Foundation

Parishram (2025)

Physics

Electrostatic Potential and Capacitance

DPP: 1

Q1 The work done in bringing a unit positive charge from infinite distance to a point at distance x from a positive charge Q is W. Then the potential ϕ at that point is

(A) $\frac{WQ}{x}$

(B) W

(C) $\frac{W}{x}$

(D) WQ

Q2 Four point charges $-Q, -q$, $2q$ and $2Q$ are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is

(A) $Q=-q$

(B) $Q=-\frac{1}{q}$

(C) $Q=q$

(D) $Q=\frac{1}{q}$

Q3 Charges $2q$, $-q$ and $-q$ lie at the vertices of an equilateral triangle. The value of E and V at the centroid of the triangle will be

(A) $\mathrm{E} \neq 0$ and $\mathrm{V} \neq 0$

(B) $\mathrm{E}=0$ and $\mathrm{V}=0$

(C) $\mathrm{E} \neq 0$ and $\mathrm{V}=0$

(D) $\mathrm{E}=0$ and $\mathrm{V} \neq 0$

Q4 Three identical charges are placed at corners of an equilateral triangle of side l. If force between any two charges is F, the work required to double the dimensions of triangle is

(A) $-3Fl$

(B) $3\mathrm{Fl}$

(C) $(-3/2)Fl$

(D) $(3/2)Fl$

Q5 Four charges $+q, -q, +q$ and $-q$ are placed in order on the four consecutive corners of a square of side a. The work done in interchanging the positions of any two neighbouring charges of the opposite sign is

(A) $\frac{q^2}{4\pi\varepsilon_0 a}(-4+\sqrt{2})$

(B) $\frac{q^2}{4\pi\varepsilon_0 a}(4+2\sqrt{2})$

(C) $\frac{q^2}{4\pi\varepsilon_0 a}(4-2\sqrt{2})$

(D) $\frac{q^2}{4\pi\varepsilon_0 a}(4+\sqrt{2})$

Q6 At a certain distance from a point charge, the field intensity is $500\ \mathrm{V/m}$ and the potential is $-3000\ \mathrm{V}$. The distance to the charge and the magnitude of the charge respectively are

(A) $6\ \mathrm{m}$ and $6\mu\mathrm{C}$

(B) $4\ \mathrm{m}$ and $2\mu\mathrm{C}$

(C) $6\ \mathrm{m}$ and $4\mu\mathrm{C}$

(D) $6\ \mathrm{m}$ and $2\mu\mathrm{C}$

Answer Key

Q1	(B)
Q2	(A)
Q3	(C)
Q4	(C)
Q5	(C)
Q6	(D)

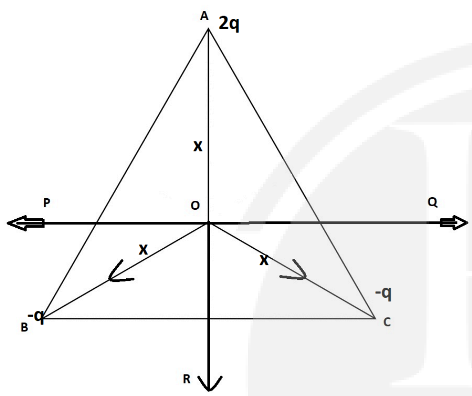
Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Video Solution:

Q3 Text Solution:

Let the three charges $2q, -q$ and $-q$ kept at the corners A, B, and C of an equilateral triangle, as shown below;



* Where 'O' is the centroid, Potential at the centroid is

$$(V) = \frac{k(2q)}{x} + \frac{k(-q)}{x} + \frac{k(-q)}{x}$$

$$(V) = \frac{k}{x}(2q - q - q)$$

$$(V) = 0$$

* Electric field by the charge 2q is along vertical downward.

* Electric field by the both '-q' charges have two component, one vertical downward and one horizontal, where the horizontal components will cut each other and the net downward force will exist. $((\therefore E \neq 0)$

Video Solution:

Q4 Video Solution:

Q5 Video Solution:

Q6 Text Solution:

Given data & Assumptions;

Electric field intensity $(E) = 500\,{}^{V}/_{m}$

Electric Potential $(V) = -3000V$ (-ve sign shows the direction)

$$V = \frac{kQ}{r} = -3000 \qquad \ldots eq.(1)$$

$$E = \frac{kQ}{r^2} = 500 \qquad \ldots eq.(2)$$

$$\frac{kQ}{r} \times \frac{1}{r} = 500$$

$$3000 \times \frac{1}{r} = 500$$

$$\therefore r = 6m$$

Now, on putting the value of 'r' in equation no. (1) we get;

$$\frac{(9\times10^9)\times Q}{6} = 3000$$

$$\therefore Q = 2 \times 10^{-6}C = 2\mu C$$

Video Solution:

Android App | iOS App | PW Website