



INDIAN SCHOOL MUSCAT

SECOND PERIODIC TEST

SUBJECT-PHYSICS

CLASS: XII

Sub. Code: 042

Time Allotted: 50mts.

21.05.2023

Max .Marks: 20

GENERAL INSTRUCTIONS:

(i) All questions are compulsory.

(ii) You may use the following values of physical constants where ever necessary

$$c = 3 \times 10^8 \text{ m/s}, \quad m_e = 9.1 \times 10^{-31} \text{ kg}, \quad e = 1.6 \times 10^{-19} \text{ C}, \quad \epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{N}^{-1} \text{m}^{-2}$$

SECTION-A

1. Electrostatic potential energy of a system of two point charges is equal to the amount of work done in bringing these two charges from infinite to that distance apart. If two charges q_1 & q_2 are separated by a distance r then the potential energy of the system of these two point charges is given

$$\text{as } U = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r} \text{ J}$$

The above potential energy expression, is unaltered whatever way the charges are brought to the specified locations, because of path-independence of work for electrostatic force.

- (i) The electric potentials at points P, Q and R are 2V, 4V and 6V respectively. A point charge of 6mC is taken from P to R via point Q. The kinetic energy gained by the charge will be

(a) 24 J (b) 24×10^{-3} J (c) 12×10^{-3} J (d) 12J

- (ii) An electron is taken from a lower potential to a higher potential. Its potential energy
- (a) increases (b) decreases (c) remains unchanged (d) becomes zero

- (iii) A square of side 'a' has a charge q placed at its center and another charge Q at one of its corners. Q is transported to the diagonally opposite corner via some mean. The work done in doing so will be

(a) $\frac{Q \cdot q}{4\pi\epsilon_0 a}$ (b) $\frac{Q \cdot q}{4\pi\epsilon_0 a^2}$ (c) $\frac{Q \cdot q}{4\pi\epsilon_0 \sqrt{2} a}$ (d) zero

- (iv) The potential energy of the system of charges will be negative when
- (a) Both charges are positive (b) Both charges are negative
- (c) Both are kept on the either side of the origin (d) Both the charges are of opposite nature

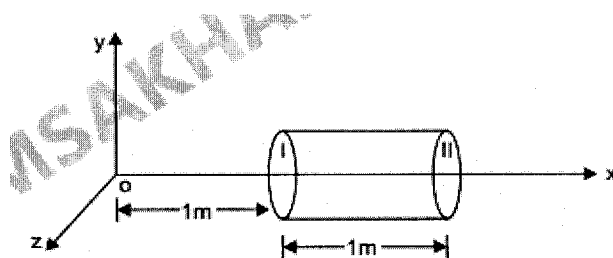
OR

A positively charged particle is released from rest in an uniform electric field. The electric potential energy of the charge

- (a) remains constant as the electric field is uniform
- (b) increases because the charge moves along the electric field
- (c) decreases because the charge moves along the electric field
- (d) decreases because the charge moves opposite to the electric field

SECTION-B

2. State four properties of equipotential surface. 2
3. If N drops of same size each having the same charge, coalesce to form a bigger drop. Calculate the potential of bigger drop. 2
4. (i) Define the term 'electric flux'. Write its S.I. unit. 2
- (ii) Two charges of magnitude $-2Q$ and $+Q$ are located at points $(a, 0)$ and $(4a, 0)$ respectively. What is the electric flux due to these charges through a sphere of radius ' $3a$ ' with its centre at origin?
5. A hollow cylindrical box of length 1m and area of cross-section 25 cm^2 is placed in a three-dimensional coordinate system as shown in the figure. The electric field in the region is given by $\mathbf{E} = 50x\hat{i}$, where \mathbf{E} is in N/C and x in meter. Calculate the net electric flux through the cylinder. 2



6. Using Gauss' law, derive an expression for the electric field due to a uniformly charged infinite plane sheet. 2

SECTION-C

7. A charge Q is distributed over two concentric hollow spheres of radii r and R ($R > r$) such that their surface densities are equal. Derive the expression for the potential at the common center. 3
8. Use Gauss' law to derive the expression for the electric field (E) due to a straight uniformly charged infinite line of charge density $\lambda \text{ C/m}$. 3



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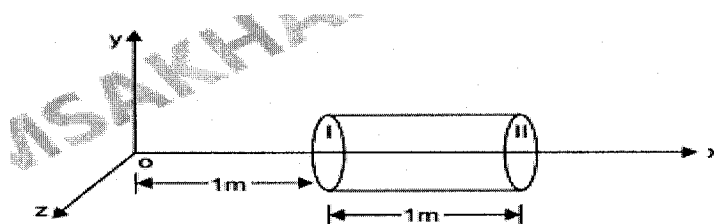
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SECTION-B

2. Twenty-seven drops of same size are charged at 220 V each. They coalesce to form a bigger drop. Calculate the potential of the bigger drop. 2
3. State four properties of equipotential surface. 2
4. (i) Define the term 'electric flux'. Write its S.I. unit. 2
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6. Using Gauss' law, derive an expression for the electric field due to a uniformly charged infinite plane sheet. 2

SECTION-C

7. Using Gauss' law, obtain the expression for the electric field due to uniformly charged spherical shell of radius R at a point outside the shell. Draw a graph showing the variation of electric field with r , $r < R$ and $r > R$. 3
8. A charge Q is distributed over two concentric hollow spheres of radii r and R ($R > r$) such that their surface densities are equal. Derive the expression for the potential at the common center. 3

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SET C



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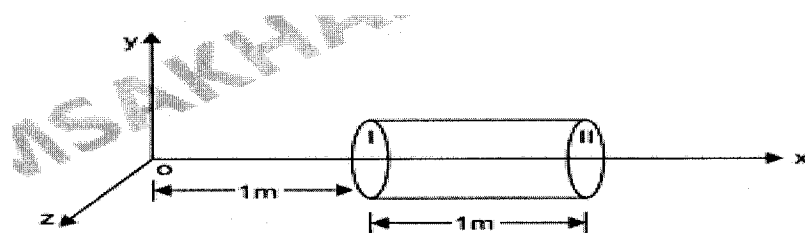
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