The Periodic Table: Chemical Periodicity

Question Paper 9

Level	International A Level
Subject	Chemistry
Exam Board	CIE
Topic	The Periodic Table: Chemical Periodici
Sub-Topic	
Paper Type	Theory
Booklet	Question Paper 9

Time Allowed: **32 minutes**

Score: /26

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	777.5%	70%	62.5%	57.5%	45%	<45%

1   The alkali metals are a series of six elements in Group I of the Periodic Table. The first ionisation energy of these elements shows a marked trend as the Group is descended.

   **(a)** Define the term *first ionisation energy*.

   ....

   ....

   .... [2]

   (b) (i) State and explain the trend in first ionisation energy as Group I is descended.

      ....

      ....

      ....

      (ii) Suggest how this trend helps to explain the increase in the reactivity of the elements as the Group is descended.

      ....

      ....
      [3]

   (c) In a redox reaction, 0.83 g of lithium reacted with water to form 0.50 dm^3 of aqueous lithium hydroxide.

$$2Li(s) + 2H_2O(l) \rightarrow 2LiOH(aq) + H_2(g)$$
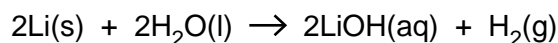
      (i) Calculate the amount, in moles, of lithium that reacted.

(ii) Calculate the volume of hydrogen produced at room temperature and pressure.

(iii) Calculate the concentration, in $mol\,dm^{-3}$, of the LiOH(aq) formed.

[5]

(d) When heated in chlorine, all of the alkali metals react to form the corresponding chloride.

Describe what you see when sodium is heated in chlorine and write a balanced equation for the reaction.

description

....

....

....

equation

....

[2]

[Total: 12]

2   The element magnesium, Mg, proton number 12, is a metal which is used in many alloys which are strong and light.

Magnesium has several naturally occurring isotopes.

(a) What is meant by the term *isotope*?

....

....

....[2]

(b) Complete the table below for two of the isotopes of magnesium.

isotope	number of protons	number of neutrons	number of electrons
^{24}Mg			
^{26}Mg			

[2]

A sample of magnesium had the following isotopic composition:
^{24}Mg, 78.60%; ^{25}Mg, 10.11%; ^{26}Mg, 11.29%.

(c) Calculate the relative atomic mass, A_r, of magnesium in the sample.
Express your answer to an appropriate number of significant figures.

[2]

Antimony, Sb, proton number 51, is another element which is used in alloys.

Magnesium and antimony each react when heated separately in chlorine.

(d) Construct a balanced equation for the reaction between magnesium and chlorine.

....[1]

When a 2.45 g sample of antimony was heated in chlorine under suitable conditions, 4.57 g of a chloride **A** were formed.

(e) **(i)** Calculate the amount, in moles, of antimony atoms that reacted.

(ii) Calculate the amount, in moles, of chlorine atoms that reacted.

(iii) Use your answers to **(i)** and **(ii)** to determine the empirical formula of **A**.

(iv) The empirical and molecular formulae of **A** are the same.

Construct a balanced equation for the reaction between antimony and chlorine.

....[5]

(f) The chloride **A** melts at 73.4 °C while magnesium chloride melts at 714 °C.

(i) What type of bonding is present in magnesium chloride?

....

(ii) Suggest what type of bonding is present in **A**.

....[2]

[Total: 14]