Exercise walk-through

Isotopes ▪ 2.3

eXercise

You must be able to

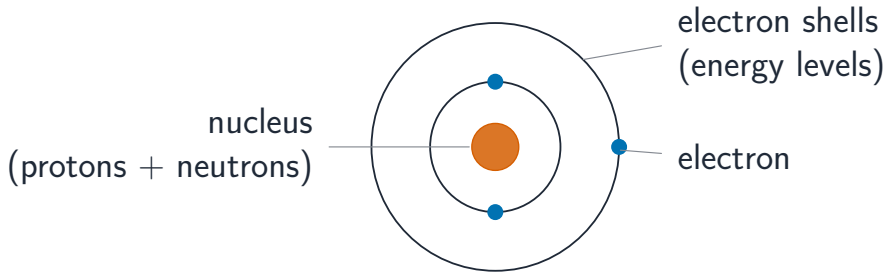
- define isotopes (same protons, different neutrons)
- explain why isotopes have the same chemical properties
- calculate A_r from isotope masses and abundances

Method — Relative atomic mass

$$A_r = \frac{\sum(\text{isotope mass} \times \text{abundance})}{100}$$

Chlorine, 75% ^{35}Cl, 25% ^{37}Cl: $A_r = \dfrac{(35 \times 75) + (37 \times 25)}{100} = 35.5.$

Method — Relative atomic mass



lithium, Li: 3 protons, 4 neutrons
electron configuration 2,1

An atom: nucleus of protons and neutrons; isotopes differ only in neutron number

Practice 2.1 ▪ 1 mark

Define isotopes.

Solution 2.1

Worked steps

atoms of the same element with the same number of protons but different numbers of neutrons B1.

Practice 2.2 ▪ 1 mark

State why isotopes of an element have the same chemical properties.

Solution 2.2

Method: Relative atomic mass

Worked steps

they have the same number of electrons / the same electronic configuration B1.

Exam-style 3.1 ▪ 1 mark

Two isotopes of an element differ in their number of:

A protons

B electrons

C neutrons

D protons and electrons

Solution 3.1

Method: Relative atomic mass

A protons

B electrons

C neutrons ✓

D protons and electrons

Worked steps

C. Isotopes differ in the number of neutrons.

Exam-style 3.2 ▪ 3 marks

Boron has two isotopes: ^{10}B (20%) and ^{11}B (80%).
(a) Calculate the relative atomic mass of boron.
(b) State the number of neutrons in an atom of ^{11}B (proton number 5).

Solution 3.2

Method: Relative atomic mass

Worked steps

(a) $A_r = \dfrac{(10 \times 20) + (11 \times 80)}{100} = \dfrac{200 + 880}{100}$ M1 M1; $= 10.8$ A1.

(b) $11 - 5 = 6$ neutrons B1.

Exam-style 3.3 ▪ 2 marks

Explain, in terms of electrons, why isotopes react in the same way.

Solution 3.3

Method: Relative atomic mass

Worked steps

chemical reactions only involve the electrons M1; isotopes have the same number of electrons / configuration, so they react identically A1.