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Test / Exam Name: Ch1 - Electric Charged And Fields | **Standard: 12th Science** | **Subject: Physics**

Student Name: ..... **Section:** ..... **Roll No.:** .....

Questions: 28 | Time: 01:45 hh:mm | Marks: 50

Instructions

1. Make sure to write in the point formation. You handwriting should be neat and clean
2. New section on new page

SECTION-A

Q1. Two large conducting spheres carrying charges Q_1 and Q_2 are kept with their centres r distance apart. The magnitude of electrostatic force between them is not exactly $\frac{1}{4\pi\varepsilon_0}\frac{Q_1Q_2}{r^2}$ because: **1 Mark**

A These are not point charges.
B Charge distribution on the spheres is not uniform.
C Charges on spheres will shift towards the centres of their respective spheres.
D Charges will shift towards the portions of the spheres which are closer and facing towards each other.

Q2. Two capacitors of capacitances C_1 and C_2 are connected in parallel. If a charge Q is given to the combination, the ratio of the charge on the capacitor C_1 to the charge on C_2 will be: **1 Mark**

A $\frac{C_1}{C_2}$
B $\sqrt{\frac{C_1}{C_2}}$
C $\sqrt{\frac{C_2}{C_1}}$
D $\frac{C_2}{C_1}$

Q3. A charge Q is uniformly distributed over the surface of a spherical shell of radius R. The work done in bringing a test charge Q_0 from its centre to its surface is: **1 Mark**

A $\frac{1}{4\pi\varepsilon_0}\frac{QQ_0}{R}$
B $\frac{1}{4\pi\varepsilon_0}\frac{QQ_0}{2R}$
C $\frac{QQ_0}{\varepsilon_0 R}$
D Zero

Q4. A point charge is situated at an axial point of a small electric dipole at a large distance from it. The charge experiences a force F. If the distance of the charge is doubled, the force acting on the charge will become: **1 Mark**

A $2F$ **B** $\frac{F}{2}$ **C** $\frac{F}{4}$ **D** $\frac{F}{8}$

Q5. A potentiometer can measure emf of a cell because **1 Mark**

A The sensitivity of potentiometer is large.
B No current is drawn from the cell at balance.
C No current flows in the wire of potentiometer at balance.
D Internal resistance of cell is neglected.

Q6. A charge Q is kept at the centre of a circle of radius r. A test charge q_0 is carried from a point X to the point Y on this circle such that arc XY subtends an angle of 60° at the centre of the circle. The amount of work done in this process will be: **1 Mark**

A $\frac{1}{4\pi\varepsilon_0}\frac{Qq_0}{2r}$
B $\frac{1}{4\pi\varepsilon_0}\frac{\sqrt{3}Qq_0}{2r}$
C Zero
D $\frac{1}{4\pi\varepsilon_0}\frac{\sqrt{3}Qq_0}{r}$

Q7. An electric dipole placed in a non-uniform electric field can experience: **1 Mark**

A A force but not a torque.
B A torque but not a force.
C Always a force and a torque.
D Neither a force nor a torque.

Q8. For two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1 Mark**

Assertion: Consider two identical charges placed distance 2d apart, along the x-axis. The equilibrium of a positive test charge placed at the point O midway between them is stable for displacements along the x-axis
Reason: Force on test charge is zero.

A Both A and R are true and R is the correct explanation of A.
B Both A and R are true but R is not the correct explanation of A.
C A is true but R is false.
D A is false and R is also false.

Q9. A proton released from rest in an electric field, will start moving towards a region of _____ potential in the field. **1 Mark**

Q10. In potentiometer, a long uniform wire is used to _____ potential gradient along the wire. **1 Mark**

Q11. Differentiate between conduction current and displacement current. **1 Mark**

Q12. Define Electric Flux. Write its SI unit. **1 Mark**

Q13. What is the electrostatic potential due to an electric dipole at an equatorial point? **1 Mark**

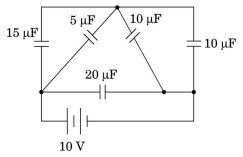
Q14. Depict equipotential surfaces due to an electric dipole. **1 Mark**

Q15. Define the term 'Mobility' of charge carriers in a conductor. Write its S.I. unit. **1 Mark**

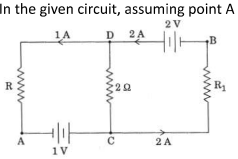
Q16. A capacitor has been charged by a dc source. What are the magnitudes of conduction and displacement currents, when it is fully charged? **1 Mark**

SECTION-B

Q17. The figure shows a network of five capacitors connected to a 10V battery. **2 Marks**
Calculate the charge acquired by the $5\mu F$ capacitor.



Q18. In the given circuit, assuming point A to be at zero potential, use Kirchhoff's rules to determine the potential at point B. **2 Marks**



Q19. A point charge is placed at the centre of a closed Gaussian spherical surface of radius r. Electric flux passing through the surface is Φ How is the electric flux Φ through the surface affected when the following changes are made in turn: **2 Marks**

1. The spherical surface is replaced by a cylindrical surface of the same radius?
2. The point charge is replaced by an electric dipole?

Justify your answer in each case.

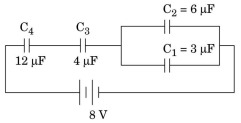
Q20. Derive an expression for the torque acting on an electric dipole of dipole moment $\vec{p}$ placed in a uniform electric field $\vec{E}$. Write the direction along which the torque acts. **2 Marks**

Q21. Derive an expression for the electric field at a point on the axis of an electric dipole of dipole moment $\vec{p}$ Also write its expression when the distance r >> the length 'a' of the dipole. **2 Marks**

Q22. The electric field E due to a point charge at any point near it is defined as $E = \lim_{q\to 0}\frac{F}{q}$ where q is the test charge and F is the force acting on it. What is the physical significance of $\lim_{q\to 0}$ in this expression? Draw the electric field lines of a point charge Q when (a) Q>0 and (b) Q<0. **2 Marks**

Q23. Three point charges $Q_1(-15\mu C), Q_2(10\mu C)$ and $Q_3(16\mu C)$ are located at (0cm, 0cm), (0cm, 3cm) and (4cm, 3cm) respectively. Calculate the electrostatic potential energy of this system of charges. **3 Marks**

Q24. In a network, four capacitors C_1, C_2, C_3 and C_4 are connected as shown in the figure. **3 Marks**



1. Calculate the net capacitance in the circuit.
2. If the charge on the capacitor C_1 is $6\mu C$ (i) calculate the charge on the capacitors C_3 and C_4 , and (ii) net energy stored in the capacitors C3 and C4 connected in series.

Q25. 1. State the underlying principle of a moving coil galvanometer. **3 Marks**
2. Give two reasons to explain why a galvanometer cannot as such be used to measure the value of the current in a given circuit.
3. Define the terms: (i) voltage sensitivity and (ii) current sensitivity of a galvanometer.

SECTION-C

Q26. If the total charge enclosed by a surface is zero, does it imply that the elecric field everywhere on the surface is zero? Conversely, if the electric field everywhere on a surface is zero, does it imply that net charge inside is zero. **4 Marks**

Q27. A metallic spherical shell has an inner radius R_1 and outer radius R_2. A charge Q is placed at the centre of the spherical cavity. What will be surface charge density on (i) the inner surface, and (ii) the outer surface? **4 Marks**

Q28. 1. Derive an expression for the potential energy of an electric dipole in a uniform electric field. Explain conditions for stable and unstable equilibrium. **5 Marks**
2. Is the electrostatic potential necessarily zero at a point where the electric field is zero? Give an example to support your answer.