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CHEMISTRY

INORGANIC CHEMISTRY

Level & Board	AQA (A-LEVEL)
TOPIC:	PROPERTIES OF PERIOD 3 ELEMENTS
PAPER TYPE:	QUESTION PAPER - 3
TOTAL QUESTIONS	10
TOTAL MARKS	39

Properties of Period 3 Elements and their Oxides

1. Consider the following oxides. Na_2O, MgO, Al_2O_3, SiO_2, P_4O_{10}, SO_3

Find one oxide that can form a solution with a pH below 3 and another oxide that can form a solution with a pH above 12.

(2)

2. Sodium, aluminium and silicon are solid elements with a silver colour.

These elements react with oxygen to form oxides with high melting points.

Aluminium is a reactive metal, but it resists corrosion in water because it has a surface coating of aluminium oxide.

(a) In terms of its structure and bonding, explain why silicon dioxide has a high melting point.

(3)

(b) State the type of bonding in aluminium oxide.

(1)

(c) Write an equation for the reaction of aluminium with oxygen.

(1)

(d) Suggest one property of the aluminium oxide coating that causes aluminium to resist corrosion in water.

(1)

(e) Sodium metal is not resistant to corrosion in water, despite having a surface coating of sodium oxide.

Write an equation to show how sodium oxide reacts with water.

(1)

3. A waste-water tank was contaminated by P_4O_{10}.

The resulting phosphoric(V) acid solution was neutralised using an excess of magnesium oxide.

The mixture produced was then disposed of in a lake.

(a) Write an equation for the reaction between phosphoric(V) acid and magnesium oxide.

(1)

(b) Explain why an excess of magnesium oxide can be used for this neutralisation.

(1)

(c) Explain why the use of an excess of sodium hydroxide to neutralise the phosphoric(V) acid solution might lead to environmental problems in the lake.

(1)

4. White phosphorus (P_4) is a hazardous form of the element. It is stored under water.

(a) Suggest why white phosphorus is stored under water.

(1)

(b) Phosphorus(V) oxide is known as phosphorus pentoxide.

Suggest why it is usually represented by P_4O_{10} rather than by P_2O_5

(1)

(c) Explain why phosphorus(V) oxide has a higher melting point than sulfur(VI) oxide.

(2)

(d) Write an equation for the reaction of P_4O_{10} with water to form phosphoric(V) acid.

Give the approximate pH of the final solution.

(2)

5. This question is about the chemistry of the Period 3 elements and the trends in their properties.

Describe what you would observe when magnesium burns in oxygen.

Write an equation for the reaction that occurs.

State the type of bonding in the oxide formed.

(4)

6. Outline an experiment that could be used to show that aluminium oxide contains ions.

Suggest one reason why a thin layer of aluminium oxide protects aluminium from corrosion in moist air.

(3)

7. Some melting points of Period 3 oxides are given in this table.

	Na_2O	SiO_2	SO_2	SO_3
Melting point / K	1548	1883	200	290

(a) Explain, in terms of structure and bonding, why sodium oxide has a high melting point.

(2)

(b) Explain, in terms of structure and bonding, why sulfur trioxide has a higher melting point than sulfur dioxide.

(2)

8. Some Period 3 oxides have basic properties.

State the type of bonding in these basic oxides.

Explain why this type of bonding causes these oxides to have basic properties.

(3)

9. The elements sodium to sulfur in Period 3 all react with oxygen to form oxides.

(a) Give an equation and two observations made for the reaction that occurs when sodium is heated in oxygen.

(2)

(b) Give an equation and one observation made for the reaction that occurs when phosphorus is heated in oxygen.

(2)

10. This question is about some Period 3 elements and their oxides.

(a) Write an equation for the reaction of phosphorus with an excess of oxygen.

(1)

(b) Describe a test you could carry out in a test tube to distinguish between sodium oxide and the product of the reaction in part (a).

(3)

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