

2 A helium atom may be modelled as a nucleus surrounded by two electrons in diametrically opposite circular orbits, each of radius 170 pm, as shown in Fig. 2.1.

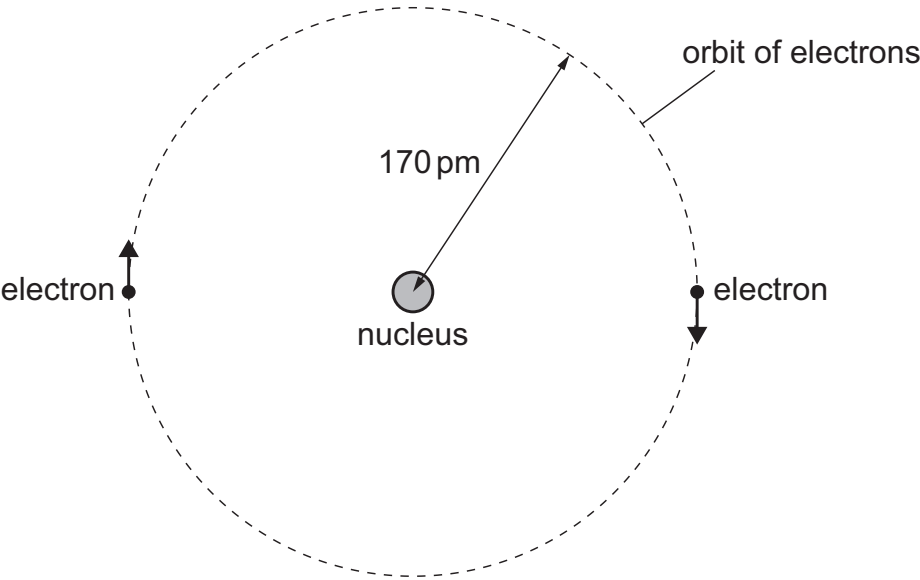


Fig. 2.1

(a) State Coulomb’s law.

.....

.....

..... [2]

(b) (i) State the charge on the nucleus, in terms of the elementary charge e .

charge = e [1]

(ii) Show that the electric force between the nucleus and one of the electrons is $1.6 \times 10^{-8} \text{ N}$.

[1]

(c) Assume that the force in (b)(ii) is the only force on the electrons.

(i) Calculate the speed of the orbiting electrons.

speed = ms⁻¹ [2]

(ii) Calculate the period of the orbit of the electrons.

period = s [2]

(d) In practice, the orbit of each electron is affected by the presence of the other electron.

(i) For the position of one of the electrons, determine the ratio

electric field strength due to the other electron

electric field strength due to the nucleus

ratio = [2]

(ii) Use your answer in (d)(i) to suggest and explain how the orbit of the electron is affected by the presence of the other electron.

.....

..... [1]

[Total: 11]