5 **(a)** Define the *coulomb*.

....[1]

(b) Two vertical metal plates in a vacuum have a separation of 4.0 cm. A potential difference of 2.0×10^2 V is applied between the plates. Fig. 5.1 shows a side view of this arrangement.
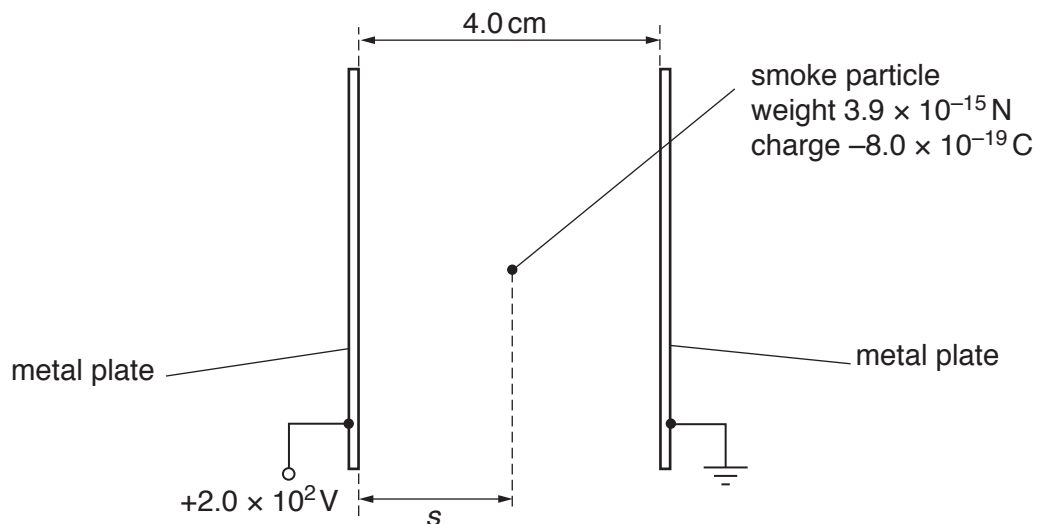

Fig. 5.1

A smoke particle is in the uniform electric field between the plates. The particle has weight 3.9×10^{-15} N and charge -8.0×10^{-19} C.

(i) Show that the electric force acting on the particle is 4.0×10^{-15} N.

[2]

(ii) On Fig. 5.1, draw labelled arrows to show the directions of the two forces acting on the smoke particle. [1]

(iii) The resultant force acting on the particle is *F*.

Determine

1. the magnitude of *F*,

magnitude = ... N

2. the angle of *F* to the horizontal.

angle = ... °

[3]

(c) The electric field in **(b)** is switched on at time $t = 0$ when the particle is at a horizontal displacement $s = 2.0\,\text{cm}$ from the left-hand plate. At time $t = 0$ the horizontal velocity of the particle is zero. The particle is then moved by the electric field until it hits a plate at time $t = T$.

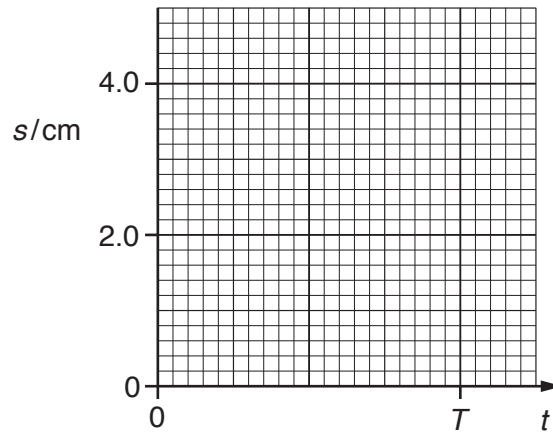On Fig. 5.2, sketch the variation with time *t* of the horizontal displacement *s* of the particle from the left-hand plate.

Fig. 5.2

[2]

[Total: 9]