"*Period Pains*"

YEAR 13 UNIT 5 TEST 2

5.2 PERIODICITY

Answer all questions

Bonne Chance!

Name:…….

Mark for section B…… /34

Mark for section C…… /15

Total: ……. /49

Grade……..

1. (a) Write equations to show what happens when the following oxides are added to water and predict approximate values for the pH of the resulting solutions.

(i) sodium oxide

Equation .....

pH .....

(ii) sulphur dioxide

Equation .....

pH .....

(4)

(b) What is the relationship between bond type in the oxides of the Period 3 elements and the pH of the solutions which result from addition of the oxides to water?

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(2)
(Total 6 marks)

2. In the question below, Z is one of the Period 3 elements Na, Mg, Al, Si or P.

The oxide of element **Z** is a crystalline solid with a very high melting point. This oxide is classified as an acidic oxide but it is not soluble in water.

(i) Deduce the type of crystal shown by the oxide of element **Z**.

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(ii) Identify element **Z**.

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(iii) Write an equation for a reaction which illustrates the acidic nature of the oxide of element **Z**.

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(4)
(Total 4 marks)

3. (a) The Period 3 elements, Na, Mg, Al, Si, P and S, all form oxides when the elements are burned in an excess of oxygen.

(i) Give the formula of an oxide of **one** of these elements in which the element is not in its highest oxidation state. Give the oxidation state of the element in this oxide.

Formula of oxide .....

Oxidation state of element .....

(ii) Write an equation for the reaction in which phosphorus(V) oxide is formed from phosphorus and oxygen.

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(3)

(b) The melting points of some of the oxides formed by Period 3 elements are given in a random order below.

Oxide	**A**	**B**	**C**	**D**	**E**
T_m/°C	2852	–73	1610	1275	300

(i) Using the letters **A** to **E**, give **two** oxides which have simple molecular structures.

Explain your answer.

Oxide 1 .....

Oxide 2 .....

Explanation .....

.....

(ii) Give a simple chemical test which could be used to show which of the oxides in the table is sodium oxide. State the observation you would make.

Chemical test .....

.....

Observation .....

(6)

(Total 9 marks)

4. Consider the following oxides.

Na_2O, MgO, Al_2O_3, SiO_2, P_4O_{10}, SO_3

(a) Identify one of the oxides from the above which

(i) can form a solution with a pH less than 3 .....

(ii) can form a solution with a pH greater than 12 .....

(2)

(b) Write an equation for the reaction between

(i) MgO and HNO_3

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(ii) SiO_2 and NaOH

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(iii) Na_2O and H_3PO_4

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(3)

(c) Explain, in terms of their type of structure and bonding, why P_4O_{10} can be vaporised by gentle heat but SiO_2 cannot.

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(4)

(Total 9 marks)

5. (a) (i) Write an equation for the reaction of sodium with cold water.

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(1)

(ii) By referring to the bonding and structure of silicon, suggest why silicon does not react with cold water.

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(2)

(b) The oxides of elements of Period 3 react to form salts with aqueous sodium hydroxide **or** with aqueous sulphuric acid **or** with both of these reagents. Give the formula of an oxide of an element of Period 3 that reacts with:

(i) aqueous sodium hydroxide **only;**

Formula of oxide.....

(1)

(ii) aqueous sulphuric acid **only;**

Formula of oxide.....

(1)

(iii) aqueous sodium hydroxide **and** aqueous sulphuric acid.

Formula of oxide.....

(1)

(Total 6 marks)

6. (a) **P** and **Q** are oxides of Period 3 elements.

Oxide **P** is a solid with a high melting point. It does not conduct electricity when solid but does conduct when molten or when dissolved in water. Oxide **P** reacts with water forming a solution with a high pH.

Oxide **Q** is a colourless gas at room temperature. It dissolves in water to give a solution with a low pH.

(i) Identify **P**. State the type of bonding present in **P** and explain its electrical conductivity. Write an equation for the reaction of **P** with water.

(ii) Identify **Q**. State the type of bonding present in **Q** and explain why it is a gas at room temperature. Write an equation for the reaction of **Q** with water.

(9)

(b) **R** is a hydroxide of a Period 3 element. It is insoluble in water but dissolves in both aqueous sodium hydroxide and aqueous sulphuric acid.

(i) Give the name used to describe this behaviour of the hydroxide.

(ii) Write equations for the reactions occurring.

(iii) Suggest why **R** is insoluble in water.

(6)
(Total 15 marks)

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