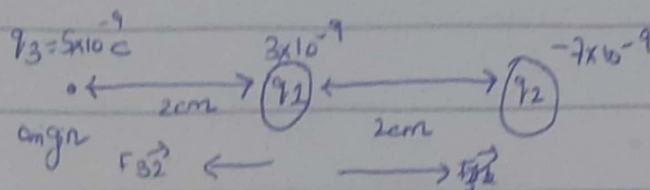


Q1).

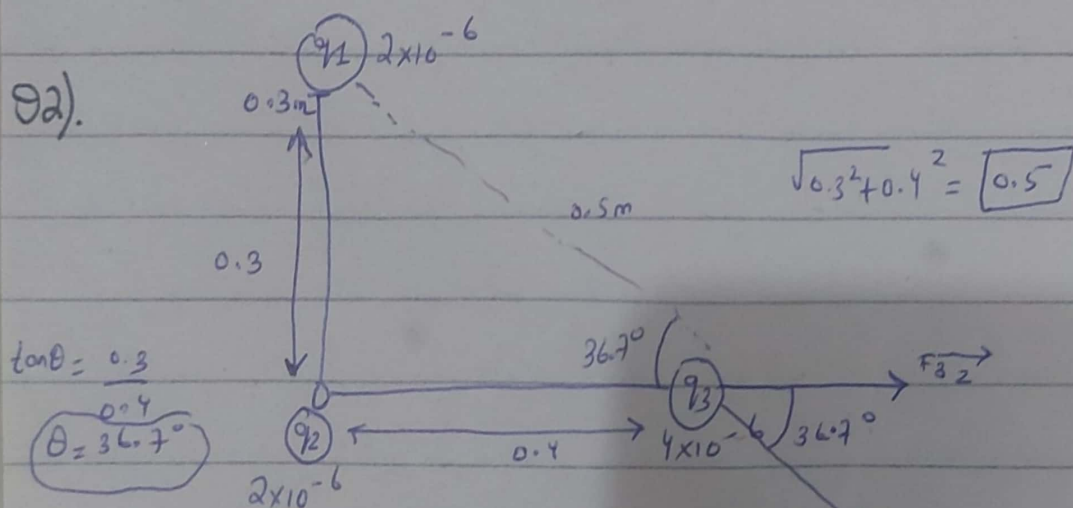


$$F_{32} = \frac{9 \times 10^9 \times 5 \times 10^{-9} \times 7 \times 10^{-9}}{(4 \times 10^{-2})^2} = 1.97 \times 10^{-4}$$

$$F_{31} = \frac{9 \times 10^9 \times 5 \times 10^{-9} \times 3 \times 10^{-9}}{(2 \times 10^{-2})^2} = 3.375 \times 10^{-4}$$

$$F_{31} - F_{32} = 3.375 \times 10^{-4} - 1.97 \times 10^{-4} = 1.405 \times 10^{-4} \text{ due east}$$

Q2).



$$\tan \theta = \frac{0.3}{0.4}$$

$$\theta = 36.7^\circ$$

$$F_{31} = \frac{9 \times 10^9 \times 4 \times 10^{-6} \times 2 \times 10^{-6}}{(0.5)^2} = 0.288$$

$$F_{32} = \frac{9 \times 10^9 \times 4 \times 10^{-6} \times 2 \times 10^{-6}}{(0.4)^2} = 0.45$$

$$F_{net} = \sqrt{F_{31}^2 + F_{32}^2} + 2(F_{31})(F_{32}) \cos \theta$$

$$F_{net} = \sqrt{0.288^2 + 0.45^2} + 2(0.288)(0.45) \cos 36.7^\circ$$

$$F_{net} = 0.702, \text{ direction: } 2$$

$$F_x = 0.45 + 0.288 \cos 36.7^\circ$$

$$F_y = -0.188 \sin(36.7^\circ) \rightarrow \tan^{-1} \left( \frac{F_y}{F_x} \right) = -0.38 \text{ rad/s or } 14.2 \text{ degrees south of east.}$$

$$Q3) S_1 = \frac{-20 + 0}{\epsilon_0} = -\frac{20}{\epsilon_0}$$

$$S_2 = 0 \text{ (overall charge is null)}$$

$$S_3 = \frac{-20 + 0 - 0}{\epsilon_0} = -\frac{20}{\epsilon_0}$$

$$S_4 = 0 \text{ (no charge present)}$$

Q1) (a).

$$m_1 = 6.3 \times 10^{-7} \text{ kg}$$

$$a_1 = 7.0 \text{ m/s}^2$$

$$m_2 = ?$$

$$a_2 = 9 \text{ m/s}^2$$

$$\frac{m_1}{m_2} = \frac{a_2}{a_1}$$

$$\frac{6.3 \times 10^{-7}}{m_2} = \frac{9}{7} \Rightarrow m_2 = 4.9 \times 10^{-7} \text{ kg}$$

(b). so  $\Rightarrow F = m_1 a_1 = 6.3 \times 10^{-7} \times 7 = 4.41 \times 10^{-6}$

$$F = \frac{k q^2}{r^2}$$

As identical so both will have same force.

$$4.41 \times 10^{-6} = \frac{9 \times 10^9 \times q^2}{(3.2 \times 10^{-3})^2} \Rightarrow q = 7.08 \times 10^{-11}$$

Q5).  $\theta_1 + \theta_2 = \theta_{\text{Total}}$

$$\theta_1 + \theta_2 = 5 \times 10^5$$

$$1 = \frac{9 \times 10^9 \theta_1 (5 \times 10^5 - \theta_1)}{(2)^2}$$

$$8.89 \times 10^{-16} + \theta_2 = 5 \times 10^5$$

$$\theta_2 = 5 \times 10^5$$

$$4 = 9 \times 10^9 \theta_1 (5 \times 10^5 - \theta_1)$$

$$4 = 4.5 \times 10^{15} \theta_1 - 9 \times 10^9 \theta_1^2$$

$$9 \times 10^9 \theta_1^2 - 4.5 \times 10^{15} \theta_1 + 4 = 0$$

$$\theta_1 = 8.89 \times 10^{-16} \rightarrow \text{smaller charge one}$$

The bigger charge  $\rightarrow 5 \times 10^5$