

- 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.

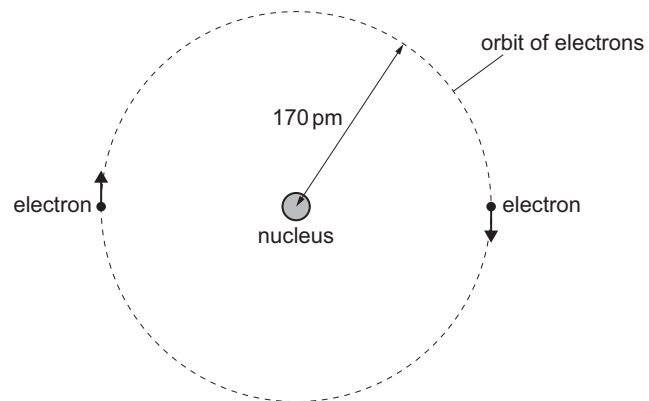


Fig. 2.1

- (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

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

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.

.....
 [1]

[Total: 11]

- 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.

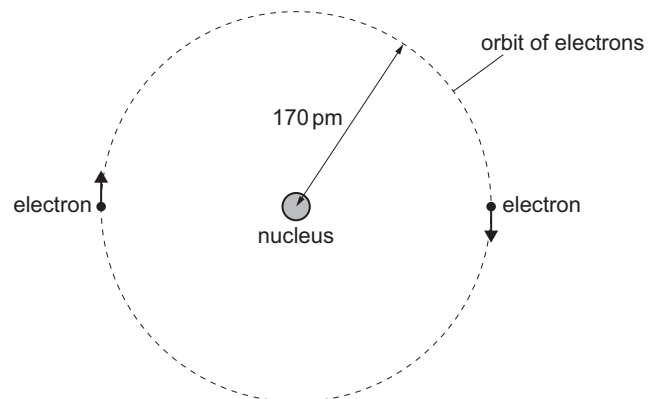


Fig. 2.1

- (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

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

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.

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

[Total: 11]