18. Electric Fields

18.3 Electric force between point charges

Paper 4

Question Paper

1 **(a)** State Coulomb's law.

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.....

..... [2]

(c) Fig. 6.2 shows the variation of the electric field strength E with distance x from the centre of the sphere in **(b)**.

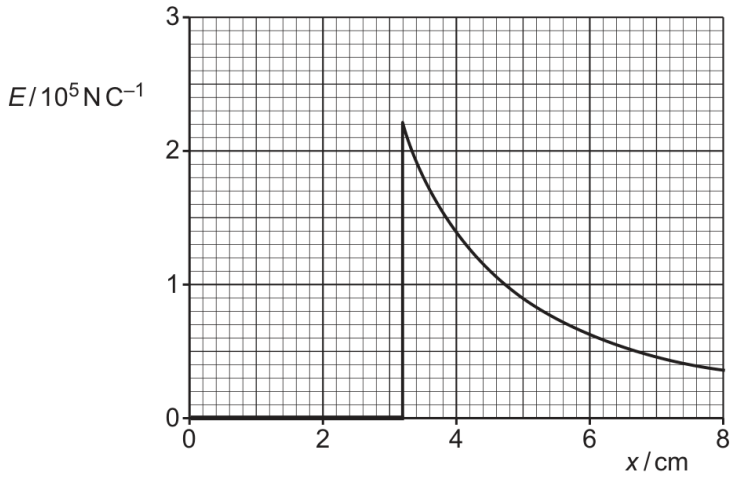


Fig. 6.2

(iii) Suggest an explanation for the fact that the electric field inside the sphere is zero.

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..... [1]

2 **(a)** State Coulomb's law.

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.....

..... [2]

(b) Two identical oil droplets are in a vacuum. The centres of the droplets are a distance of 3.8×10^{-6} m apart. The droplets have equal charge and exert an electric force on each other of magnitude 6.3×10^{-17} N.

Determine the magnitude of the charge on each droplet.

charge = ... C [2]

3 **(a)** State Coulomb's law.

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..... [2]

(b) Positronium is a system in which an electron and a positron orbit, with the same period, around their common centre of mass, as shown in Fig. 2.1.

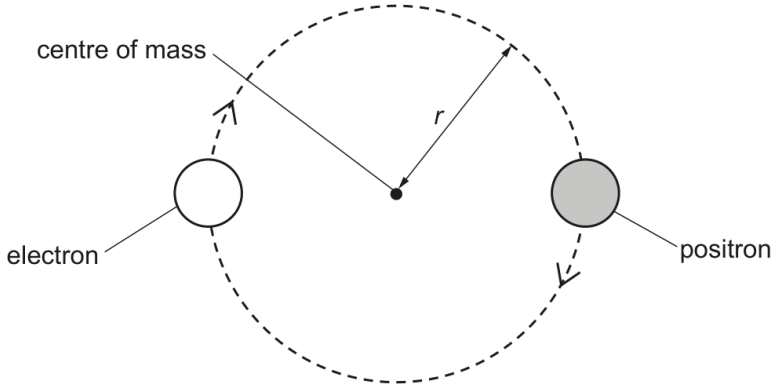


Fig. 2.1 (not to scale)

The radius r of the orbit of both particles is 1.59×10^{-10} m.

(ii) Show that the magnitude of the electric force between the electron and the positron is 2.28×10^{-9} N.

[2]

4 **(c)** A second identical solid metal sphere B is now placed near sphere A. The centres of the spheres are separated by a distance 6*R*, as shown in Fig. 5.2.



Fig. 5.2

Point P lies midway between spheres A and B.

Sphere B has charge –*Q*.

Explain why:

(ii) the electric field strength at point P due to the charged metal spheres is not, in practice, equal to 2*E*, where *E* is the electric field strength determined in **(b)**.

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..... [2]

5 A metal sphere of radius *R* is isolated in space.

Point P is a distance *x* from the centre of the sphere, as illustrated in Fig. 7.1.

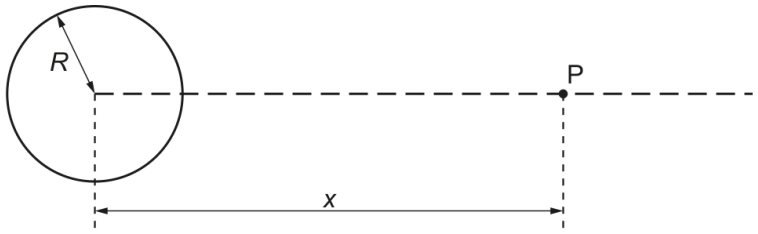


Fig. 7.1

The variation with distance *x* of the electric field strength *E* due to the charge on the sphere is shown in Fig. 7.2.

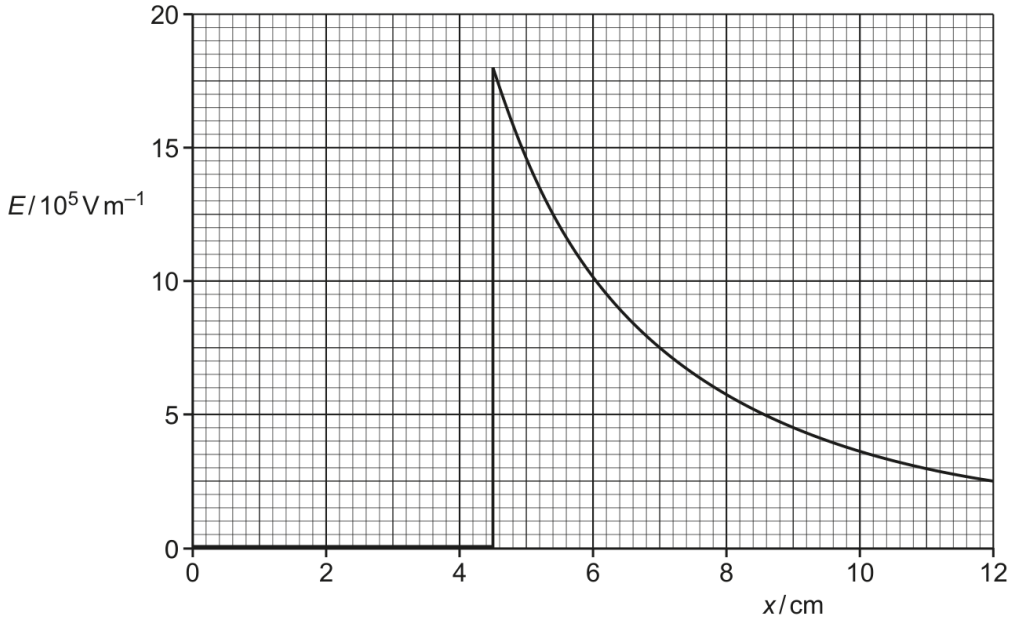


Fig. 7.2

(b) (i) Use Fig. 7.2 to determine the radius *R* of the sphere. Explain your working.

R = ... cm [2]