3055 BA SANGAM COLLEGE

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WORKSHEET 9

SCHOOL: BA SANGAM COLLEGE **YEAR: 13**

SUBJECT: PHYSICS **NAMEOF STUDENT: _____**

STRAND	**4- ELECTROSTATIC**
SUB-STRAND	**ELECTRIC POTENTIAL**
LEARNING OUTCOME	• To calculate the net Electric Potential (voltage) between different charges

Electric Potential (Voltage)

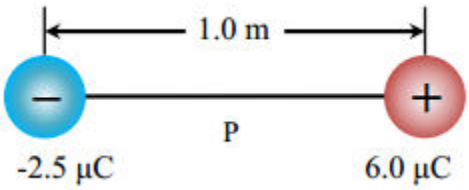
- The potential difference, V, for a charge at different positions can be described as the amount of work-done in moving the charge from one point to another. If the charge is moved from A to B and is found by:

$$V = \frac{kQ}{r}$$

- Voltage or Electric Potential is a scalar quantity therefore we will directly add the voltages.
- use the negative sign in the calculations as shown below.

EXAMPLE 1

Find the net electric potential at point P, halfway between the –2.5 µC and 6.0 µC charges separated by a distance of 1.0 m?



$V = \frac{kQ}{r}$ + $V = \frac{kQ}{r}$

$= \frac{8.99 \times 10^{9} (-2.5 \times 10^{-6})}{(0.5)}$ $= \frac{8.99 \times 10^{9} (6.0 \times 10^{-6})}{(0.5)}$

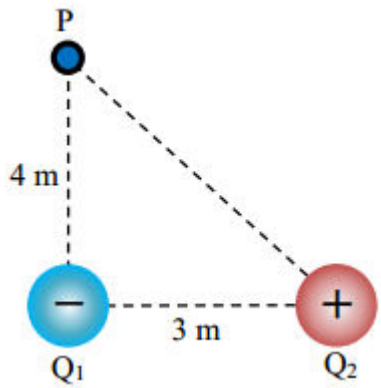
= - 44950 V + = 107880V

V_{TOTAL} = 62930 V

EXAMPLE 2

A 6.0 µC point charge Q_1 is at the origin and a point charge Q_2 of value –4.0µC is 3 m on x-axis.

a) If the electric potential is zero at infinity, find the total electric potential due to these charges at P.



$$V_1 = \frac{k_e q}{r} = \frac{8.99\times 10^9 \left(6.0\times10^{-6}\right)}{4} = 1.35\times10^4 \text{ V}$$

$$V_2 = \frac{k_e q}{r} = \frac{8.99\times 10^9 \left(-4.0\times10^{-6}\right)}{5} = -0.72\times10^4 \text{ V}$$

$$V_P = V_1 + V_2 = 6.3\times10^3 \text{ V}$$

Note: use Pythagoras theorem to find distance from point P to Q_2

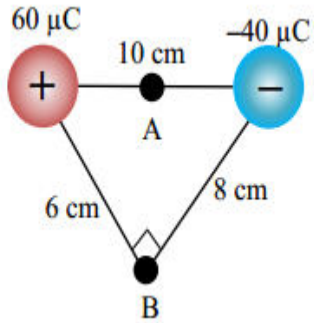
b) How much work is required to bring a third charge of 8.0 µC from infinity of point P.

$$W = V_P\, q_3 = \left(8.0\times10^{-6}\right)\times\left(6.3\times10^3\right) = 5.2\times10^{-2} \text{ J}$$

EXERCISE

1. Two point charges of 12 nC and –12 nC are placed 10 cm apart. Calculate the electric field and potential at point A in between them that 6 cm from the positive charge. (4 marks)

2. Two point charges of 60 µC and –40 µC are placed 10 cm apart. Point A is midway between these charges and point B is a point near this two charges as shown in Figure 4.27. (6 marks)



a) Determine the magnitude of the electric field vector at point A.

b) Find the value of electric potential at points A and B.

c) When a test charge is moved from A to B, it's electric potential energy increases by 9×10^{-5} J. Find the magnitude of charge of the test charge.