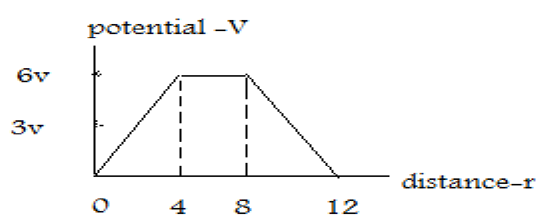
	INDIAN SCHOOL AL WADI AL KABIR	

CLASS: XII	**DEPARTMENT: SCIENCE (2024-25)** **SUBJECT: PHYSICS**	**DATE: 30-04-2024**
WORKSHEET NO: 2 WITH ANSWERS	**TOPIC: ELECTRIC POTENTIAL AND CAPACITANCE**	**NOTE: A4 FILE FORMAT**
NAME OF THE STUDENT:	**CLASS & SEC:**	**ROLL NO.**

SECTION A

Directions (Q1-Q6) Select the most appropriate option from those given below each question

[1]The graph shows the variation of potential with distance from a fixed point charge, find the electric field 3m from the point charge.



[a] 2v/m [b] 3v/m [c.] -1.5v/m [d] – 3v/m

Ans: [c]

[2] When charge is supplied to a conductor, its potential depends upon

[a] amount of charge [b] geometry and size of the conductor [.c] both [a]&[b] [d] only on [a]

Ans: [c]

[3] The variation of potential V with r & electric field with r for a point charge is correctly shown in the graphs

Ans: [b]

[4] A dipole is placed parallel to electric field .If W is the workdone in rotating the dipole from 0^0 to 60^0 ,then work done in rotating it from o^o to 180^0 is

[a] 2W [b] 3W [c] 4W [d] $\frac{W}{2}$

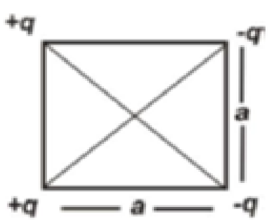
Ans: [c]

[5] A parallel plate capacitor is charged by a battery. Once it is charged, battery is removed. Now a dielectric material is inserted between the plates of the capacitor, which of the following does not change?

[a] Electric field [b] potential difference [c] charge on the plates [d] energy stored

Ans: [c]

[6] The potential at the centre of the square is



[a] zero [b] 2kq [c] $\frac{kq}{a^2}$ [d] $\frac{kq}{2a^2}$

Ans: [a]

[7] [1]A pith ball A of mass 9 x $1O^{-5}$ kg carries & charge of 5 μc. What must be the magnitude of charge and its sign on the pith ball B held 2 cm directly above the ball A such that the ball A remains stationary.

[a] 4.84 x 10^{-12} C [b] 7.84 x 10^{-12} C [c] 7.84 x 10^{-12} C [d] 7.84 x 10^{-12} C

Ans: [b] [7.84 x 10^{-12} C]

SECTION B [2 marks]

[8] A 4μF capacitor is charged by a 200 V supply. It is then disconnected from the supply and is connected to another 2 μF capacitor. How much energy of the first capacitor is lost in the form of radiation?

$E1 = ½ C1 V1^2$

$E2 = \frac{1}{2} C_p V^2$

Energy lost = E1 –E2 = 2.67×10^{-2} J

[9] The electric field intensity at a point due to a point charge is 20 N/C and the electric potential is 10 J/C. Find the magnitude of the charge and distance of the point from charge.

$V = \frac{KQ}{r}$, E = V/d

Q = 0.55×10^{-9} C

[10] A capacitor with air between the plates has a capacitance of 8F. The separation between the plates is now reduced by half and the space between them is filled with a medium of dielectric constant 5.Calculate the value of the capacitance of the capacitor in second case.

$C = \frac{\epsilon o A}{d}$

$C^1 = \epsilon\, r \frac{\epsilon o A}{\frac{d}{2}}$

C^1 = 80F

SECTION C [3 marks]

[11] A charge +lμc is placed at a distance of 0.lm from another charge of +4μc in air. At what point on the line joining the charges, is the electric field intensity zero?

[x = 10/3 cm from +1μc]

[12] Two point charges of $+3 \times 10^{-19}$ C and $+12 \times 10^{-19}$ C are separated by a distance of 2.5m. Find the point on the line joining them where electric field intensity is zero.

[x = 5/3cmfrom 12×10^{-19} c]

[13] A neutral hydrogen molecule has two protons and two electrons. If one of the electrons is removed, we get a hydrogen molecule ion (H_2). In the ground state of H_2 the protons are separated by roughly 1.5A° and the electron is roughly 1A° from each proton. Estimate the potential energy of the system.

$U = \frac{Kq1q2}{r12} + \frac{kq2q3}{r23} + \frac{kq3q1}{r31}$ = -19.2eV

[14] [a] Define electrostatic potential energy[b] Derive the expression for electrostatic potential energy of a system of 3 charges q1, q2 and q3

[15] Derive the expression for the capacitance of a capacitor in presence of a dielectric

SECTION D [5 marks]

[16] Derive the expression for capacitance of a parallel plate capacitor

[17] What is an electric dipole. Derive an expression for electrostatic potential energy of an electric dipole in an external electric field of strength E.

CASE STUDY QUESTION

EQUIPOTENTIAL SURFACES:

All points in a field that have the same potential can be imagined as lying on a surface called an equipotential surface. When a charge moves on such a surface no energy transfer occurs and no work is done.

The force due to the field must therefore act at right angles to the equipotential surfaces and field lines always intersect at right angles. Equipotential surfaces for a point charge are concentric spheres; there is a spherical symmetry. If the equipotential are drawn so that the change of potential from one to the next is constant, then the spacing will be closer where the field is stronger. The closer the equipotential, the shorter the distance that need be travelled to transfer a particular amount of energy.

The surface of a conductor in electrostatics (i.e., one in which no current is flowing) must be an equipotential surface since any difference of potential would cause a redistribution of charge in the conductor until no field exist in it.

(i) Equipotential surface at a great distance from a collection of charges whose total sum is not zero are approximately,

(a) spheres (b) planes (c) paraboloids (d) ellipsoids

(ii) Two equipotential surfaces have a potential of - 20 V and 80 V respectively, the difference in potential between these surfaces is

(a) 100 V (b) 80 V (c) 90 V (d) 0 V

(iii) Equipotential surfaces

(a) are closer in regions of higher electric fields compared to the regions of lower electric fields.

(b) will be more crowded near sharp edges of a conductor.

(c) will be more crowded near regions of large charge densities.

(d) All of the above.

(iv) The work done to move a charge along an equipotential from A to B,

(a) cannot be defined as $-\int_A^B \vec{E}.\overrightarrow{dl}$ (b) must be defined as $-\int_A^B \vec{E}.\overrightarrow{dl}$

(c) is zero (d) can have a nonzero value.

OR

The shape of equipotential surface for an infinite line charge is

(a) parallel plane surface

(b) parallel plane surface perpendicular to lines of force

(c) coaxial cylindrical surface

(d) none of the above

Ans: - (i) b (ii) a (iii) d (iv) c Or c

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