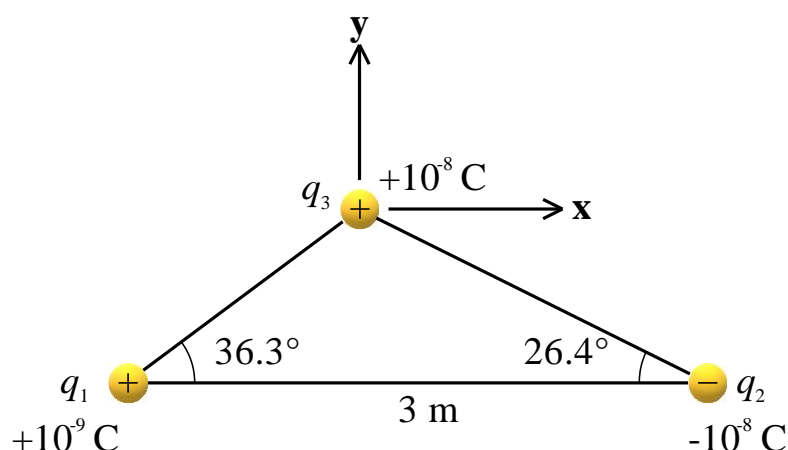


## 6 Electrostatics

1.

Two small conducting spheres  $q_1$  and  $q_2$  are separated by a distance of 3 m between centres and carry charges  $+10^{-9}$  C and  $-10^{-8}$  C respectively. A third charge  $q_3$  of  $+10^{-8}$  C is placed in the same plane as  $q_1$  and  $q_2$  as shown:



The medium is air.

$$\epsilon_0 = 8.85419 \times 10^{-12} \text{ Fm}^{-1}$$

- Find the force on the charge  $q_3$ . (Hint: you could first find the  $x$  and  $y$  components of the forces).
- In what direction would  $q_3$  move initially if let free? (Describe as an angle to the  $x$ -axis.)
- What is the electric field intensity  $\mathbf{E}$  at the position of  $q_3$  due to charges  $q_1$  and  $q_2$ ?

## 6.2

2.

Use Gauss' Law to obtain the electrostatic flux density  $\mathbf{D}$  and hence the field intensity  $\mathbf{E}$ , at a distance  $r$ , in a vacuum, from:

- (a) the centre of a uniformly charged spherical shell, with radius  $a$ , and a total charge  $q$ , when  $r \geq a$ .
- (b) as in (a) but with  $r < a$ .
- (c) an infinite line charge with uniform charge density  $\lambda \text{ Cm}^{-1}$ .
- (d) an infinite plane with uniform charge density  $\sigma \text{ Cm}^{-2}$ .