Bhavan's Tripura Vidyamandir

1ST Periodic Assessment - (2024-2025)

Class: - 12 **Subject :- Physics**

Time :- 2 Hours Total : - 50 Marks

Name of the Student: Roll Section

General instructions:

1) There are 31 questions in all. All questions are compulsory.
2) This question paper has four sections: Section A, Section B, Section C, Section D. All the sections are compulsory.
3) Section A contains twelve MCQ and four Assertion-Reason of 1 mark each, Section B contains five questions of 2 marks each, Section C contains five questions of 3 marks each, section D contains one long questions of 5 mark.
4) There is no overall choice. However, an internal choice has been provided in section
5) B, C, D. You have to attempt only one of the choices in such questions.
6) Use of calculators is not allowed.

SECTION-A [1X20=20]

Each of the following carries 1 mark:

1. What is the electric field inside the spherical conductor of radius 12 cm and has a charge of 1.6×10^{-7} C distributed uniformly on its surface.
   a) Infinite b) 1.6×10^{7} V/m c) Zero d) 1.2×10^{-7} V/m
2. Kirchhoff's first law, i.e., $\sum i = 0$ at a junction, deals with the conservation of-
   a) charge b) energy
   c) momentum d) angular momentum
3. How to increase the capacity of the parallel plate capacitor?
   a) Decrease the area of the plate b) Increase the area of the plate
   c) Increase the distance between the plate d) None of the above
4. An electric dipole is placed in non-uniform electric field, then it experiences-
   a) only torque b) force and torque
   c) only force d) neither force nor torque
5. In a Wheatstone bridge if the battery and galvanometer are interchanged then the deflection in galvanometer will
   a) change in previous direction b) not change
   c) change in opposite direction d) none of these.
6. A cell has an emf of 6V, internal resistance of 1 ohms and a current of 0.5 A passing through it. This cell is connected to a resistor. Find out the resistance of the resistor.
   a) 10 ohms b) 11 ohms c) 12 ohms d) 13 ohms
7. Give the number of electrons passing through a wire per minute. The current flowing through it is 500mA.
   a) 1.875×10^{20} b) 6.875×10^{20} c) 1.875×10^{-20} d) 6.875×10^{-10}
8. The electric potential at a point at distance r from a short dipole is proportional to
   a) r^2 b) r^{-1} c) r^{-2} d) r
9. The process in which a region is made free from any electric field is known as-
   a) Electrostatic forcing b) electrostatic shielding
   c) electrostatic binding d) none of this.
10. A silver wire has a resistance of 2.1 Ω at 27.5 ^{0}C. and a resistance of 2.7 Ω at 100 ^{0} C. What is the temperature coefficient of resistivity of silver?
    a) 0.0059 b) 0.0039 c) 0.0129 d) 0.0159

11. What is angle between electric field and equipotential surface?
    a) 90° b) 0° c) 0° to 90° d) 0° to 180°
12. Calculate potential at a point at 9 cm distance due to charge 4×10-7C.
    a) 8×10^{-5} V b) 8×10^{4} V c) 4×10^{-4} V d) 4×10^{4} V
13. What is the dimension of electric flux?
    a) $[M\ L^3\ T^{-3}\ I^{-1}]$ b) $[M\ L^2\ T^{-3}\ I^{-1}]$ c) $[M\ L^3\ T^{-3}\ I^{1}]$ d) $[M\ L^3\ T^3\ I^{-1}]$
14. A wire of resistance 10 Ω is elongated by 10%. The resistance of the elongated wire is-
    a) 10.1Ω b) 11.1 Ω c) 12.1Ω d) 13.1 Ω
15. If a non-polar substance is placed in an electric field, what will happen?
    a) A net dipole moment will be observed
    b) The substance will oscillate
    c) The substance will orient itself perpendicular to the electric field
    d) It will conduct electricity
16. The electrostatic potential on the perpendicular bisector due to an electric dipole is-
    a) Zero b) 1 c) Infinite d) Negative

Question no. 17-20 are assertion-reason based question. These consist of two statements-Assertion (A) and Reason(R). Answer the question selecting the appropriate option given below:

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true and R is not the correct explanation of A.
c) A is true but R is false
d) A is false but R is true

17. **Assertion (A):** On disturbing an electric dipole in stable equilibrium in an electric field, it returns back to its stable equilibrium orientation.
    Reason (R): A restoring torque acts on the dipole on being disturbed from its stable equilibrium.
18. **Assertion (A):** When a conductor is placed in an external electrostatic field, the net electric field inside the conductor becomes zero after a small instant of time.
    Reason (R): It is not possible to set up an electric field inside a conductor.
19. **Assertion (A):** In a simple battery circuit, the point of the lowest potential is positive terminal of the battery.
    Reason (R): The current flows towards the point of the higher potential, as it does in such a circuit from the negative to the positive terminal.
20. **Assertion (A):** Electric field inside a conductor is zero.
    Reason (R): The potential at all the points inside a conductor is same.

SECTION-B [2X5=10]

21. Find the potential difference across the whole terminals for given cell which has an emf of 5.0 volt and also an internal resistance of 1.0 Ω. Cell terminals are joined through a 9 Ω resistor.

    OR

    State the two Kirchhoff's law for electrical circuits.
22. How much positive and negative charge is here in a cup of water (250g)?
23. A system has two charges $q_a=2.5 \times 10^{-7}$ C and $q_b=-2.5 \times 10^{-7}$ C located at points a (0, 0, -15cm) and b (0, 0, 15cm), respectively. What is the total charge and electric dipole moment of the system?
24. Three charges - q, Q and - q are placed at equal distances on a straight line. If the total potential energy of the system of three charges is zero, what is the ratio Q: q ?
25. In a region of space the electric field is given by $\vec{E} = 8\vec{\imath} + 4\vec{\jmath} + 3\vec{k}$ N/C, Calculate the electric flux through a surface of area of 100 m^2 lying in x-y plane.

SECTION-C [3X5=15]

26. Two point charges q_A = 3 μC and q_B= –3 μC are located 20 cm apart in a vacuum.
    (i) What is the electric field at the midpoint O of the line AB joining the two charges?
    (ii) If a negative test charge of magnitude 1.5 × 10^{-9} C is placed at this point, what is the force experienced by the test charge?
27. Three charges of +5 μC are located at the corners of an equilateral triangle whose sides are 6 cm long. Find the potential at the mid-point of the base of the triangle.

OR

An electric dipole of length 4 cm, when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of 4√3 Nm. Calculate the (i) magnitude of the electric field, (ii)potential energy of the dipole, if it has charge ±8 nC.

28. Derive an expression for the potential energy of an electric dipole placed in a uniform electric field.
29. When a Wheatstone bridge is said to be balanced? Apply Kirchhoff's law to derive the balance condition of the Wheatstone bridge.

OR

Derive a relation between the internal resistance, emf and terminal potential difference of a cell.

30. Deduce the expression for the capacitance of a parallel plate capacitor when a dielectric slab is inserted between its plates. Assume the slab thickness less than the plate separation.

SECTION-D [5X1=5]

31. a) Derive an expression for drift velocity of electron.
    b) When 5 V potential difference is applied across a wire of length 0.1 m the drift speed of electron is 2.5 x 10^{-4} m/s. If the electron density in the wire is 8x10^{28} m^3, calculate the resistivity of the wire. [3+2]

OR

a) Establish the relation between $\vec{j}$, σ and $\vec{E}$.
b) A heating element using nichrome connected to a 230 V supply draws an initial current of 3.2 A which settles after a few seconds to a steady value of 2.8 A. What is the steady temperature of the heating element if the room temperature is 27°C ? Temperature coefficient of resistance of nichrome averaged over the temperature range involved is 1.70 x 10^{-4} $^0C^{-1}$. [2+3]