Name ..... Class: .....

Start Time ..... End Time ..... Time Taken .....

Time allowed: 51 minutes

INSTRUCTIONS TO CANDIDATES

- This document is designed to be used as a practice test.
- Complete the test under exam conditions in one sitting.
- Optional: Before marking it, go through the paper with a set of notes and improve your answers.
- Mark the test using the mark scheme make corrections on the paper.
- Complete the table on the front page.
- Improve your notes so that they better reflect your weaknesses.
- Make a note of your strengths and weaknesses for future revision.

Success Criteria	**Questions in Paper**	**Mark**	**Out of**	**%**	**Rank Order**
pH of Period 3 Oxides	1a, 4eii, 4eiii		4		
Equations of Period 3 Oxides	1b, 4d, 4ei, 2bii	3, 2, 1, 1	7		
Physical Properties of Period 3 Oxides	1c, 3a, 3b 4b, 4c	4, 4, 4, 1, 2	15		
Structure of Period 3 Oxides	2ai, 4b	3, 1	4		
Testing for Period 3 Oxides	2aii	3	3		
General Chemistry	2bi, 2biii	3	3		
Chemical Calculations	3c	5	5		
Reactions of Period 3 Elements	4a, 5	1, 6	7		
Total			49		

Q1.

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

_____

(ii) SiO_2 and $NaOH$

_____

(iii) Na_2O and H_3PO_4

_____

(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.

_____

_____

_____

_____

(4)

(Total 9 marks)

Q2.

(a) 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)

(b) The base calcium oxide can be used to remove sulfur dioxide from flue-gases produced when fossil fuels are burnt in coal-fired power stations. Calcium oxide is produced when calcium carbonate, is decomposed by heat.

(i) Write an equation for the action of heat on calcium carbonate.

_____

(ii) Identify the product formed when sulfur dioxide reacts with calcium oxide.

_____

(iii) Despite the additional cost, operators of power stations are encouraged to remove the sulfur dioxide from flue-gases. Explain why this may not be environmentally beneficial.

_____

_____

(4)

(Total 10 marks)

Q3.

(a) State and explain the trend in electronegativities across Period 3 from sodium to sulfur.

(4)

(b) Explain why the oxides of the Period 3 elements sodium and phosphorus have different melting points. In your answer you should discuss the structure of and bonding in these oxides, and the link between electronegativity and the type of bonding.

(6)

(c) A chemical company has a waste tank of volume 25 000 dm^3. The tank is full of phosphoric acid (H_3PO_4) solution formed by adding some unwanted phosphorus(V) oxide to water in the tank.

A 25.0 cm^3 sample of this solution required 21.2 cm^3 of 0.500 mol dm^{-3} sodium hydroxide solution for complete reaction.

Calculate the mass, in kg, of phosphorus(V) oxide that must have been added to the water in the waste tank.

(5)

(Total 15 marks)

Q4.

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.

Equation _____

pH _____

(2)

(e) 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.

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

_____

(1)

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

_____

_____

_____

(1)

(iii) 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)

(Total 9 marks)

Q5.

(a) Write an equation for the reaction that occurs when magnesium is heated in steam. Describe what you would observe when this reaction occurs.

Equation _____

Observations _____

_____

_____

_____

(3)

(b) Write an equation for the reaction that occurs when sodium is heated in oxygen. Describe what you would observe when this reaction occurs.

Equation _____

Observations _____

_____

_____

_____

(3)

(Total 6 marks)