

NAAHAR PUBLIC SCHOOL CBSE SEMNIOR SECONDARY
ACADEMIC YEAR (2022-2023)
FULL REVISION-I

STD: XII
SUBJECT: PHYSICS
SUBJECT TEACHER: Mrs. Gayatri

TOTAL: 70
DATE: 02.12.2022
DUR: 3HRS

General Instructions:

- (1) There are 35 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. All the sections are compulsory.
- (3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, Section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.
- (4) There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.
- (5) Use of calculators is not allowed.

SECTION-A

1. SI unit of permittivity of free space is
(a) Farad (b) Weber (c) $C^2N^{-1} m^{-2}$ (d) $C^2N^{-1} m^{-2}$
2. The unit of electric dipole moment is
(a) Newton (b) coulomb (c) farad (d) Debye
3. Equipotential surfaces
(a) are closer in regions of large electric fields compared to regions of lower electric fields.
(b) Will be more crowded near sharp edges of a conductor.
(c) Will always be equally spaced. (d) Both (a) and (b) are correct.
4. Dielectric constant for a metal is
(a) zero (b) infinite (c) 1 (d) 10
5. Combine three resistors 5 Q, 4.5 Q and 3 Q in such a way that the total resistance of this combination is maximum
(a) 12.5 Q (b) 13.5 Q (c) 14.5 Q (d) 16.5 Q
6. The resistivity of alloy manganin is
(a) Nearly independent of temperature (b) Increases rapidly with increase in temperature
(c) Decreases with increase in temperature (d) Increases rapidly with decrease in temperature
7. Ampere's circuital law is given by
(a) $\oint \vec{H} \cdot d\vec{l} = \mu_0 I_{enc}$ (b) $\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{enc}$
(c) $\oint \vec{B} \cdot d\vec{l} = \mu_0 J$ (d) $\oint \vec{H} \cdot d\vec{l} = \mu_0 J$
8. In a moving coil galvanometer the deflection (Φ) on the scale by a pointer attached to the spring is
(a) $\left(\frac{NA}{kB}\right) I$ (b) $\left(\frac{N}{kAB}\right) I$
(c) $\left(\frac{NAB}{k}\right) I$ (d) $\left(\frac{NAB}{kI}\right) -$
9. Ferrites may be:
(a) ant. Ferromagnetic (b) ferromagnetic (c) ferromagnetic (d) None of the above

10. A magnetic bar of M magnetic moment is placed in the field of magnetic strength B, the torque acting on it is:

- (a) $\vec{M} \cdot \vec{B}$
- (b) $-\vec{M} \cdot \vec{B}$
- (c) $\vec{M} \times \vec{B}$
- (d) $\vec{B} \times \vec{M}$

11. Which of the following is not equal to a henry?

- (a) $\frac{\text{Voltsecond}}{\text{ampere}}$
- (b) $\frac{\text{Voltsecond}^2}{\text{Coulomb}}$
- (c) $\frac{\text{Volt}^2 \text{second}}{\text{Coulomb}}$
- (d) $\frac{\text{Joulesecond}}{\text{Coulomb}^2}$

12. A transformer is used to light 100 W and 110 V lamps from a 220 V mains. If the main current is 0.5 A. Then the efficiency of the transformer is:

- (a) 11%
- (b) 50%
- (c) 80%
- (d) 90%

13. What is the ratio of inductive and capacitance reactance's in an ac circuit?

- (a) 1
- (b) $\omega^2 L$
- (c) $\omega^2 LC$
- (d) 1

14. An ac ammeter connected in series in an ac circuit reads 5A. The peak value of current:

- (a) 5 A
- (b) $5\sqrt{2}$ A
- (c) $\frac{5}{\sqrt{2}}$ A
- (d) zero

15. The Q factor of an LCR circuit at resonance is :

- (a) $\sqrt{R^2 + \omega^2 L^2}$
- (b) $\sqrt{R^2 + (\frac{1}{C\omega})^2}$
- (c) $\frac{\omega_r L}{R}$
- (d) $\sqrt{R^2 + \frac{1}{C^2 \omega^2}}$

Directions: Each of these questions contains two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

- (a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
- (b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
- (c) Assertion is correct, reason is incorrect
- (d) Assertion is incorrect, reason is correct.

16. Assertion: Faraday's laws are consequence of conservation of energy.

Reason: In a purely resistive ac circuit, the current lags behind the emf in phase.

17. Assertion: The total charge stored in a capacitor is zero.

Reason: The field just outside the capacitor is σ/ϵ_0 . (σ is the charge density).

Assertion: A capacitor is connected to a direct current source. Its reactance is infinite.

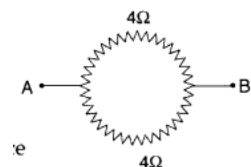
18. Reason: Reactance of a capacitor is given by $X_c = 1/\omega C$.

SECTION-B

19. Define the term electric dipole moment of a dipole. State its S.I. unit

20. Derive an expression for the potential energy of an electric dipole of dipole moment $\vec{p}$ in the electric field E

21. a. A wire of resistance 8R is bent in the form of a circle. What is the effective resistance between the ends of a diameter AB?



b. The emf of a cell is always greater than its terminal voltage. Why? Give reason.

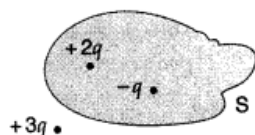
22. An ammeter of resistance 0.6 Ω can measure current up to 1.0 A. Calculate

- (i) The shunt resistance required to enable the ammeter to measure current up to 5.0 A
- (ii) The combined resistance of the ammeter and the shunt.

23. (i) Write two characteristics of a material used for making permanent magnets.
 (ii) Why is core of an electromagnet made of ferromagnetic materials?
24. a. Define self-inductance of a coil. Write its S.I. unit.
 b. State Lenz's law.
25. A spherical conductor of radius 12 cm has a charge of $1.6 \times 10^{-7} \text{ C}$ distributed uniformly on its surface. What is the electric field?
 (a) Inside the sphere (b) just outside the sphere
 (c) at a point 18 cm from the centre of the sphere?
26. A 100 Ω resistor is connected to a 220 V, 50 Hz a.c. supply.
 (a) What is the rms value of current in the circuit?
 (b) What is the net power consumed over a full cycle?
 (c) Define the term 'wattless current'
27. A 1.0 m long metallic rod is rotated with an angular frequency of 400 rad s^{-1} about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field of 0.5 T parallel to the axis exists everywhere. Calculate the emf developed between the centre and the ring.

SECTION-C

28. Figure shows three point charges, $+2q$, $-q$ and $+3q$. Two charges $+2q$ and $-q$ are enclosed within a surface 'S'. What is the electric flux due to this configuration through the surface 'S'?



29. Derive the expression for the electric potential at any point along the axial line of an electric dipole
30. Derive an expression for the resistivity of a good conductor, in terms of the relaxation time of electrons.
31. Draw magnetic field lines when a
 (i) diamagnetic,
 (ii) paramagnetic substance is placed in an external magnetic field.
 Which magnetic property distinguishes this behavior of the field lines due to the two substances?
- (iii) Current flows through a circular loop. Depict the north and south pole of its equivalent magnetic dipole.
32. The electrostatic force on a small sphere of charge $0.4 \mu\text{C}$ due to another small sphere of charge $-0.8 \mu\text{C}$ in air is 0.2 N.
 (a) What is the distance between the two spheres?
 (b) What is the force on the second sphere due to the first?
33. Prove that an ideal capacitor in an a.c. circuit does not dissipate power.
34. a. Two long and parallel straight wires A and B carrying currents of 8.0 A and 5.0 A in the same direction are separated by a distance of 4.0 cm. Estimate the force on a 10 cm section of wire A.
 b. A square coil of side 10 cm consists of 20 turns and carries a current of 12 A. The coil is suspended vertically and the normal to the plane of the coil makes an angle of 30° with the direction of a uniform horizontal magnetic field of magnitude 0.80 T. What is the magnitude of torque experienced by the coil?

SECTION-D

35. Deduce the expression for the electrostatic energy stored in a capacitor of capacitance 'C' and having charge 'Q'.
 How will the
 (i) energy stored and
 (ii) the electric field inside the capacitor be affected when it is completely filled with a dielectric material of dielectric constant 'K'? **(OR)**
- a. In a parallel plate capacitor with air between the plates, each plate has an area of $6 \times 10^3 \text{ m}^2$ and the distance between the plates is 3 mm. Calculate the capacitance of the capacitor. If this, capacitor is connected to a 100 V supply, what is the charge on each plate of the capacitor?
- b. A $12 \mu\text{F}$ capacitor is connected to a 50 V battery. How much electrostatic energy is stored in the capacitor?
36. Draw a schematic diagram of a step-up transformer. Explain its working principle. Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coils. In an ideal transformer, how is this ratio related to the currents in the two coils? How is the

transformer used in large scale transmission and distribution of electrical energy over long distances?

(OR)

A radio can tune over the frequency range of a portion of MW broadcast band: (800 kHz to 1200 kHz), if its LC circuit has an effective inductance of 200 μH , what must be the range of its variable capacitor?

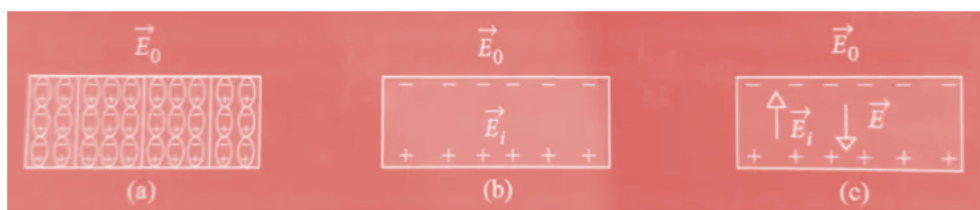
37. Define mutual inductance between two long coaxial solenoids. Find out the expression for the mutual inductance of inner solenoid of length l having the radius r_1 and the number of turns n_1 per unit length due to the second outer solenoid of same length and n_2 number of turns per unit length.

(OR)

A rectangular wire loop of sides 8 cm and 2 cm with a small cut is moving out of a region of uniform magnetic field of magnitude 0.3 T directed normal to the loop. What is the f.e.m.f. developed across the cut if velocity of loop is 1 cm s^{-1} in a direction normal to the (a) longer side (b) shorter side of the loop? For how long does the induced voltage last in, each case?

SECTION-E

38. When an insulator is placed in an external field, the dipoles become aligned. Induced surface charges on the insulator establish a polarization field $\vec{E}_i$ in its interior. The net field $\vec{E}$ in the insulator is the vector sum of $\vec{E}_0$ and $\vec{E}_i$ as shown in the figure.



On the application of external electric field, the effect of aligning the electric dipoles in the insulator is called polarization and the field $\vec{E}_i$ is known as the polarization field.

The dipole moment per unit volume of the dielectric is known as *polarization* ($\mathbf{P}$).

For linear isotropic dielectrics, $\mathbf{P} = \chi \mathbf{E}$, where χ = electrical susceptibility of the dielectric medium.

(i) Which among the following is an example of polar molecule?

- (a) O_2 (b) H (c) N_2 (d) HCl

(ii) When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges separated by a distance

- (a) increases K times (b) remains unchanged
(c) decreases K times (d) increases 2K times.

(iii) Which of the following is a dielectric?

- (a) Copper (b) Glass (c) Antimony (Sb) (d) None of these

(iv) For a polar molecule, which of the following statements is true?

- (a) The centre of gravity of electrons and protons coincide.
(b) The centre of gravity of electrons and protons do not coincide.
(c) The charge distribution is always symmetrical.
(d) The dipole moment is always zero.

(v) When a comb rubbed with dry hair attracts pieces of paper. This is because the

- (a) comb polarizes the piece of paper
(b) comb induces a net dipole moment opposite to the direction of field
(c) electric field due to the comb is uniform
(d) comb induces a net dipole moment perpendicular to the direction of field

39. 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.

The number of turns in the primary and secondary coils of an ideal transformer are 2000 and 50 respectively. The primary coil is connected to a main supply of 120 V and secondary coil is connected to a bulb of resistance 0.6 Ω

(i) The value of voltage across the secondary coil is

- (a) 5V (b) 2V (c) 3 V (d) 10 V

(ii) The value of current in the bulb is

- (a) 7 A (b) 15 A (c) 3 A (d) 5 A

(iii) The value of current in primary coil is

- (a) 0.125 A (b) 2.52 A (c) 1.51 A (d) 3.52 A

(iv) Power in primary coil is

- (a) 20W (b) 5W (c) 10 W (d) 15W

(v) Power in secondary coil is

(a) 15W

(b) 20 W

(c) 7W

(d) 8 W