Oxford Cambridge and RSA

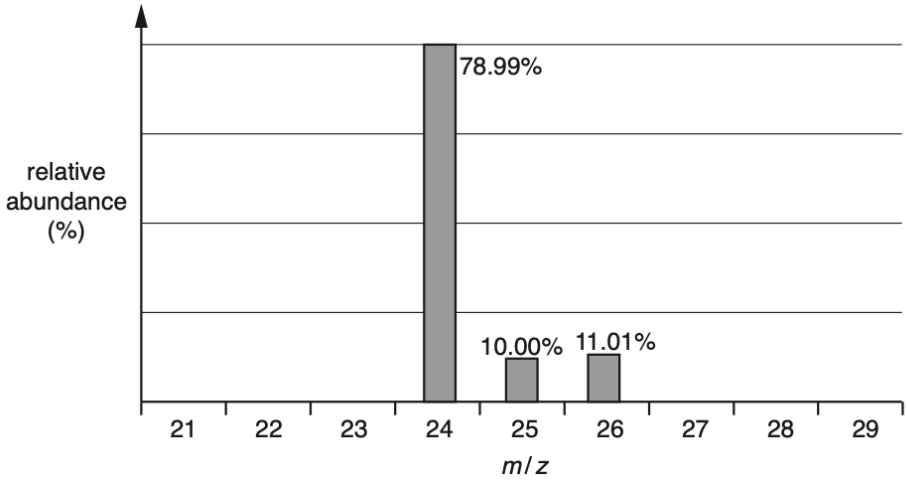
AS Level Chemistry A

H032/01 Breadth in chemistry

Question Set 9

1. This question is about elements from the s-block and p-block of the periodic table.

(a) A sample of magnesium is analysed by mass spectrometry. The mass spectrum is shown below.



(i) The species causing the peaks in the mass spectrum are 1+ ions of magnesium.

Complete the table to show the number of protons, neutrons and electrons in each **1+ ion** of magnesium.

m/z	protons	neutrons	electrons
24			
25			
26			

[2]

(ii) Calculate the relative atomic mass of the magnesium in the sample.

Give your answer to **two** decimal places.

[2]

(b) **B** and **C** are ionic compounds of two different Group 1 elements. The molar masses of **B** and **C** are both approximately 140 g mol^{-1}.

A student dissolves **B** and **C** in water in separate test tubes and analyses the solutions.

The observations are shown below.

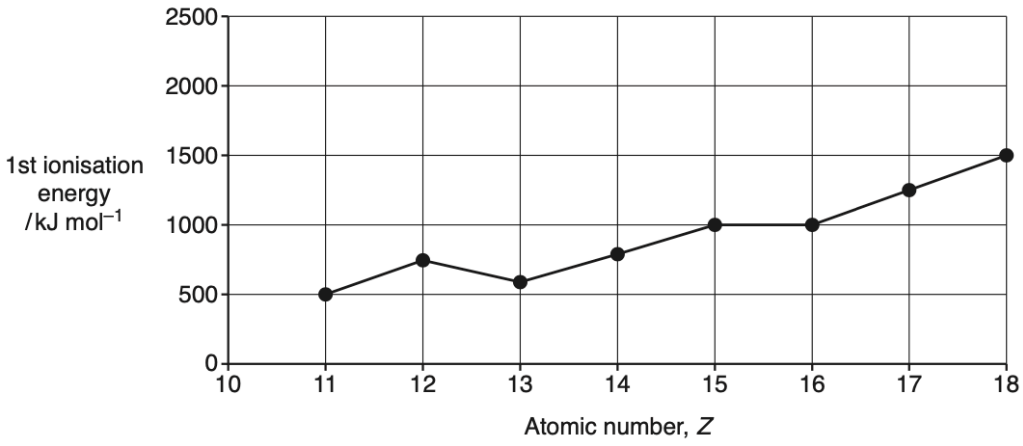
Test	Observation	
	B(aq)	C(aq)
Addition of HNO_3(aq)	bubbles	no change
followed by $BaCl_2$(aq)	no change	white precipitate

Use this information and the observations to identify the formulae of **B** and **C.**

Explain your reasoning.

[5]

(c) **Fig. 22.1** shows first ionisation energies for elements across Period 3.



(i) Add a point to **Fig. 22.1** for the first ionisation energy of the element with Z = 10.

[1]

(ii) Estimate the energy required to form **one** Na^+(g) ion from one Na(g) atom.

Give your answer in kJ, in standard form, and to **two** significant figures.

[1]

(iii) Explain why the first ionisation energies in **Fig. 22.1** show a general increase across Period 3 (Na–Ar).

[3]

(iv) Explain why the general increase in first ionisation energies across Period 3 is **not** followed for Mg (Z = 12) to Al (Z = 13).

[2]

Total Marks for Question Set 9: 11