

Q1. (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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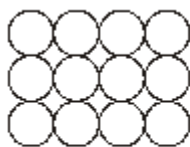
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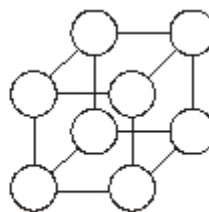
(5)
(Total 20 marks)

Q2. At room temperature, both sodium metal and sodium chloride are crystalline solids which contain ions.

(a) On the diagrams for sodium metal and sodium chloride below, mark the charge for each ion.



Sodium metal



Sodium chloride

(2)

(b) (i) Explain how the ions are held together in solid sodium metal.

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(ii) Explain how the ions are held together in solid sodium chloride.

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(iii) The melting point of sodium chloride is much higher than that of sodium metal. What can be deduced from this information?

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(3)

(c) Compare the electrical conductivity of solid sodium metal with that of solid sodium chloride. Explain your answer.

Comparison

Explanation

(3)

(d) Explain why sodium metal is malleable (can be hammered into shape).

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(1)

(e) Sodium chlorate(V), NaClO_3 , contains 21.6% by mass of sodium, 33.3% by mass of chlorine and 45.1% by mass of oxygen.

(i) Use the above data to show that the empirical formula of sodium chlorate(V) is NaClO_3

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(ii) Sodium chlorate(V) may be prepared by passing chlorine into hot aqueous sodium hydroxide. Balance the equation for this reaction below.



(3)
(Total 12 marks)

Q3. (a) Complete the following table.

Particle	Relative charge	Relative mass
Proton		
Neutron		
Electron		

(3)

(b) An atom of element **Z** has two more protons and two more neutrons than an atom of $^{34}_{16}\text{S}$. Give the symbol, including mass number and atomic number, for this atom of **Z**.

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(2)

- (c) Complete the electronic configurations for the sulphur atom, S, and the sulphide ion, S²⁻.

S 1s²

S²⁻ 1s²

(2)

- (d) State the block in the Periodic Table in which sulphur is placed and explain your answer.

Block

Explanation

(2)

- (e) Sodium sulphide, Na₂S, is a high melting point solid which conducts electricity when molten. Carbon disulphide, CS₂, is a liquid which does not conduct electricity.

- (i) Deduce the type of bonding present in Na₂S and that present in CS₂

Bonding in Na₂S

Bonding in CS₂.....

- (ii) By reference to all the atoms involved explain, in terms of electrons, how Na₂S is formed from its atoms.

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- (iii) Draw a diagram, including all the outer electrons, to represent the bonding present in CS₂

- (iv) When heated with steam, CS_2 reacts to form hydrogen sulphide, H_2S , and carbon dioxide.
Write an equation for this reaction.

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(7)
(Total 16 marks)