

“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
$T_m/^{\circ}\text{C}$	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

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- (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

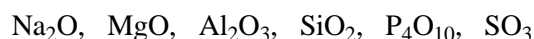
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Observation

(6)

(Total 9 marks)

4. Consider the following oxides.



- (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.

- 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.
- 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.

- (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.

- (ii) Write equations for the reactions occurring.

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

(6)

(Total 15 marks)

[illegible]

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