

Q1. (a) Complete the following table.

	Relative mass	Relative charge
Neutron		
Electron		

(2)

(b) An atom has twice as many protons as, and four more neutrons than, an atom of ${}^9\text{Be}$. Deduce the symbol, including the mass number, of this atom.

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(2)

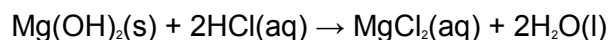
(c) Draw the shape of a molecule of BeCl_2 and the shape of a molecule of Cl_2O . Show any lone pairs of electrons on the central atom. Name the shape of each molecule.



Name of shape Name of shape

(4)

(d) The equation for the reaction between magnesium hydroxide and hydrochloric acid is shown below.



Calculate the volume, in cm^3 , of 1.00 mol dm^{-3} hydrochloric acid required to react completely with 1.00 g of magnesium hydroxide.

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Q2. Chlorine has two isotopes, ^{35}Cl and ^{37}Cl . The number of molecular ion peaks in the mass spectrum of a sample of Cl_2 is

- A** 2
- B** 3
- C** 4
- D** 5

(Total 1 mark)

Q3. (a) One isotope of sodium has a relative mass of 23.

(i) Define, in terms of the fundamental particles present, the meaning of the term *isotopes*.

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(ii) Explain why isotopes of the same element have the same chemical properties.

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(iii) Calculate the mass, in grams, of a single atom of this isotope of sodium. (The Avogadro constant, L , is $6.023 \times 10^{23} \text{ mol}^{-1}$)

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(5)

(b) Give the electronic configuration, showing all sub-levels, for a sodium atom.

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(1)

(c) Explain why chromium is placed in the d block in the Periodic Table.

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(1)

(d) An atom has half as many protons as an atom of ^{28}Si and also has six fewer neutrons than an atom of ^{28}Si . Give the symbol, including the mass number and the atomic number, of this atom.

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(2)

(Total 9 marks)

Q4. Assuming that chlorine exists as two isotopes, and that hydrogen and carbon exist as one isotope each, how many molecular ion peaks will be shown in the mass spectrum of $\text{C}_4\text{H}_6\text{Cl}_4$?

- A** 2
- B** 3
- C** 4
- D** 5

(Total 1 mark)

- Q5.** (a) State the relative charge and relative mass of a proton, of a neutron and of an electron.
In terms of particles, explain the relationship between two isotopes of the same element.
Explain why these isotopes have identical chemical properties.

(7)

- (b) Define the term *relative atomic mass*. An element exists as a mixture of three isotopes.
Explain, in detail, how the relative atomic mass of this element can be calculated from data obtained from the mass spectrum of the element.

(7)

(Total 14 marks)