



Indian School Al Wadi Al Kabir

Assessment I (2026-2027)

Sub: Physics (042)

Class: XII

Date: 24/09/2026

Set- II

Max. Marks: 70

Time: 3 Hours

General Instructions

Read the following instructions carefully and follow them:

- (i) This question paper contains **33 questions**. **All questions are compulsory**.
- (ii) This question paper is divided into **five sections – Sections A, B, C, D and E**.
- (iii) In **Section A – Q. 1 to 16** are Multiple Choice type questions. Each question carries **1 mark**.
- (iv) In **Section B – Q. 17 to 21** are Very Short Answer type questions. Each question carries **2 marks**.
- (v) In **Section C – Q. 22 to 28** are Short Answer type questions. Each question carries **3 marks**.
- (vi) In **Section D – Q. 29 and 30** are Case study-based questions. Each question carries **4 marks**.
- (vii) In **Section E – Q. 31 to 33** are Long-answer type questions. Each question carries **5 marks**.
- (viii) There is **no overall choice** given in the question paper. However, an **internal choice** has been provided in a few questions in all the Sections except Section A.
- (ix) Use of **calculators is not allowed**.

You may use the following values of physical constants wherever necessary:

- $c = 3 \times 10^8$ m/s
- $h = 6.63 \times 10^{-34}$ J s
- $e = 1.6 \times 10^{-19}$ C
- $\mu_0 = 4\pi \times 10^{-7}$ T m A⁻¹
- $\epsilon_0 = 8.854 \times 10^{-12}$ C² N⁻¹ m⁻²
- $1/(4\pi\epsilon_0) = 9 \times 10^9$ N m² C⁻²
- Mass of electron (m_e) = 9.1×10^{-31} kg
- Mass of neutron = 1.675×10^{-27} kg
- Mass of proton = 1.673×10^{-27} kg
- Avogadro's number = 6.023×10^{23} per gram mole
- Boltzmann constant = 1.38×10^{-23} J K⁻¹

SECTION A (1 x 16 = 16)

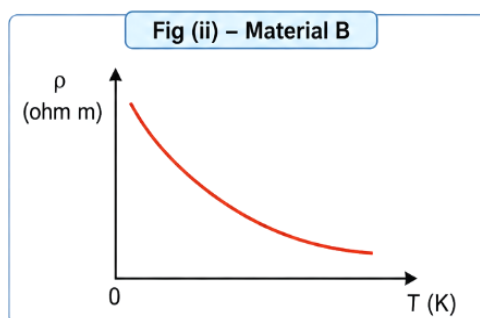
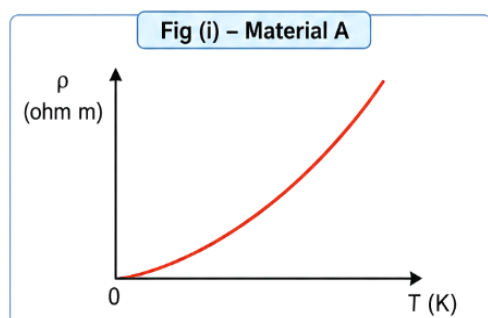
1. The electric field at a point on the equatorial line of a dipole is:

(A) Parallel to P
(B) Anti-parallel to P
(C) Zero
(D) Perpendicular to P

2. A charged particle is released from rest in a uniform electric field. Which statement is correct?

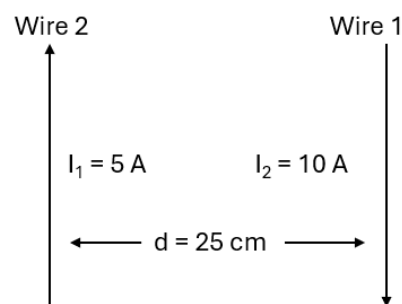
(A) Its acceleration remains constant if its charge-to-mass ratio is constant.
(B) Its velocity remains constant.
(C) Its electric potential energy always increases.
(D) No work is done by the electric field.

3. A closed spherical surface encloses charges $+3 \mu\text{C}$, $-2 \mu\text{C}$ and $+5 \mu\text{C}$. What is the electric flux through the surface?
 (A) 0
 (B) $6.0 \times 10^5 \text{ N m}^2\text{C}^{-1}$
 (C) $6.78 \times 10^5 \text{ N m}^2\text{C}^{-1}$
 (D) $9.0 \times 10^5 \text{ N m}^2\text{C}^{-1}$
4. A dielectric is introduced between the plates of a capacitor mainly to:
 (A) decrease its capacitance.
 (B) increase its capacitance.
 (C) decrease the plate area.
 (D) increase the plate separation.
5. Electric field lines are always _____ to equipotential surfaces.
 (A) parallel
 (B) perpendicular
 (C) inclined at 45°
 (D) tangent
6. An isolated conducting sphere of radius 9 cm is in vacuum. What is its capacitance?
 (A) 1 pF
 (B) 10 pF
 (C) 100 pF
 (D) 0.1 pF
7. A resistor R is connected first across a voltage V and then across a voltage 2V. Assuming resistance remains constant, the ratio of power consumed is:
 (A) 1:2
 (B) 1:4
 (C) 2:1
 (D) 4:1
8. A cell of emf 10 V and internal resistance 1Ω is connected to an external resistance of 4Ω . Its terminal voltage is:
 (A) 2 V
 (B) 6 V
 (C) 8 V
 (D) 10V
9. The temperature (T) dependence of the resistivity of material A and material B is represented by fig (i) and fig (ii), respectively. Identify material A and material B



- (A) A – Metal B – Semiconductor
 (B) A – Semiconductor B – Metal
 (C) A – Alloy B – Metal
 (D) A – Metal B – Alloy

10. If n cells each of emf ε and internal resistance r are connected in parallel, then the total emf and internal resistance will be
 (A) ε and nr
 (B) $n\varepsilon$ and r/n
 (C) ε and r/n
 (D) $n\varepsilon$ and r
11. Two parallel conductors carry currents in opposite directions. $I_1 = 5 \text{ A}$, $I_2 = 10 \text{ A}$ and $d = 25 \text{ cm}$



The force per unit length is:

- (A) $4 \times 10^{-5} \text{ N/m}$, attractive
 (B) $4 \times 10^{-5} \text{ N/m}$, repulsive
 (C) $8 \times 10^{-5} \text{ N/m}$, attractive
 (D) $2 \times 10^{-5} \text{ N/m}$, repulsive
12. A bar magnet has magnetic dipole moment M . Its initial position is parallel to the direction of the uniform magnetic field B . In this position, the magnitudes of torque and force acting on it respectively, are
 (A) 0 and MB
 (B) MB and MB
 (C) 0 and 0
 (D) m and 0

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

- (A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
 (B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
 (C) Assertion is true, but Reason is false.
 (D) Both Assertion and Reason are false.
13. **Assertion(A):** The conductivity of an electrolyte is very low as compared to a metal at room temperature.
Reason(R): The number density of free ions in an electrolyte is much smaller than the number density of free electrons in metals. Further, ions drift much more slowly because they are heavier.

14. **Assertion (A):** Susceptibility is defined as the ratio of intensity of magnetisation I to magnetic intensity H .
Reason (R): The greater the value of susceptibility, the smaller the value of intensity of magnetisation
15. **Assertion (A):** The negative sign in Faraday's law indicates the direction of induced emf.
Reason (R): The induced current always produces a magnetic field that supports the change in magnetic flux.
16. **Assertion (A):** A capacitor completely blocks alternating current.
Reason (R): The capacitive reactance of a capacitor increases with an increase in frequency.

SECTION B (2 x 5 = 10)

- 17 (I) An electric iron rated 2.2 kW, 220 V is operated on a 110 V supply.
Find: (i) its resistance, and (ii) the heat produced by it in 10 minutes.
- OR**
- (II) A current of 0.5 A flows through a wire of length 1 m and cross-sectional area 10 mm^2 , when a potential difference of 2 V is applied across its ends. Calculate the resistivity of the material of the wire.
18. A charged parallel plate capacitor is disconnected from the battery. The separation between its plates is increased. State with reason how the following quantities change.
1. Capacitance
 2. Potential difference across the plates
19. A small piece of bismuth is placed in a region of a strong magnetic field. It tends to move from the region of stronger magnetic field towards the region of weaker magnetic field.
- (a) Identify the magnetic nature of bismuth.
(b) Explain why it moves towards the weaker magnetic field and give the value of its relative permeability.
- 20 (I) A charged particle enters a uniform magnetic field with its velocity making an angle θ with the magnetic field.
- (a) Describe the path followed by the particle.
(b) What happens when $\theta = 0^\circ$?
- OR**
- (II) (a) Write the expression for the magnetic force acting on a charged particle moving with velocity v in the presence of a magnetic field B .
(b) When is the force on a charged particle moving in a magnetic field
(i) maximum and (ii) minimum?
21. A conducting rod of length 1m rotates with an angular speed of 20 rad s^{-1} about one end in a uniform magnetic field of 0.5 T, with the magnetic field perpendicular to the plane of rotation. Calculate the emf induced between its ends.

SECTION C (3 x 7 = 21)

22. A galvanometer has a resistance of 12Ω and the meter shows full-scale deflection for a current of 3 mA. How will you convert the galvanometer into a voltmeter of range 0–18 V? Explain with the help of a diagram by finding the value of each component used.

23. (A) Define temperature coefficient of resistivity.
(B) Derive a formula for resistance and resistivity in terms of number density of electrons and relaxation time.
24. Explain the following statements giving reason:
(i) An equipotential surface through a point is normal to the electric field at that point.

(ii) When a dielectric is placed in an external electric field, the electric field inside the dielectric is less than that outside it.

(iii) The potential difference between the plates of a charged parallel plate capacitor decreases when its plates are brought closer.
25. A series combination of **L, C and R** is connected to an AC source $V = V_0 \sin \omega t$
(i) Derive the impedance of the circuit using a phasor diagram.
(ii) Obtain the expression for the instantaneous current I , and
(iii) Obtain the phase relationship of current to the applied voltage.
26. (a) Define the term resonant frequency and state the condition of resonance.
(b) An inductor of $\frac{5}{\pi}$ H, a capacitor of $\frac{50}{\pi}$ μ F, and a resistor of 400 Ω are connected in series across an voltage : $V = 140 \sin(100\pi t)$ V.

Calculate:

- (i) Impedance of the circuit, and
(ii) RMS value of current that flows in the circuit.
(Take $\sqrt{2} = 1.4$)

- 27 (I)
(a) Two concentric circular coils of radii r_1 and r_2 ($r_2 \gg r_1$) are placed coaxially with their centres coinciding. If a current I is passed through the outer coil, obtain the expression for the mutual inductance of the arrangement.
(b) The current in a solenoid decreases steadily from 6 mA to 2 mA in 50 ms. If an average emf of 0.4 V is induced, find the self-inductance of the solenoid.

OR

(II)

A coil of 200 turns experiences a change in magnetic flux from 4×10^{-4} Wb to 1×10^{-4} Wb in 0.02s.

- (a) Calculate the magnitude of the induced emf in the coil.
(b) Name the law used to calculate the induced emf and the law used to find the direction of the Induced emf.
(c) If the change in flux is completed in half the time, what happens to the induced emf?
28. (a) A rectangular loop of sides l and b carries a current I clockwise. Write the magnetic moment $\vec{M}$ of the loop and show its direction in a diagram.

(b) The loop is placed in a uniform magnetic field $\vec{B}$ and is free to rotate about an axis which is perpendicular to $\vec{B}$. Prove that the loop experiences no net force, but a torque $\vec{\tau} = \vec{M} \times \vec{B}$.

SECTION D (4 x 2=8)

29 Gauss's Law and its Significance

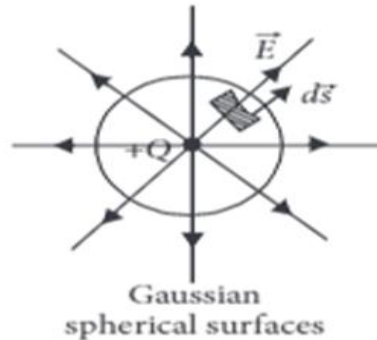
Gauss's law and Coulomb's law, although expressed in different forms, are equivalent ways of describing the relation between charge and electric field in static conditions.

Gauss's law is $\phi = \frac{q}{\epsilon_0}$

where 'q' is the net charge inside an imaginary closed surface called a Gaussian surface.

$\phi = \oint \vec{E} \cdot d\vec{s}$ gives the electric flux through the Gaussian surface.

The two equations hold only when the net charge is in vacuum or air.



Answer the following questions:

(I) If there is only one type of charge in the universe, then
(E-Electric field, ds - Area vector)

(A) $\oint \vec{E} \cdot d\vec{s} \neq 0$ on any surface

(B) $\oint \vec{E} \cdot d\vec{s}$ could not be defined

(C) $\oint \vec{E} \cdot d\vec{s} = \infty$, if the charge is inside

(D) $\oint \vec{E} \cdot d\vec{s} = 0$ if the charge is outside, $\oint \vec{E} \cdot d\vec{s} = \frac{q}{\epsilon_0}$ if the charge is inside.

(II) What is the nature of the Gaussian surface involved in Gauss's law of electrostatics?

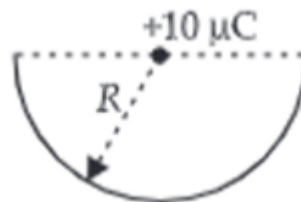
(A) Magnetic

(B) Scalar

(C) Vector

(D) Electrical

(III) A charge of $10 \mu\text{C}$ is placed at the centre of a hemisphere of radius $R = 10 \text{ cm}$ as shown. The electric flux through the hemisphere in SI units is



(A) 20×10^5

(B) 10×10^5

(C) 6×10^5

(D) 2×10^5 .

(IV) The electric flux through a closed surface area S enclosing charge Q is ϕ . If the surface area is doubled, then the flux is

(A) 2ϕ

(B) $\frac{\phi}{2}$

(C) $\frac{\phi}{4}$

(D) ϕ

OR

(IV) A Gaussian surface encloses a dipole. The electric flux through this surface is

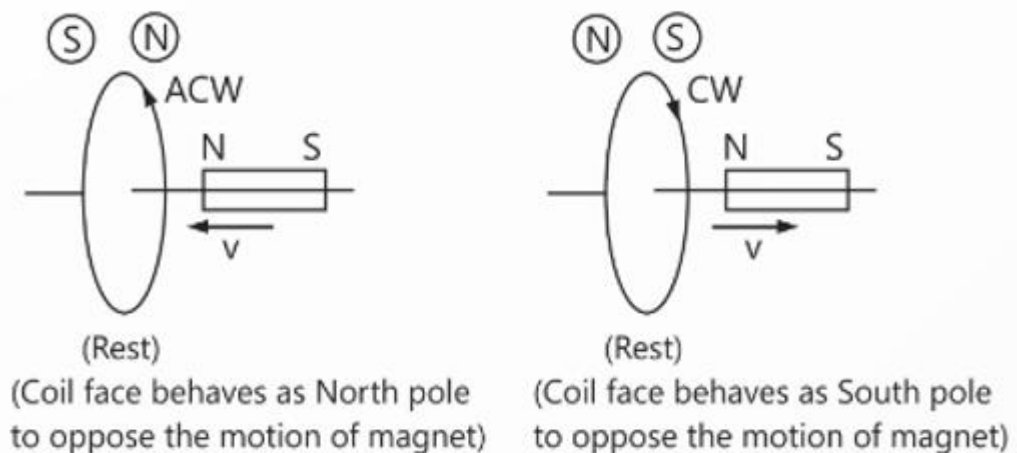
(A) $\frac{q}{\epsilon_0}$

(B) $\frac{2q}{\epsilon_0}$

(C) $\frac{q}{2\epsilon_0}$

(D) Zero

30. Lenz's law states that the direction of induced current in a circuit is such that it opposes the change which produces it. Thus, if the magnetic flux linked with a closed-circuit increases, the induced current flows in such a direction that a magnetic flux is created in the opposite direction of the original magnetic flux. If the magnetic flux linked with the closed circuit decreases, the induced current flows in such a direction as to create a magnetic flux in the direction of the original flux.



Answer the following questions.

(I) Which of the following statements is correct?

- (A) The induced emf is not in the direction opposing the change in magnetic flux to oppose the cause which produces it.
- (B) The relative motion between the coil and the magnet produces a change in magnetic flux.
- (C) The emf is induced only if the magnet is moved towards the coil.
- (D) The emf is induced only if the coil is moved towards the magnet.

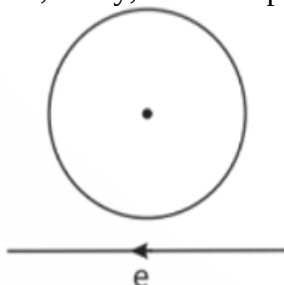
(II) The polarity of the induced emf is given by

- (A) Ampere's circuital law
- (B) Biot-Savart law
- (C) Lenz's law
- (D) Fleming's Right Hand Rule

(III) Lenz's law is the consequence of

- (A) Charge
- (B) Energy
- (C) Momentum
- (D) Mass

(IV) Near a circular loop of conducting wire as shown in the figure, an electron moves along a straight line. The direction of the induced current, if any, in the loop is



- (A) Clockwise
- (B) Zero
- (C) Variable
- (D) Anticlockwise

OR

(IV) Two identical circular coils A and B are kept in a horizontal tube side by side without touching each other. If the current in coil A increases with time, in response, coil B:

- (A) Is attracted by A
- (B) Remains stationary
- (C) Is repelled
- (D) Rotates

SECTION E (5 x 3 = 15)

31 (I)

- (A) Define the coefficient of mutual induction (mutual inductance) between two coils. Derive an expression for the mutual inductance M between two long coaxial solenoids of length ℓ , common cross-sectional area A , and number of turns N_1 and N_2 , respectively, when a time-varying current I flows through the first solenoid.
- (B) Two coils having 30 and 600 turns, respectively, are wound side-by-side on a closed iron circuit of cross-section 100 cm^2 and mean length 200 cm . Estimate the mutual inductance between the coils if the relative permeability of the iron is 2000.

OR

(II)

- (A) With the help of a labelled diagram, describe the principle and working of an AC generator. Also obtain an expression for the instantaneous value of the emf generated if the angular velocity of the armature coil is ω .
- (B) A rectangular coil of area 0.02 m^2 rotates at 50 revolutions per second in a magnetic field of 0.5 T . If the maximum induced emf is 314 V , find the number of turns in the coil.

32 (I)

- (A) With the help of a labelled diagram, explain the principle and working of a moving coil galvanometer. Write the purpose of using (i) a radial magnetic field and (ii) a soft iron core in it.
- (B) Define current sensitivity of a galvanometer. "Increasing the current sensitivity may not necessarily increase the voltage sensitivity". Give reason.

OR

(II)

(A) Write Ampere's circuital law in mathematical form and explain the terms used.

(B) As the current-carrying solenoid is made longer, the magnetic field produced outside it approaches zero. Why?

(C) A flexible loop of irregular shape carrying current, when located in an external magnetic field, changes to a circular shape. Give a reason.

(D) A long, straight wire carries a current of 5 A. Using Ampere's circuital law, calculate the magnetic field at a point 10 cm away from the wire.

33 (I)

(A) Two cells of emf E_1 and E_2 have internal resistances r_1 and r_2 . Deduce an expression for the equivalent emf of their parallel combination.

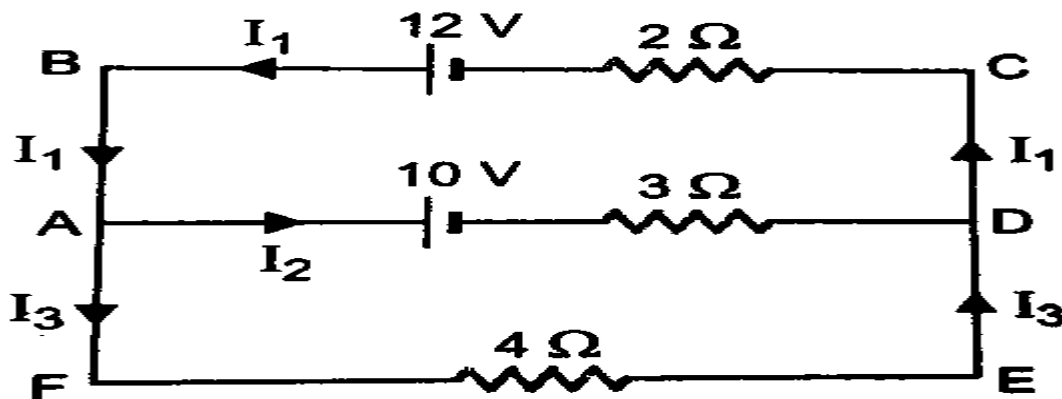
(B) Two cells of emfs 1.5 V and 2.0 V having internal resistances $0.2\ \Omega$ and $0.3\ \Omega$ respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell.

OR

33 (II)

(A) State Kirchhoff's current law and voltage law. Apply these laws to obtain the condition for balance of a Wheatstone bridge.

(B) Find the values of I_1 , I_2 & I_3 using Kirchhoff's laws.



All the best!