9 **(a)** **(i)** Explain what is meant by a *field of force*.

....

....

.... [2]

(ii) A force due to a field is acting on a charged particle.

Explain why this force may **not** be due to the presence of an electric field.

....

....

....

....

.... [4]

(b) Two charged solid metal spheres A and B are situated in a vacuum. Their centres are separated by a distance of 30.0 cm, as shown in Fig. 9.1. The diagram is not to scale.

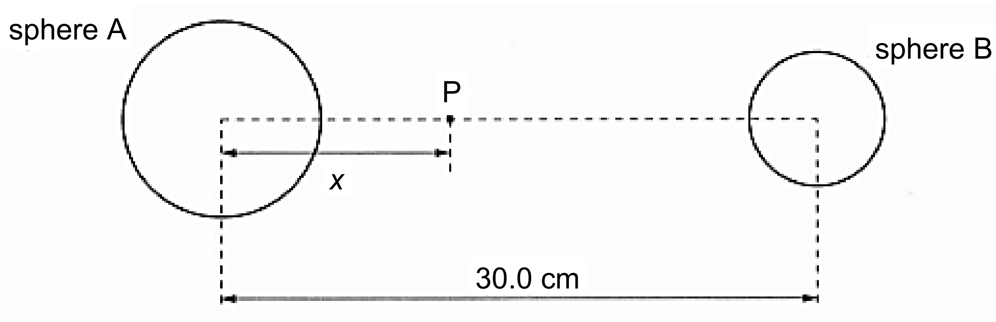

Fig. 9.1

Point P is a point on the line joining the centres of the two spheres. Point P is a distance x from the centre of sphere A.

The variation with distance x of the electric field strength E at point P is shown in Fig. 9.2.

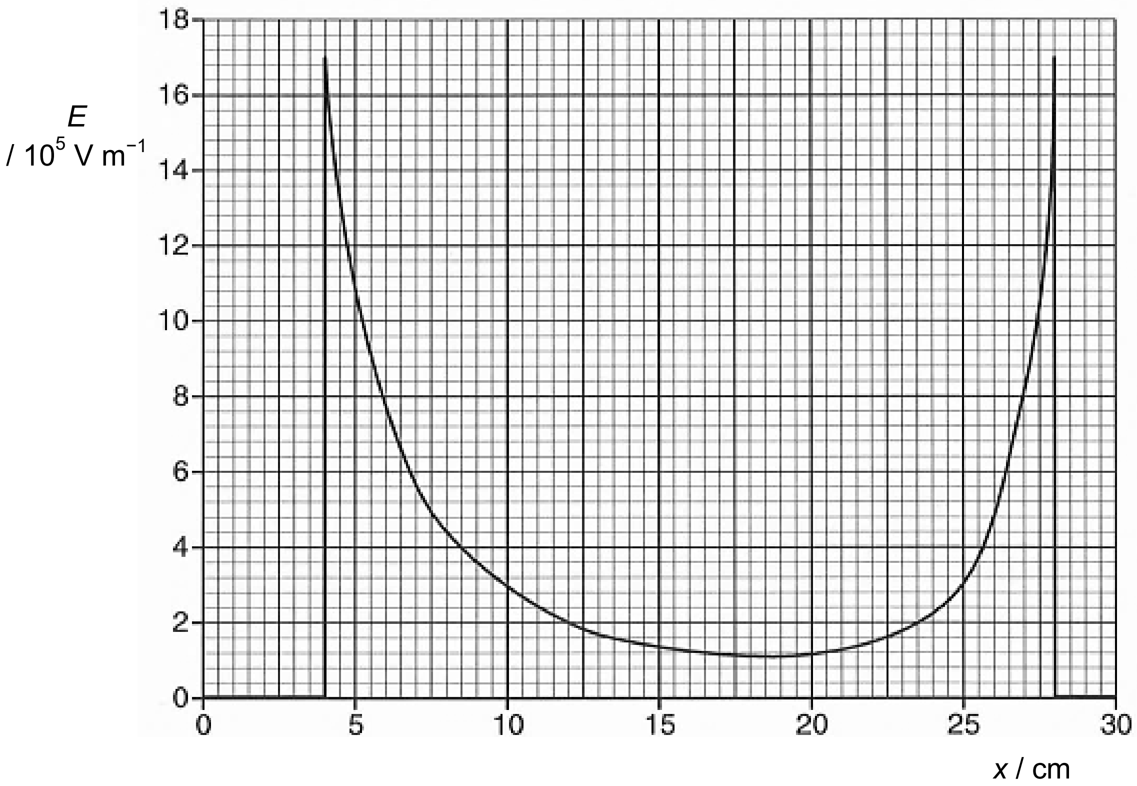

Fig. 9.2

(i) Suggest why the electric field strength is zero for two regions of x.

…………………………………………………………………………………………...

…………………………………………………………………………………………

………………………………………………………………………………………..... [1]

(ii) Use Fig. 9.2 to

1. determine the radius of each sphere,

radius of sphere A = ………………………….. cm

radius of sphere B = ………………………….. cm
[1]

2. state and explain whether the spheres have charge of the same, or opposite sign.

…………………………………………………………………………………

…………………………………………………………………………………

………………………………………………………………………………... [2]

(iii) A lithium-7 ($^{7}_{3}Li$) nucleus moves along the line joining the centres of the two spheres.

1. Estimate the energy gained by this nucleus as it moves from point P where x = 16.0 cm to the point P where x = 21.0 cm.

Explain your working.

energy = …………………………….. J [5]

2. Calculate the acceleration of the nucleus at point P where x = 25.0 cm.

acceleration = ……………………… m s^{-2} [2]

3. The nucleus is at rest at point P where x = 4.0 cm.

Describe qualitatively the variation with x of the acceleration of the nucleus for x = 4.0 cm to x = 28.0 cm.

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………………………………………………………………………………………

………………………………………………………………………………………

……………………………………………………………………………………… [3]

End of paper