7 Two charged metal spheres A and B of diameter 10 cm and 20 cm respectively, are situated in a vacuum. Their centres are separated by a distance of 50 cm, as shown in Fig. 7.1. *x* is the distance from the centre of sphere A to any arbitrary point along the line joining the centres of the two spheres.

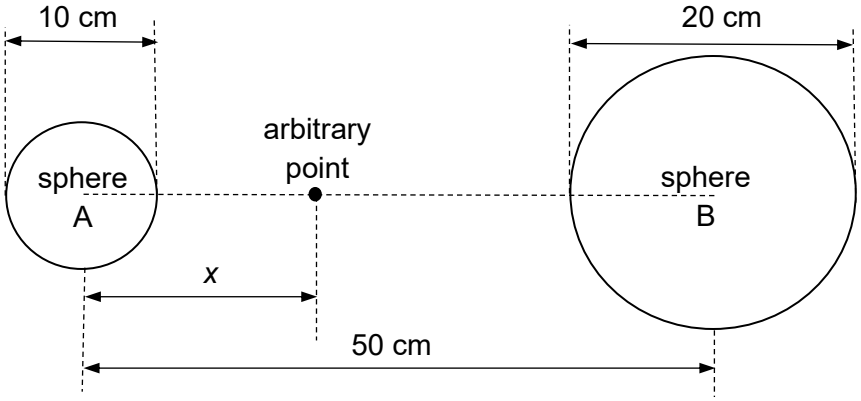

Fig. 7.1 (not to scale)

The variation with *x* of the electric potential *V* is shown in Fig. 7.2.

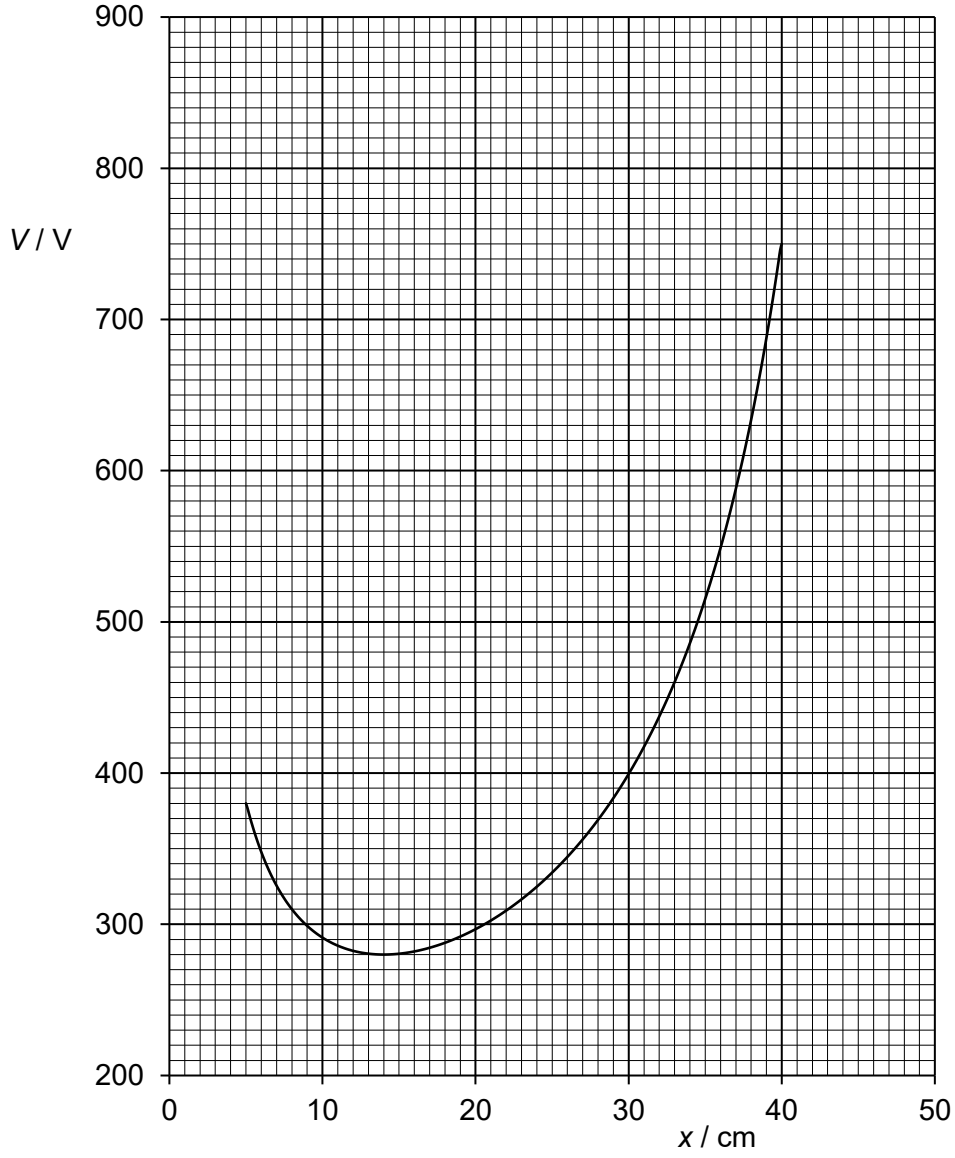

Fig. 7.2

(a) On Fig. 7.2, complete the graph for between x = 0 cm to x = 5.0 cm and between x = 40.0 cm and x = 50.0 cm. [1]

(b) Describe how the resultant electric force on an electron will vary as it is moved from the surface of sphere A to the surface of sphere B, along the line joining their centres.

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…… [3]

(c) State and explain which sphere has a smaller magnitude of charge.

……

……

…… [2]

(d) The charge on each sphere may be considered to be a point charge at its centre. The magnitude of charge of sphere A is 1.2 nC.

Estimate the magnitude of charge of sphere B, leaving your answer in nC.

magnitude of charge = …… nC [2]

(e) An electron is ejected from the surface of sphere A at a speed of 9.7×10^6 m s^{-1}. It moves towards sphere B along the line joining the centre of the two spheres.

Determine, with suitable calculations, whether the electron is able to reach the surface of sphere B.

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……..... [3]