shown in the figures. Indicate what magnetic substance they represent.



18. Derive the expression for the magnetic field at the site of a point nucleus in a Hydrogen atom due to the circular motion of the electron. Assume that the atom is in its ground state and give the answer in terms of fundamental constants.
19. (a) Draw the magnetic field lines due to a circular loop of area $\vec{A}$ carrying current I. Show that it act as a bar magnet of magnetic moment $\vec{m} = \overrightarrow{IA}$.
    (b) Derive the expression for the magnetic field due to a solenoid of length 2 l, radius a having n number of turns per unit length and carrying a steady current I at a point on the axial line, distance r from the centre of the solenoid. How does this expression compare with the axial magnetic field due to a bar magnet of magnetic moment m?

<u>CH-6 ELECTROMAGNETIC INDUCTION</u>

1. **Assertion:** Induced emf will always occur whenever there is change in magnetic flux.
   Reason: Current always induces whenever there is change in magnetic flux.
2. **Assertion:** Faraday's laws are consequence of conservation of energy.
   Reason: In a purely resistive ac circuit, the current legs behind the emf in phase.

3. According the Faraday's first law, whenever the amount of magnetic flux linked with a circuit changes, an emf is induced in it. Induced current is determined by the rate at which the magnetic flux changes. Mathematically, the magnitude of the induced emf in a circuit is equal to the rate of change of magnetic flux through the circuit.

Induced emf $\propto$ rate of change of magnetic flux

(i) On the basis of Faraday's law, current in the coil is larger
(a) when the magnet is on pushed towards the coil faster
(b) when the magnet is pulled away the coil faster
(c) Both (a) and (b)
(d) Neither (a) nor (b)

(ii)The flux linked with a circuit is given by $\phi = t^3 + 3t - 7$. The graph between time (X-axis) and induced emf (Y-axis) will be a
(a) Straight line through the origin
(b) Straight line with positive intercept
(c) Straight line with negative intercept
(d) Parabola not through the origin

(iii) Wire loop is rotated in a magnetic field. The frequency of change of direction of the induced emf is
(a) Once per revolution
(b) Twice per revolution
(c) Four times per revolution
(d) Six times per revolution

(iv) The instantaneous magnetic flux linked with a coil is given by $\phi = (5t^3 - 100t + 300)$ Wb. The emf induced in the coil at time t=2 s is
(a) – 40 V
(b) 40V
(c) 140 V
(d) 300 V
(v) A copper disc of radius 0.1 m is rotated about its centre with 20 rev/s in a uniform magnetic field of 0.1 T with its plane perpendicular to the field. The emf induced across the radius of the disc is

(a) $\frac{\pi}{20} V$ (b) $\frac{\pi}{10} V$
(c) 20π mV (d) None of these

20. A loop, made of straight edges has six corners at A (0, 0, 0), B (L,0,0), C(L,L 0), D (0,L,0), E(0,L,L) and F(0,0,L). A magnetic field B = B_0 ($\hat{\imath}$+ $\hat{k}$)T is present in the region. The flux passing through the loop ABCDEFA (in that order) is
(a) $B_0 L^2$ Wb. (b) 2 $B_0 L^2$ Wb. (c) $\sqrt{2}\ B_0 L^2$ Wb. (d) 4 $B_0 L^2$ Wb

21. There are two coils A and B as shown in figure. A current starts flowing in B as shown, when A is moved towards B and stops when A stops moving. The current in A is counterclockwise. B is kept stationary when A moves. We can infer that

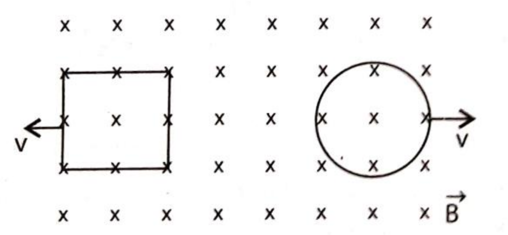
(a) There is a constant current in the clockwise direction in A.

(b) There is a varying current in A.

(c) There is no current in A.

(d) There is a constant current in the counterclockwise direction in A.

22. A rectangular loop and a circular loop are moving out of a uniform magnetic field to a field-free region with a constant velocity v as shown in the figure. Explain in which loop do you expect the induced emf to be constant during the passage out of the field region. the magnetic field is normal to the loops.



23. (a) How are eddy currents reduced in a metallic core?

(b) Give two uses of eddy currents.

24. A metallic rod of length I is rotated with a frequency v with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius r, about an axis passing through the centre and perpendicular to the plane of the ring. A constant uniform magnetic field B parallel to the axis is presents everywhere. Using Lorentz force, explain how emf is induced between the centre and the metallic ring and hence obtain the expression for it.

25. (a) A rod of length l is moved horizontally with a uniform velocity v in a direction perpendicular to its length through a region in which a uniform magnetic field is acting vertically downward. Drive the expression for the emf induced across the ends of the rod.

(b) How does one understand this motional emf by invoking the Lorentz force acting on the free charge carriers of the conductor? Explain.

26. (a) Define mutual inductance and write its SI units.

(b) Derive an expression for the mutual inductance of two long co-axial solenoids of same length would one over the other.

(c) In an experiment, two coils c_1 and c are placed close to each other. Find out the expression for the emf induced in the coil c_1 due to change in the current through the coil c_2

27. (a) Describe a simple experiment (or activity) to show that the polarity of emf induced in a coil is always such that it tends to produce a current which oppose the change of magnetic flux that produces it.

(b) The current flowing through an inductor of self-inductance L is continuously increasing. Plot a graph showing the variation of

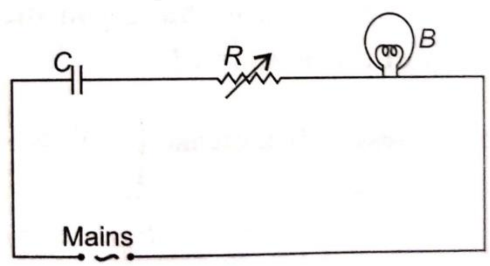
(i) Magnetic flux versus the current

(ii) Induced emf versus dI/dt

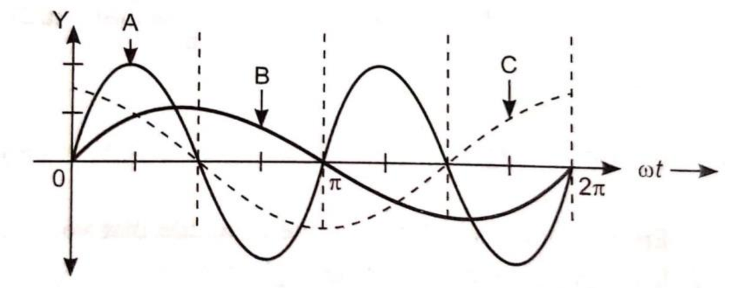
(iii) Magnetic potential energy stored versus the current.

CH-7 ALTERNATING CURRENT

1. An inductor of reactance 1 Ω and a resistor of 2 Ω are connected in series to the terminals of a 6V (rms) a.c source. The power dissipated in the circuit is
   (a) 8 W. (b) 12 W. (c) 14.4 W. (d) 18 W.
2. As the frequency of an ac circuit increases, the current first increases and then decreases. What combination of circuit elements is most likely to comprise the circuit?
   (a) Inductor and capacitor.
   (b) Resistor and inductor.
   (c) Resistor and capacitor.
   (d) Inductor only.
3. A capacitor C, a variable resistor R and a bulb B are connected in series to the ac mains in circuit as shown. The bulb glows with some brightness. How will the glow of the bulb change if (a) a dielectric slab is introduced between the plates of the capacitor, keeping resistance R to be the same; (b) the resistance R is increased keeping the same capacitance?



4. State underlying principle of a transformer. How is the large scale transmission of electric energy over long distance done with the use of transformers?
5. A series LCR circuit is connected to an ac source. using the phasor diagram, drive the expression for the impedance of the circuit. Plot a graph to show the variation of current with frequency of the source, explaining the nature of its variation.
6. An inductor L of inductance X_L is connected in series with a bulb B and an ac source. How would brightness of the bulb change when (a) number of turn in the inductor is reduced, (b) an iron rod is inserted in the inductor and (c) a capacitor of resistance X_C = X_L is inserted in series in the circuit. Justify your answer in each case.
7. A device X is connected across an ac source of voltage V = V_0 sin wt. The current through X is given as I = I_0 sin$\left(\omega t + \frac{\Pi}{2}\right)$.
   (a) Identify the device X and write the expression for its resistance
   (b) Drow graphs showing variation of voltage and current with time over one cycle of ac, for X.
   (c) How does the reactance of the device X vary with frequency of the ac? Show this variation graphically.
   (d) Draw the phasor diagram for the device X.
8. A device X is connected to an ac source V = V_0 sin ωt. The variation of voltage, current and power in one cycle is shown in the following graph.



(a) Identify the device X.

(b) Which of the curves A, B and C represent the voltage, current and the power consumed in the circuit? Justify your answer.

(c) How does it impedance vary with frequency of the ac source? Show graphically.

(d) Obtain an expression for the current in the circuit and its phase relation with ac voltage.