6 (a) Fig. 6.1 shows an electron in an electric field, in a vacuum, at an instant when the electron is stationary.

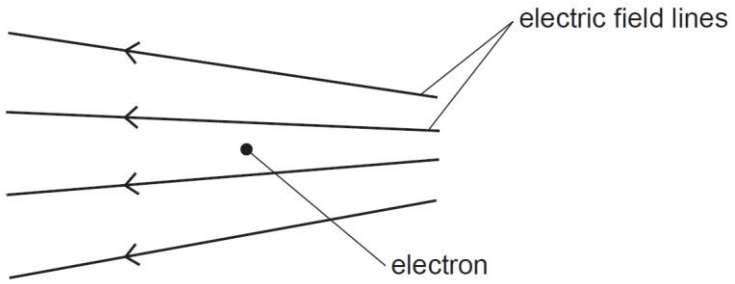

Fig. 6.1

(i) On Fig. 6.1, draw an arrow to show the direction of the electric force acting on the stationary electron. [1]

(ii) The electric field causes the electron to move from its initial position.

Describe and explain the acceleration of the electron due to the field, as the electron moves through the field.

.....

.....

..... [2]

(iii) A stationary proton is now placed in the same electric field at the same initial position that was occupied by the electron.

Compare the initial electric force acting on the proton with the initial electric force that acted on the electron.

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.....

.....

..... [2]

(b) Two point charges A and B are separated by a distance of 12.0 cm in a vacuum, as illustrated in Fig. 6.2.

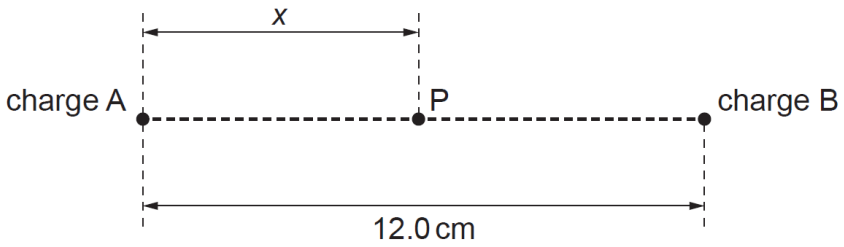

Fig. 6.2

The charge of A is $+2.0 \times 10^{-9}$ C.

A point P lies on the line joining charges A and B. Its distance from charge A is x.

The variation with distance x of the electric potential V at point P is shown in Fig. 6.3.

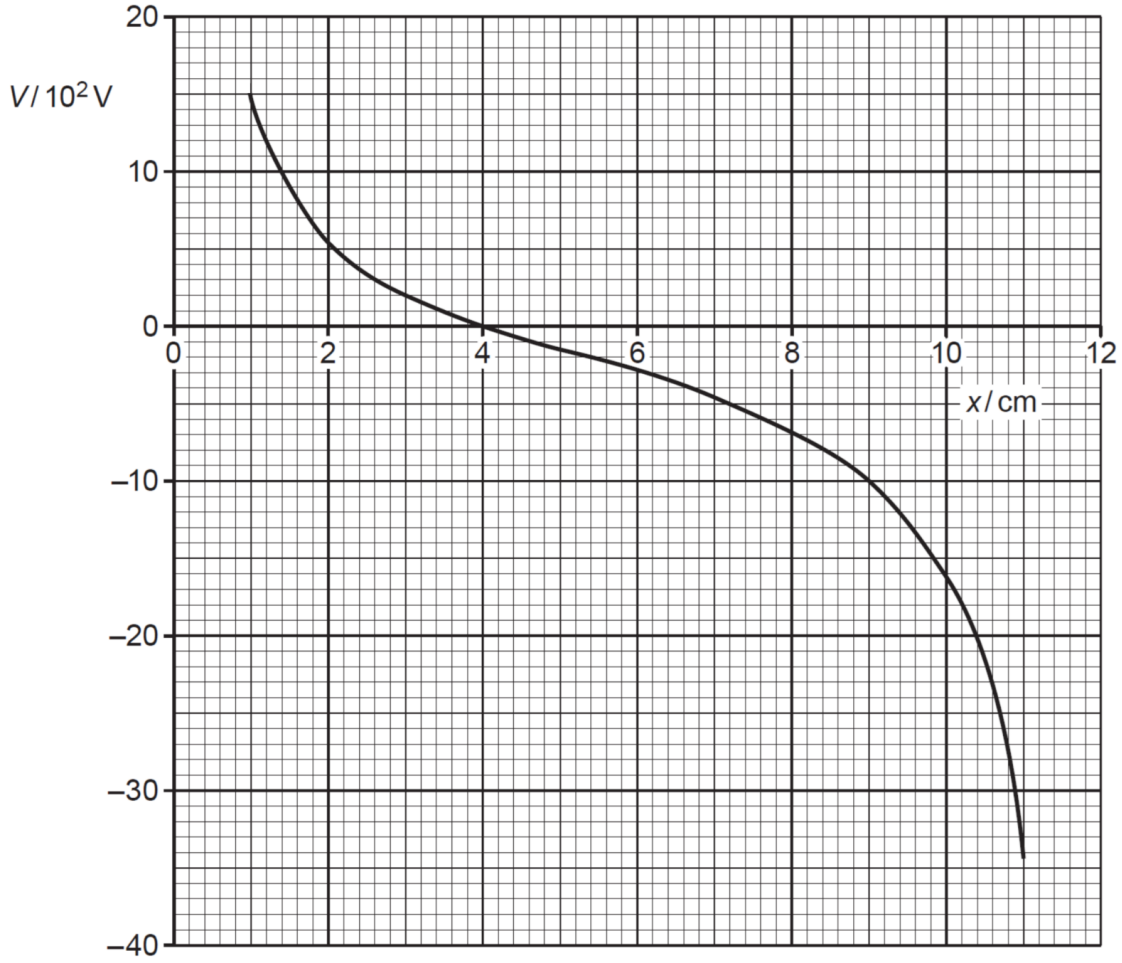

Fig. 6.3

(i) A proton moves along the line joining point charges A and B in Fig. 6.2.

The proton moves from the position where x = 9.0 cm and just reaches the position where x = 3.0 cm.

Calculate the speed v of the proton at the position where x = 9.0 cm.

v = ... m s^{-1} [3]

(ii) State and explain the value of x where the proton experiences the smallest electric force.

.....

.....

..... [2]

[Total: 10]