



PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

ENTRANCE EXAMINATIONS - 2014

CHEMISTRY

TIME ALLOWED: 3 HOURS

NAME: _____

SIGNATURE: _____

DATE: _____

INFORMATION FOR CANDIDATES:

1. You have 10 minutes to read the paper. You must not begin writing during this time.
2. **ANSWER ALL QUESTIONS IN SECTIONS A AND B.** Section A consists of 20 multiple-choice questions worth 1 mark each.
3. **ALL** answers must be written **ONLY** in this question/answer book.
4. **WRITE YOUR NAME CLEARLY ON THE FRONT PAGE. DO THIS NOW.**
5. Calculators are permitted in the examination room. Notes and textbooks are **NOT ALLOWED**.
6. Show **ALL** workings and calculations in the answer book.
7. **All MOBILE PHONES** must be switched off. **DO IT IMMEDIATELY.**

MARKING SCHEME:

Section A: [20 marks]
Section B: [80 marks]

**DO NOT TURN OVER THE PAGE AND DO NOT WRITE UNTIL YOU ARE TOLD
TO START**

DO NOT WRITE UNTIL YOU ARE TOLD TO START

Section A**Multiple Choice**

Choose the best answer to each question by circling the letter of your choice: A, B, C, D or E, beside the question number.

Question 1

The colour of phenolphthalein indicator in basic solution is;

- A. Blue
- B. Red
- C. Pink
- D. Colourless

Question2

When strong acid solutions dissociate, they;

- A. Dissociate completely
- B. Only dissolves partially
- C. Do not dissociate.
- D. Dissociates and there are more hydroxide ions in solution

Question3

Which of the following solutions is basic?

- A. Bleach
- B. Detergents
- C. Soft drink
- D. Sea water

Question4

One common type of reaction that occurs in aqueous solution is

- A. Decomposition reaction
- B. Precipitation reaction
- C. Synthesis reaction
- D. Neutralization reaction.

Question5

The formula mass for propane, $\text{CH}_3\text{CH}_2\text{CH}_3$:

- A. 44.01
- B. 55.70
- C. 40.10
- D. 39.30

Question6

If 0.20 mole of MgCO_3 is dissolved in 500 mL of solution the molarity of the solution is:

- A. 0.40
- B. 8.00
- C. 0.04
- D. 4.00

Question 7

A certain compound is 40.1% carbon, 6.6% hydrogen and 53.3% oxygen by mass. The empirical formula of the compound is:

- A. $\text{C}_3\text{H}_2\text{O}_2$
- B. CHO_2
- C. $\text{C}_2\text{H}_2\text{O}_2$
- D. CH_2O

Question8

25 mL of $\text{Ca}(\text{OH})_2$ solution was titrated with 29.1 mL of $0.1065 \text{ mol L}^{-1}$ HCl. The molarity of the $\text{Ca}(\text{OH})_2$ determined was:

- A. $0.2479 \text{ mol L}^{-1}$
- B. 0.233 mol L^{-1}
- C. $0.0233 \text{ mol L}^{-1}$
- D. $0.1240 \text{ mol L}^{-1}$

Question9

The number of valence electrons in Ca^{2+} is;

- A. Eight
- B. Six
- C. Ten
- D. Two

Question10

Which of the following best represents the electron configuration of the chloride (Cl^-) ion?

- A. 2,8,5
- B. 2,8
- C. 2,8,8
- D. 2,8,6

Question 11

Which of the following is True about non-metals?

- A. They have high melting points.
- B. They are poor conductors of electricity.
- C. They are good conductors of heat
- D. They can be hammered into shapes and drawn into wires.

Question 12

In a Be^{2+} ion there are:

- A. Three electrons and two protons
- B. The number of protons and electrons are the same
- C. There are no protons
- D. Four protons and two electrons

Question 13

The anode is the electrode where;

- A. Reduction occurs and electrons are gained.
- B. Reduction occurs and electrons are lost
- C. Oxidation occurs and electrons are gained
- D. Oxidation occurs and electrons are lost.

Question 14

An example of a material that can be used as an inert electrode is;

- A. Selenium
- B. Copper
- C. Iron
- D. Platinum

Question 15

When sodium chloride is electrolysed, the electrolysis products are:

- A. $\text{H}_2(\text{g})$ and $\text{O}_2(\text{g})$
- B. $\text{H}_2(\text{g})$ and $\text{Cl}_2(\text{g})$
- C. $\text{Na}^+(\text{aq})$ and $\text{OH}^-(\text{aq})$
- D. $\text{Na}^+(\text{aq})$ and $\text{Cl}_2(\text{g})$

Question 16

When a concentrated solution of copper (II) sulphate is electrolysed the product at the cathode is:

- A. Chlorine gas
- B. Hydrogen gas
- C. Oxygen gas
- D. Copper solid
- E. Copper gas

Question 17

A reaction goes faster when the temperature is raised or concentration is increased. When the concentration is increased by 1M the rate of the reaction:

- A. Decreases until the reaction stops
- B. Increases until the reaction stops
- C. Increases 3 to 4 fold
- D. Approximately doubles

Question 18

Which of the following is false about an endothermic reaction?

- A. Heat is given off and the change in enthalpy is positive
- B. Heat is absorbed and the change in enthalpy is negative
- C. Heat is absorbed and the change in enthalpy is positive
- D. Heat is given off and the change in enthalpy is negative.

Question 19

Potassium chlorate, KClO_3 , can be decomposed in the presence of a catalyst, MnO_2 . KCl and O_2 gas are the products of the decomposition of potassium chlorate. Which of the following statements is NOT true about this reaction?

- A. The catalyst is not used up in the reaction.
- B. The amount of O_2 produced is greater with a catalyst.
- C. The amount of O_2 produced is the same with or without the catalyst
- D. The amount of oxygen gas produced is not dependent on the initial amount of potassium chlorate.

Question 20

Which of the following statements is true about the rate of a chemical reaction?

- A. The rate is faster when the temperature is decreased.
- B. The greater the number of successful collisions the faster the rate of reaction.
- C. The rate is faster when the surface area of the solid reactant is smaller.
- D. The rate is slower when the concentration is increased.

Section B Short Answers

Answer all questions in this section in the spaces provided on the paper. All equations must be correctly balanced, and must include the states of the reactants/products.

Question 21

(a) In what type of solution are there; [4 marks]

More OH^- ions than H^+ ions _____

More H^+ ions than OH^- ions _____

Less H^+ than OH^- ions _____

Equal numbers of H^+ ions and OH^- ions _____

(b) Phenolphthalein was added to a hydrochloric solution.

(i) Is the solution acidic or alkaline? _____ [1 mark]

(ii) What colour would phenolphthalein turn to? _____ [1 mark]

(c) Write down the formula of

Zinc sulphate _____ [1 mark]

Magnesium hydroxide _____ [1 mark]

Aqueous ammonia _____ [1 mark]

Acetic acid _____ [1 mark]

Sodium carbonate _____ [1 mark]

Copper (II) chloride _____ [1 mark]

(d) Complete and balance the equation. [2 marks]



(e) Write a balanced chemical equation for the reaction of magnesium hydroxide and nitric acid.

_____ [2 marks]

Question22

(a) What is the relative atomic mass of an element? [2 marks]

(b) Calculate the formula mass of silver chloride. [2 marks]

(c) Calculate the number of moles in 15.0 g of SrCO_3 . [2 marks]

(d) Calculate the mass of 3.0 moles of Zn metal. [2 marks]

(e) A compound formed by sulfur and nitrogen has the following composition; 69.6% sulfur by mass and 30.4% nitrogen. What is the empirical formula of the compound? [3 marks]

(f) A saturated solution of calcium hydroxide contains 0.340g per 100 mL of solution. Calculate the molarity of the saturated calcium hydroxide solution. [3 marks]

(f) What volume of 0.137 mol L^{-1} sodium hydroxide is required to titrate 25 mL of 0.109 mol L^{-1} hydrochloric acid? [4 marks]

Question 23

(a) Write down the electronic configurations of the following elements and their ions. [2 marks]

O _____ O²⁻ _____ Mg _____ Mg²⁺ _____

(b) Which of the following pairs of elements is the more electronegative?

(i) Iodine and fluorine _____ [1 mark]

(ii) Sulfur and oxygen _____ [1 mark]

(iii) Sodium and potassium _____ [1 mark]

(iv) Magnesium and sulfur _____ [1 mark]

(v) Hydrogen and chlorine _____ [1 mark]

(vi) Chlorine and chromium _____ [1 mark]

(c) What type of bond is formed between the following elements?

(i) Calcium and bromine _____ [1 mark]

(vi) Phosphorus and oxygen _____ [1 mark]

(d) Show the covalent bonding in for the following molecules using lines to represent bonds. You must also show the unpaired electron pairs.

(i) Lithium chloride [2 marks]

(vii) H₂S [2 marks]

(viii) Phosphorus pentachloride [2 marks]

Question 24

(a) For the electrolysis of *molten* lead bromide:

(i) Write the equation for the reaction at the cathode.

_____ [2 marks]

(ii) Write the equation for the reaction at the anode.

_____ [2 marks]

(iii) Write the equation for the overall reaction.

_____ [2 marks]

(b) For the electrolysis reaction of *concentrated* lead bromide, write the equation for the reactions at the anode and the cathode.

Anode: _____ [2 marks]

Cathode: _____ [2 marks]

(c) A nickel ring is to be electroplated with silver.

(i) Which terminal of the battery would the nickel ring be connected to?

_____ [1 mark]

(ii) Name a suitable electrolyte.

_____ [1 mark]

(iii) Write equation for the reaction at the anode.

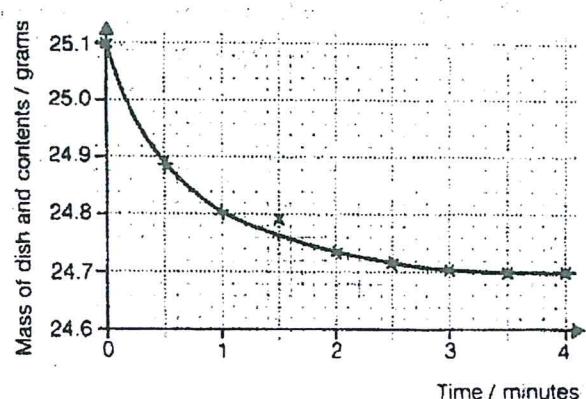
_____ [2 marks]

(iv) Write equation for the reaction at the cathode.

_____ [2 marks]

Question 25

A small quantity of hydrochloric acid and a large quantity of magnesium carbonate chips are reacted on a beaker, which was placed on the pan of a balance. The mass of the beaker and its contents were recorded every half minute. The results are shown in the graph below.



(a) Write a chemical equation to show the reaction of the hydrochloric acid and the magnesium chips.

[2 marks]

(b) Explain why the curve slows down.

[2 marks]

(c) What is the mass of the beaker and its contents at the start and end of the experiment? [2 marks]

Start: _____

End: _____

(d) What is the mass of carbon dioxide at the 1st and 4th minutes? [2 marks]

1st Minute: _____

4th Minute: _____

(e) In the graph above, sketch curves to show the experiment at lower temperature and the magnesium carbonate as powder. [2 marks]

Question 26

Suggest a reason for each of the following observations.

(a) Zinc foil burns more slowly in oxygen than zinc powder does.

[2 marks]

(b) Throwing powdered limestone over an acid spill.

[2 marks]

(c) In fireworks, powdered magnesium is used rather than magnesium ribbon.

[2 marks]

END OF EXAMINATION