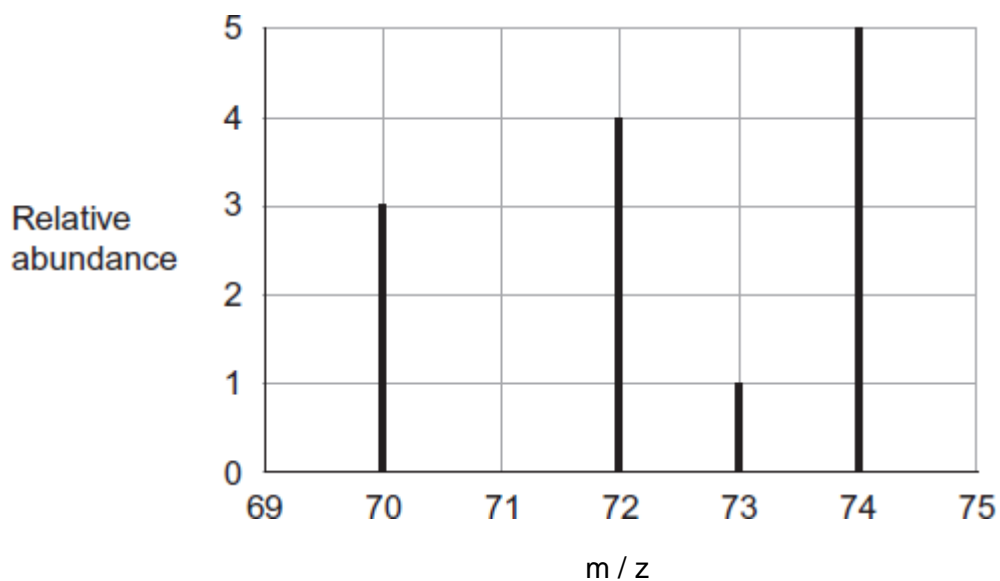


Q1. The mass spectrum of the isotopes of element X is shown in the diagram.



(a) Define the term *relative atomic mass*.

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(2)

(b) Use data from the diagram to calculate the relative atomic mass of X.  
Give your answer to one decimal place.

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(3)

**Q2.** Define the term *mass number* of an atom.

The mass number of an isotope of nitrogen is 15. Deduce the number of each of the fundamental particles in an atom of  $^{15}\text{N}$

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**(Total 3 marks)**

**Q3.** (a) Define the term *relative atomic mass*.

An organic fertiliser was analysed using a mass spectrometer. The spectrum showed that the nitrogen in the fertiliser was made up of 95.12%  $^{14}\text{N}$  and 4.88%  $^{15}\text{N}$

Calculate the relative atomic mass of the nitrogen found in this organic fertiliser. Give your answer to two decimal places.

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**(4)**

(b) In a mass spectrometer, under the same conditions,  $^{14}\text{N}^+$  and  $^{15}\text{N}^+$  ions follow different paths. State the property of these ions that causes them to follow different paths.

State **one** change in the operation of the mass spectrometer that will change the path of an ion.

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(2)

- (c) Organic fertilisers contain a higher proportion of  $^{15}\text{N}$  atoms than are found in synthetic fertilisers.

State and explain whether or not you would expect the chemical reactions of the nitrogen compounds in the synthetic fertiliser to be different from those in the organic fertiliser. Assume that the nitrogen compounds in each fertiliser are the same.

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(2)

(Total 8 marks)

- Q4.** (a) (i) Define the term *relative atomic mass* ( $A_r$ ) of an element.

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(2)

- (ii) A sample of the metal silver has the relative atomic mass of 107.9 and exists as two isotopes. In this sample, 54.0% of the silver atoms are one isotope with a relative mass of 107.1

Calculate the relative mass of the other silver isotope.

State why the isotopes of silver have identical chemical properties.

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(4)

(b) The isotopes of silver, when vaporised, can be separated in a mass spectrometer.

Name the **three** processes that occur in a mass spectrometer before the vaporised isotopes can be detected.

State how each process is achieved.

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(6)

(c) State the type of bonding involved in silver.

Draw a diagram to show how the particles are arranged in a silver lattice and show the charges on the particles.

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(3)

(d) Silver reacts with fluorine to form silver fluoride (AgF).

Silver fluoride has a high melting point and has a structure similar to that of sodium chloride.

State the type of bonding involved in silver fluoride.

Draw a diagram to show how the particles are arranged in a silver fluoride lattice and show the charges on the particles.

Explain why the melting point of silver fluoride is high.

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(5)  
(Total 20 marks)

**Q5.** There are several oxides of nitrogen.

- (a) An oxide of nitrogen contains 25.9% by mass of nitrogen. Determine the empirical formula of this oxide.

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(3)

- (b) Give **one** reason why the oxide NO is a pollutant gas.

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(1)

- (c) The oxide NO reacts with oxygen to form nitrogen dioxide. Write an equation for this reaction.

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(1)

- (d) Explain how NO is produced in the engine of a motor vehicle.

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(2)

- (e) Write an equation to show how NO is removed from the exhaust gases in motor vehicles using a catalytic converter.

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(1)  
(Total 8 marks)

- Q6.** (a) Complete the following table.

	Relative mass	Relative charge
Proton		
Electron		

(2)

- (b) An atom of element **Q** contains the same number of neutrons as are found in an atom of  $^{27}\text{A}1$ . An atom of **Q** also contains 14 protons.

- (i) Give the number of protons in an atom of  $^{27}\text{A}1$ .

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- (ii) Deduce the symbol, including mass number and atomic number, for this atom of element **Q**.

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(3)

- (c) Define the term *relative atomic mass* of an element.

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(2)

- (d) The table below gives the relative abundance of each isotope in a mass spectrum of a sample of magnesium.

<i>m/z</i>	24	25	26
Relative abundance (%)	73.5	10.1	16.4

Use the data above to calculate the relative atomic mass of this sample of magnesium.

Give your answer to one decimal place.

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(2)

- (e) State how the relative molecular mass of a covalent compound is obtained from its mass spectrum.

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(1)

(Total 10 marks)