

SECTION B

Question 1 (5 marks)

a. $F_{\text{net}} = F(Q_1 \text{ on } Q_3) + F(Q_2 \text{ on } Q_3)$

$$F(Q_2 \text{ on } Q_3) = F_{\text{net}} - F(Q_1 \text{ on } Q_3)$$

$$F(Q_2 \text{ on } Q_3) = \left\langle \text{-----} \text{-----} \right\rangle \quad 1 \text{ mark}$$

$$= \left\langle \text{-----} \right\rangle$$

$$= -1.0 - 2.0$$

$$= -3.0 \text{ N}$$

$$= 3.0 \text{ N} \quad 1 \text{ mark}$$

direction: D (to the left) 1 mark

- b. If the force of Q_1 on Q_3 is to the right and the net force is to the left, then the force of Q_2 on Q_3 is to the left.

Given that Q_3 is positive and Q_2 is to the left of Q_3 , then Q_2 must be positive. 1 mark

$$F(Q_2 \text{ on } Q_3) = \frac{kQ_2Q_3}{d^2}$$

$$3.0 = \frac{9.0 \times 10^9 \times 1.49 \times 10^{-5} \times Q_2}{(1.0)^2}$$

$$Q_2 = \frac{3.0}{9.0 \times 10^9 \times 1.49 \times 10^{-5}}$$

$$= 2.24 \times 10^{-5} \text{ C} \quad 1 \text{ mark}$$

Note: Consequential on answer to **Question 1a.**

Question 2 (5 marks)

a. force = $N \times B \times I \times l$

$$I = \frac{V}{R}$$

$$= \frac{6.0}{5.0}$$

$$= 1.2 \text{ A} \quad 1 \text{ mark}$$

$$\text{force} = 20 \times 0.50 \times 1.2 \times 0.10$$

$$= 1.2 \text{ N} \quad 1 \text{ mark}$$

By the right-hand palm rule:

thumb = current out of page

fingers = B field to the right

palm of hand = force upwards

Direction: U 1 mark