3 (a) Define *electric potential* at a point.

....

....

.... [1]

(b) An isolated nucleus in a vacuum produces electric potential V at distance r from its centre. Fig. 3.1 shows the variation with r of V.

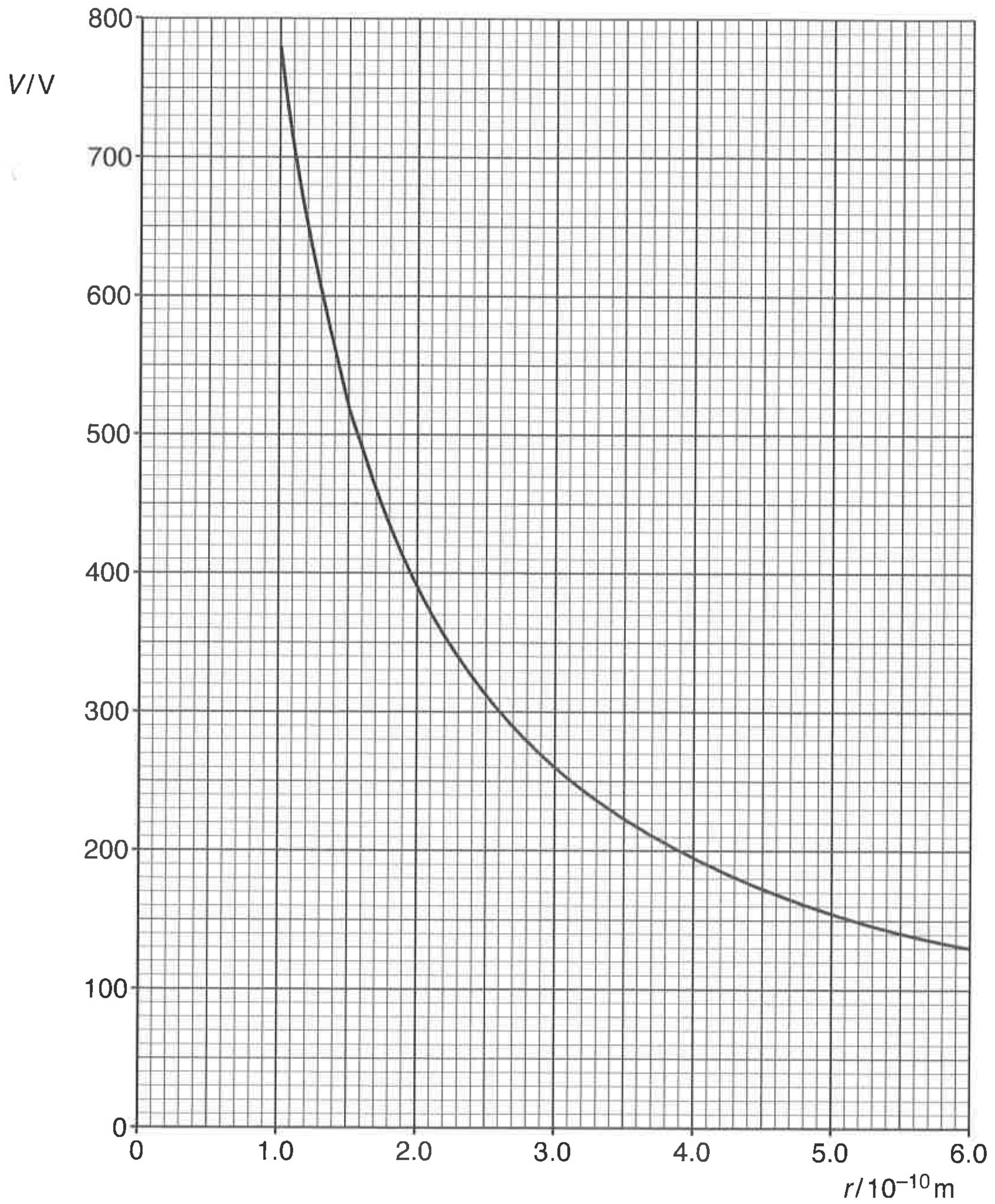

Fig. 3.1

(i) Use data from Fig. 3.1 to show that there are 54 protons in the nucleus.

[3]

(ii) A single proton is placed at a distance of 2.0×10^{-8} m from the centre of the nucleus.

Suggest why it may be assumed that the proton and the nucleus behave as point charges.

....

....

.... [1]

(iii) Determine the acceleration a of the proton in **(b)(ii)** at this distance.

a = ... $\mathrm{m\,s^{-2}}$ [3]

(iv) Calculate the change ΔE_k in kinetic energy of the proton in **(b)(ii)** when it has reached infinity. Explain your working.

ΔE_k = ... J [3]

[Total: 11]