4 Two equally charged conducting spheres with small radii, each of mass m and charge $+3.20 \times 10^{-7}$ C are hung from the ceiling with insulated strings of negligible mass and length 0.50 m as shown in Fig. 4.1.
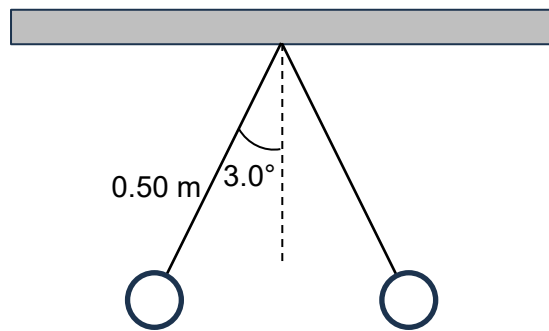

Fig. 4.1 (not to scale)

(a) Determine the magnitude of the electric force acting on each sphere.

electric force = ………………………………… N   [2]

(b) Determine the mass m of each sphere.

m = ………………………………… kg   [2]

(c) **(i)** Define electric potential at a point.

……………………………………………………………………………………..........

…………………………………………………………………………………........ [1]

(ii) On Fig. 4.2 below, sketch the variation of the net electric field strength with distance x between the two spheres.

E / N C^{-1}

[2]

Fig. 4.2

(iii) Explain how the potential difference between two points along the line joining the centre of the spheres may be determined using your graph in Fig. 4.2.

……………………………………………………………………………………........

……………………………………………………………………………………........

…………………………………………………………………………………........ [2]

(d) Describe, with the help of a diagram, the effect on the positions of the spheres when the charge on one sphere is reduced while the charge on the other sphere remains the same, with all other factors remaining the same.

……………………………………………………………………………………................

…………………………………………………………………………………................ [2]

[Total: 11]