Model Question Paper
HP Board of School Education Dharamsala
Subject : Physics Class: XII (Regular)
Term - I Session : 2022-23

Time : 3 hours Max. Marks : 50

General Instructions:

1. The question paper has 31 questions. All the questions are compulsory. The internal choice is given where applicable.
2. Questions number 1 to 20 are multiple choice questions, carrying one mark each. Cutting of answers once recorded is not allowed in MCQ.
3. Questions number 21 to 25 are very short answer type questions carrying 2 marks each. Questions number 26 to 29 are short answer type questions carrying 3 marks each and questions number 30 to 31 carry four marks each.
4. There is no negative marking
5. In your answer book, write the serial number of questions exactly as these are in the question paper.

Section A (MCQ)

1. Dimensional formula for inductive reactance is
   A) $[M L^{2} T^{-3} A^{-2}]$ B) $[M L^{-2} T^{-3} A^{1}]$ C) $[M L^{-2} T^{-2} A^{-1}]$ D) $[M L^{2} T^{-3} A^{2}]$

2. Which statement is not true about the ratio , where M is mass of proton, m is the mass of electron and other symbols have the usual meanings.
   A) This is the ratio of electric force to the gravitational force between electron and proton
   B) This is the ratio of the gravitational force to electric force between electron and proton
   C) This ratio is dimensionless
   D) This ratio is of the order of magnitude

3. Which statement is true regarding the relation between electric field and potential.
   A) Electric field is opposite to the direction in which the potential decreases steepest
   B) Electric field is in the direction in which the potential decreases steepest
   C) The magnitude of electric field is given by the product of change in potential and displacement normal to the equipotential surface at that point
   D) Electric field has no relation with the potential

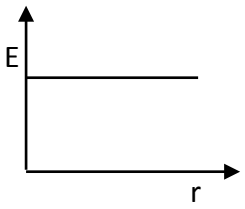
4. Dielectric strength is the maximum value of _____, that a dielectric medium can withstand without break down?
   A) Electric potential B) Electric field C) Dielectric constant D) Charge

5. The resistance of a colour coded resistor is Ω ± 5%. The order of the colours is
   A) orange, violet, yellow. gold B) orange, blue, yellow, silver
   C) red, green, orange, gold D) orange, blue, yellow, gold

6. Gyromagnetic ratio is the ratio of these quantities respectively
   A) angular momentum and magnetic moment
   B) magnetic moment and angular momentum
   C) Planck's constant and magnetic moment
   D) Plank's constant and angular momentum

7. The graph between the electric field E and distance r for a point charge is given by

A)



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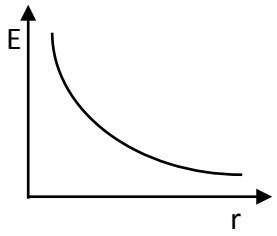

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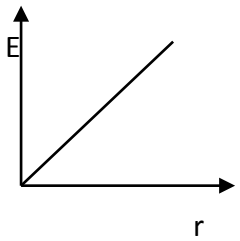

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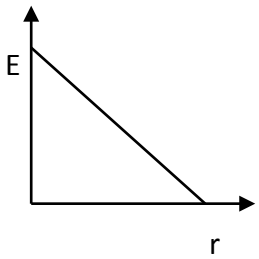


Study the following paragraph and answer questions no. 8 and 9 based on it.

The electrical resistivity is the property of the material and depends upon temperature and pressure. The resistivity of a substance varies over a very wide range. Metals have low resistivity in the range of 10^{-8} Ωm to 10^{-6} Ωm. Insulators like glass and rubber have 10^{22} to 10^{24} times greater resistivity. Semiconductors like Si and Ge lie roughly in the middle range of resistivity on a logarithmic scale.

8. Resistivity of a wire will vary, if its _____ is varied.
   A) length B) radius C) temperature D) area of cross section

9. Arrange the semiconductors (S), Conductors (C) and Insulators (I) in the increasing order of their resistivities
   A) C, I, S B) C, S, I C) I, S, C D) I, C, S

10. A student first uses entire heater coil to produce heat and then she cuts the heater coil into two equal parts and uses only one part in the heater. Now the heat produced will be

    A) same B) halved

    C) doubled D) four times

11. Current density may be given by the relation

    A) current / volume B) current / length

    C) current / area D) current / (area x time)

12. For the resonance in a series LCR circuit, which is true?

    A) Only R must be there in the circuit

    B) Apart from R either of L and C must be there in the circuit

    C) Both L and C must be present in the circuit

    D) Voltages across L and C are equal and are in phase

13. The magnetic field due to Biot - Savart's current element is directed

    A) along the current element

    B) opposite to the current element

    C) along the plane containing **dl** and **r**

    D) perpendicular to the plane containing **dl** and **r**

14. In the cyclotron what makes the charged particle to go round in a circular path inside the metallic dee?

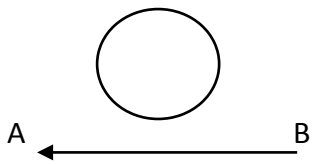
    A) electric field only

    B) magnetic field only

    C) both electric and magnetic field

    D) the applied alternating current

15. What is the direction of induced current in the metallic loop, if the current in the wire is increasing steadily?



    A) Clockwise

    B Anticlockwise

    C) Into the plane of paper

    D) Out of the plane of paper

16. Core of electromagnets are made of ferromagnetic materials which have
    A) low permeability and low retentivity
    B) low permeability and high retentivity
    C) high permeability and low retentivity
    D) high permeability and high retentivity

17. Match the following regarding a transformer

1. hysteresis loss	a) can be minimised using thick wires
2. flux leakage	b) the effect can be reduced by laminating the core
3. eddy currents	c) can be reduced by overlapping windings of the primary and secondary coils
4. resistance of the windings	d) expenditure of energy due to cycles of magnetisation and demagnetisation

    A) 1- a, 2- b, 3 – c, 4 – d
    B) 1- b, 2- a, 3 – c, 4 – d
    C) 1- b, 2- a, 3 – d, 4 – c
    D) 1- d, 2- c, 3 – b, 4 – a

18. Match the following

1. Diamagnetic substances	a) Ticonal
2. Paramagnetic substances	b) Aluminium
3. Ferromagnetic substances	c) Copper
4. Permanent magnets	d) Cobalt

    A) 1- c, 2-b , 3 – d, 4 – a
    B) 1- c, 2- d, 3 – b, 4 – a
    C) 1- a, 2- b, 3 – d, 4 – c
    D) 1- a, 2- d, 3 – b, 4 – c

    In question number 19 and 20, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct option out of the options given below
    A) If both assertion and reason are correct and R is true explanation of A.
    B) If both assertion and reason are correct and R is not the correct explanation of A.
    C) If assertion is true but reason is false.
    D) If both assertion and reason are false.

19. Assertion: Magnetic field lines arise due to charges in motion.
    Reason: In paramagnetic materials despite of net charge being zero, the atoms have net dipole moment

20. Assertion: Gaussian surface should not pass through any discrete charge.
    Reason: Electric field due to a system of discrete charges is not well defined at the location of any charge.

Section B

21. What will happen if for any charge configuration, the equipotential surface through a point is not normal to the electric field?
    OR
    Obtain an expression for the electric field due to a uniformly charged infinite plane sheet.

22. How a galvanometer can be used as a voltmeter to measure the voltage across a given section of a circuit? Give a relation for voltage sensitivity. (1.5 + 0.5 = 2)

23. To show the temperature dependence of resistivity , answer the following
    a) Write equation for resistivity of metallic conductor in terms of temperature coefficient of resistivity.
    b) Draw resistivity versus temperature graphs (not to scale) for nichrome, copper and a semiconductor. (0.5 + 1.5 = 2)

24. State Faraday's law of induction.

25. While entering a sensitive area, a person is made to walk through the doorway of a metal detector for the security reasons. The metal detector emits a sound if any metallic item is carried by the person. On what principle does the metal detector work?
    OR
    When a small and strong magnet like neodymium magnet is dropped through an aluminium pipe held vertically, such that it does not touch the walls of the pipe while falling, it is observed that it takes more time to come out of the pipe as it would take when dropped through the same height without the pipe. Name the phenomenon involved here and explain the reason for the same.

26. A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but has a thickness ¾ d, where d is the separation of the plates. How is the capacitance changed when the slab is inserted between the plates.
    OR
    a) Derive an expression for the potential energy of a system of two charges in an external field.

b) If electrostatic potential energy of a system consisting of two charges with no external field is -0.7 J, how much work is required to separate the two charges infinitely away from each other? (2+1 = 3)

27. Obtain an expression for the electric field due to an electric dipole at a point lying on the axial line of a dipole. Compare the directions of electric field vector and dipole moment vector. (2.5 + 0.5 = 3)

28. Obtain relation for force between two parallel currents to show that antiparallel currents repel. Hence define one ampere. (2.5 + 0.5 = 3)

OR

What is Ampere's circuital law? Discuss two observations based on the result of Ampere's circuital law for an infinite wire. (1+2)

29. Define paramagnetic materials? What is the cause of paramagnetism? (1+2 = 3)

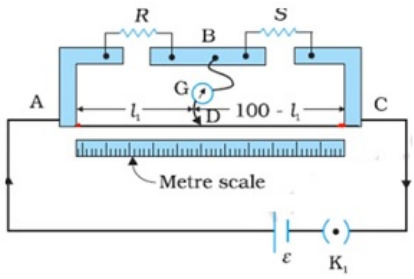
30. a) Express Ohm's law in vector form.

b) Explain the limitations of Ohm's law using the relevant plots where applicable. (2+2 = 4)

OR

a) What is Wheatstone bridge?

b) Meter bridge is a practical device based on Wheatstone bridge. A student while performing the meter bridge experiment found the null point at a distance of 33.7 cm from end A, the point of high potential. If now a resistance of 12 Ω is connected in parallel with S, the null point occurs at 51.9 cm, determine the values of R and S.



31. A metallic rod of 1m length is rotated with a frequency of 50 rps with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius 1m, about an axis passing through the centre and perpendicular to the plane of the ring. A constant and uniform magnetic field 1 tesla parallel to the axis is present everywhere. What is the emf between the centre and the metallic ring?

OR

What do you mean by sharpness of resonance in a series LCR resonant circuit? Obtain an expression for quality factor of the circuit. Hence relate the sharpness and selectivity of the circuit.