



# 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  $\text{MgCO}_3$  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.  $\text{CHO}_2$
- C.  $\text{C}_2\text{H}_2\text{O}_2$
- D.  $\text{CH}_2\text{O}$

**Question8**

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

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

**Question9**

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

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

**Question10**

Which of the following best represents the electron configuration of the chloride ( $\text{Cl}^-$ ) 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  $\text{Be}^{2+}$  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,  $\text{KClO}_3$ , can be decomposed in the presence of a catalyst,  $\text{MnO}_2$ .  $\text{KCl}$  and  $\text{O}_2$  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  $\text{O}_2$  produced is greater with a catalyst.
- C. The amount of  $\text{O}_2$  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  $\text{OH}^-$  ions than  $\text{H}^+$  ions \_\_\_\_\_

More  $\text{H}^+$  ions than  $\text{OH}^-$  ions \_\_\_\_\_

Less  $\text{H}^+$  than  $\text{OH}^-$  ions \_\_\_\_\_

Equal numbers of  $\text{H}^+$  ions and  $\text{OH}^-$  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  $\text{SrCO}_3$ . [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  $0.137 \text{ mol L}^{-1}$  sodium hydroxide is required to titrate 25 mL of  $0.109 \text{ mol L}^{-1}$  hydrochloric acid? [4 marks]



**Question 23**

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

O \_\_\_\_\_  $O^{2-}$  \_\_\_\_\_ Mg \_\_\_\_\_  $Mg^{2+}$  \_\_\_\_\_

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

(i) Iodine and fluorine \_\_\_\_\_ [1 mark]

(i) Sulfur and oxygen \_\_\_\_\_ [1 mark]

(ii) Sodium and potassium \_\_\_\_\_ [1 mark]

(iii) Magnesium and sulfur \_\_\_\_\_ [1 mark]

(iv) Hydrogen and chlorine \_\_\_\_\_ [1 mark]

(v) 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)  $H_2S$  [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.

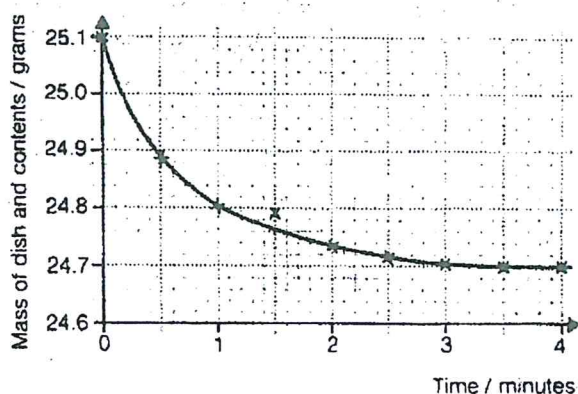
\_\_\_\_\_ [2 marks]

(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 1<sup>st</sup> and 4<sup>th</sup> minutes? [2 marks]

1<sup>st</sup> Minute: \_\_\_\_\_

4<sup>th</sup> 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**