4 In an adapted version of the Millikan's oil-drop experiment, oil drops are injected at 1.5 m s^{-1} horizontally into a vacuum chamber between two parallel plates, as shown in Fig. 4.1. The plates are 60 mm long and 20 mm apart.

The potential difference between the plates is adjusted so that the oil drops travel horizontally between the two plates.
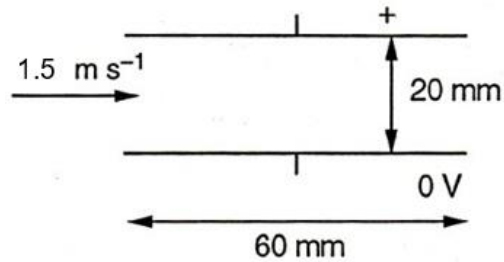

1.5 m s^{-1}

+

20 mm

0 V

60 mm

Fig. 4.1

(a) For an oil drop of mass 2.0×10^{-14} kg, carrying a charge of -7.85×10^{-18} C, calculate the potential difference ΔV between the two plates.

ΔV = ……………………….. V [3]

(b) The potential difference is now increased to two times the original value.

(i) Explain whether the time taken for the oil drop to pass through the plates is affected by this change.

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

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

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

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

(ii) Hence show that the oil drop emerges from the plates at a speed of 1.55 m s⁻¹.

[3]