

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.

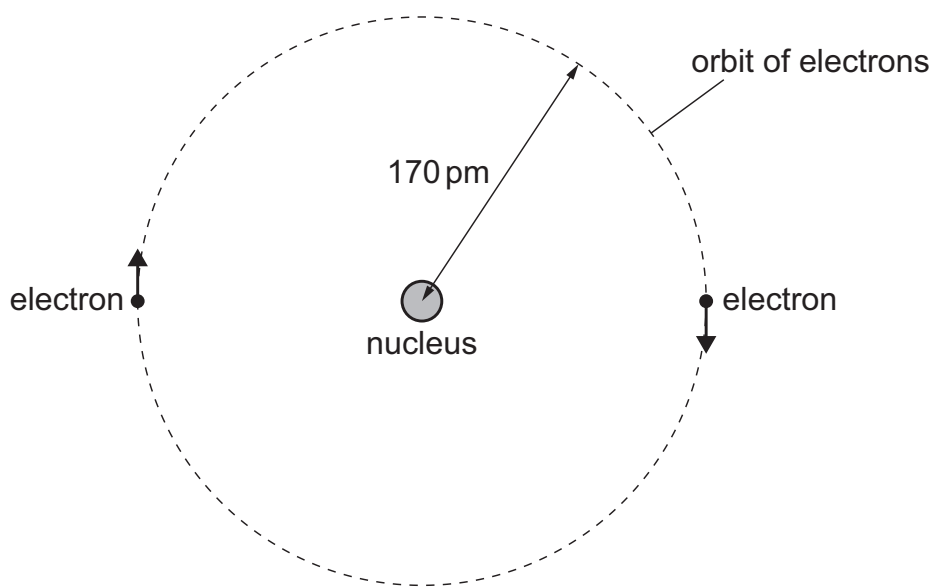


Fig. 2.1

(a) State Coulomb's law.

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 [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

$$\frac{\text{electric field strength due to the other electron}}{\text{electric field strength due to the nucleus}}$$

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.

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 [1]