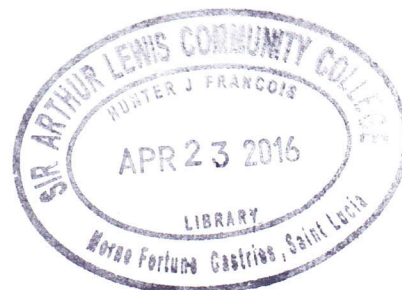


SIR ARTHUR LEWIS COMMUNITY COLLEGE
DIVISION OF TECHNICAL EDUCATION & MANAGEMENT STUDIES

EXAMINATION SESSION : May 2015 Final Examination
 TUTOR (S) : Mrs. A. William-Henry, Ms. C. Regis
 PROGRAMME TITLE : ---
 PROGRAMME CODE : ---
 COURSE TITLE : Chemistry
 COURSE CODE : CHM102
 CLASS (ES) : ---
 DATE : Friday 15th May, 2015
 COMMENCEMENT TIME : 9:00 a.m.
 DURATION : 3 hours
 INVIGILATOR (S) : V. Etienne, G. St. Paul
 ROOM (S) : CEHI-1R-02



#C66

Student ID Number: _____

PLEASE TICK YOUR PROGRAMME UNDER CORRECT SECTION		
Section A (Mrs. Marty):	<input type="checkbox"/> DAGRI	<input type="checkbox"/> CON <input type="checkbox"/> QUS
Section B (Ms. Regis):	<input type="checkbox"/> CON	<input type="checkbox"/> QUS
Section C (Ms. Regis):	<input type="checkbox"/> ART	
Section D (Mrs. Charlemagne):	<input type="checkbox"/> ART	

INSTRUCTIONS

1. This is a THREE hour examination consisting of TWO Sections and a Periodic Table.

Section A – 25 Multiple Choice Questions

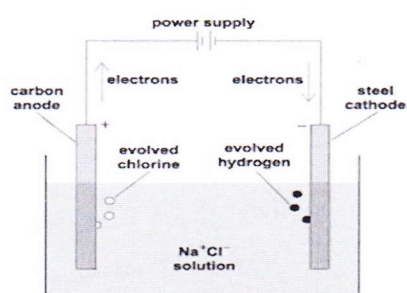
Section B – 6 Structured Questions

2. Answer ALL questions for each section in the SPACES provided.
3. For numerical problems, ALL working must be shown for full marks.
4. Use of pocket electronic calculators is permitted.
5. Information on molar volumes, the gas constant, the specific heat capacity of water and Faraday's constant are found on the bottom of page 5

Section	Number	Marks Earned	Maximum Marks
Section A Multiple choice	1 - 25		25 marks
Section B Structured Questions	1		25 marks
	2		25 marks
	3		25 marks
	4		25 marks
	5		20 marks
	6		20 marks
	TOTAL		165/ marks

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO

7. What is the name of the salt that is formed from the reaction between hydrochloric acid and potassium hydroxide?
- (A) Hydrogen hydroxide
 (B) Potassium chloride
 (C) Potassium hydrochloride
 (D) Potassium Hydride
8. In the following reaction: $2 \text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$, what is the ratio of oxygen to carbon dioxide?
- (A) 2:7 (B) 4:7 (C) 7:4 (D) 7:6
9. Which of the following statements is TRUE about ideal gases?
- (A) Gas particles are very attracted to one another
 (B) Gas particles are very large and occupy a large portion of the container they are placed in.
 (C) Energy is lost by collisions of gas particles with the walls of the container or with each other
 (D) Gas particles move in straight lines in all directions colliding frequently with one another and the sides of the container
10. Which of the following reactions are endothermic?
- (A) The test tube feels cooler when ammonium nitrate dissolves in water
 (B) The temperature changes from -10°C to 0°C when a salt was added to the water
 (C) Magnesium ribbon when burnt in oxygen releases light energy
 (D) The test tube feels warmer when sodium chloride dissolves in water
11. Identify the type of cell shown in the diagram below

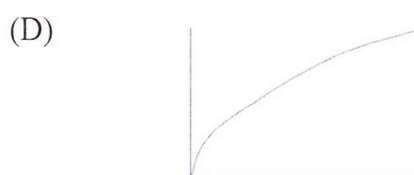
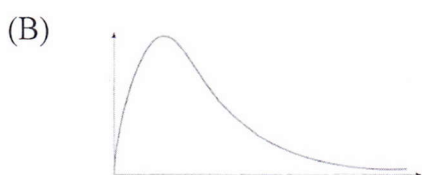
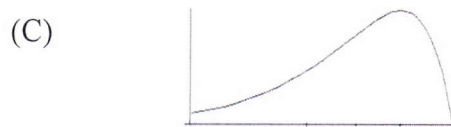
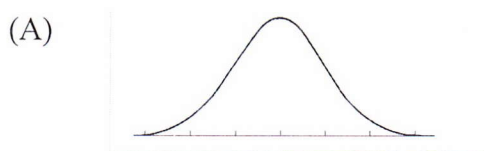


- (A) Photochemical (C) Voltaic
 (B) Electrolytic (D) Galvanic
12. Which of the following represents the reduction half of a redox reaction?
- (A) $\text{Na (s)} \rightarrow \text{Na}^+ \text{(aq)}$
 (B) $\text{Fe}^{3+} \text{(aq)} \rightarrow \text{Fe}^{2+} \text{(aq)}$
 (C) $2\text{Cl}^- \text{(aq)} \rightarrow \text{Cl}_2 \text{(g)}$
 (D) $\text{Sn}^{2+} \text{(aq)} \rightarrow \text{Sn}^{4+} \text{(aq)}$
13. In K_2SO_4 , the oxidation number of sulphur is:

- (A) +2 (B) +4 (C) +6 (D) -2

14. Pick out the statement that correctly defines an oxidizing agent in a redox reaction.
- (A) The oxidizing agent causes another substance to be oxidized and gains electrons
 - (B) The oxidizing agent causes another substance to be reduced and gains electrons
 - (C) The oxidizing agent is the substance that is oxidized in the redox reaction
 - (D) The oxidizing agent loses electrons in a redox reaction and is reduced.
15. Which of the following oxides is an ionic compound?
- (A) Carbon dioxide
 - (B) Lithium oxide
 - (C) diphosphorus pentaoxide
 - (D) Silicon dioxide
16. Which of the following will NOT conduct electricity?
- (A) Solid sodium
 - (B) Solid sodium chloride
 - (C) A solution of sodium chloride in water
 - (D) Molten sodium chloride
17. In the electrolysis of molten copper (II) chloride using inert electrodes, the substance formed at the anode is
- (A) Copper
 - (B) oxygen
 - (C) chlorine
 - (D) carbon
18. Pick out the FALSE statement below
- (A) Molecules in a reaction mixture are constantly moving randomly in different directions
 - (B) Reactant molecules must collide for a chemical reaction to take place
 - (C) Reactant molecules react when they have the right amount of energy and the right orientation
 - (D) All collisions are effective and result in a chemical reaction taking place
19. Which statement is TRUE of BOTH electrolytes and metals?
- (A) They do not conduct electricity
 - (B) They contain free moving charged particles
 - (C) They conduct electricity only in the solid state
 - (D) They are the only substances that conduct electricity
20. Which of the following factors will increase the rate of a chemical reaction involving gases?
- (A) Decreasing the temperature
 - (B) Adding less reactants to the mixture
 - (C) Adding a catalyst
 - (D) Increasing the volume of the container
21. Which of the following is NOT an acid?
- (A) H_3PO_4
 - (B) HNO_3
 - (C) H_2SO_4
 - (D) NH_3

22. Which of the following graphs illustrates the Boltzmann distribution curve?



23. Which of the following statements BEST describe how a catalyst works?

- (A) Catalysts increase the rate of a chemical reaction by increasing the activation energy.
- (B) Catalysts increase the rate of a chemical reaction by providing a different low energy mechanism for the reaction
- (C) Catalysts increase the rate of a chemical reaction by increasing the concentrations of the reactants
- (D) Catalysts increase the rate of a chemical reaction by increasing the temperature of the reaction mixture.

24. Which of the following equation is used to find the heat transferred in a system

- (A) $E = mc^2$
- (B) $Q = IT$
- (C) $Q = MC\Delta T$
- (D) $F = ma$

25. _____ are biological catalysts that increase the rate of a chemical reaction

- (A) Substrate
- (B) Activation Energy
- (C) Enzymes
- (D) Concentration

END OF MULTIPLE CHOICE

GO ON TO SECTION B

IMPORTANT INFORMATION FOR SECTION B

Specific heat capacity of water = $4.18 \text{ Jg}^{-1}\text{ }^\circ\text{C}^{-1}$

At r.t.p, the molar volume is 24 dm^3

At s.t.p, the molar volume is 22.4 dm^3

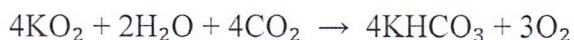
$1\text{F} = 96500\text{C}$

The gas constant $R = 0.0821 \text{ dm}^3\text{atm mol}^{-1}\text{K}^{-1}$

SECTION B

Answer ALL questions in the spaces provided

1. (a) Oxygen masks for producing oxygen in emergency situations contain potassium superoxide (KO_2). The potassium superoxide produces oxygen according to the equation:



- (i) Determine the number of molecules contained in a 30g sample of potassium superoxide. (3 marks)

- (ii) If 0.0675 moles of potassium superoxide were present in the oxygen mask when Jane placed it over her mouth, determine the mass of oxygen gas produced. (3 marks)

- (iii) If 18.4g of oxygen was produced in a particular mask, determine the mass of water vapour that reacted to produce the oxygen. (4 marks)

- (iv) If a person wearing an oxygen mask exhales 0.85g of carbon dioxide every minute, how many moles of potassium superoxide are consumed every 10 minutes? (4 marks)

(b) Element Y is an alkaline earth metal.

(i) Identify TWO properties of element Y (2 marks)

(ii) Element Y can engage in bonding with the element chlorine to form a white crystalline solid. Draw a diagram to show the bonding between element Y and chlorine that may take place (2 marks)

(iii) A 0.802 gram sample of element Y contains 1.204×10^{22} atoms. Use this information to determine the molar mass of element Y (3 marks)

(c) Using the ideal gas equation, $PV = nRT$, calculate the pressure inside a television picture tube, given that its volume is 5L, its temperature is 23 °C, and it contains 0.500g of N_2 (4 marks)

Total 25 marks

2. Liquefied petroleum gas (LPG) commonly known as cooking gas contains mainly the hydrocarbon propane C_3H_8 that has been compressed into a metal cylinder for easy storage and use. Propane is a very good fuel that burns completely in oxygen gas to produce carbon dioxide and water vapour.

(a) Write a balanced chemical equation to show the products formed from the burning of propane gas. You must include state symbols! (3 marks)

- (b) Describe a test you can use in the laboratory to confirm that carbon dioxide is a product made from the burning of propane gas. (2 marks)

- (c) Mark, a chemistry student, during an experiment combined 10.0 g of propane with 10.0g of oxygen at s.t.p.

- (i) Determine the limiting reactant (5 marks)

- (ii) What is the theoretical yield in grams of carbon dioxide produced? (2 marks)

- (iii) If 4032 cm³ of carbon dioxide were collected, determine the percent yield for the reaction. (4 marks)

- (d) State Avogadro's Law (2 marks)

- (e) Butane C₄H₁₀ is another hydrocarbon that is present in small quantities in LPG cylinders. At a particular temperature and pressure 325 cm³ of nitrogen dioxide weighs 1.15g. At same temperature, pressure and volume, butane weighs 1.45g.

(i) Determine the molar mass of butane (4 marks)

(ii) Use the molar mass you calculated in part (i) to determine the correct formula for butane. (3 marks)

Total 25 marks

3. (a) Distinguish between oxidation and reduction (2 marks)

(b) Define the term 'oxidation number'. (1 mark)

(c) Find the oxidation state of the underlined element in the following substances:

(i) $\underline{\text{Mn}}\text{O}_4^{-1}$ (2 marks)

(ii) $\underline{\text{N}}_2\text{O}_5$ (2 marks)

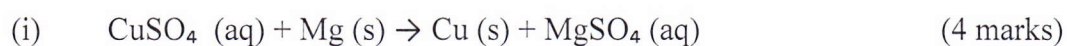
(iii) $\text{K}_2\underline{\text{Cr}}_2\text{O}_7$ (2 marks)

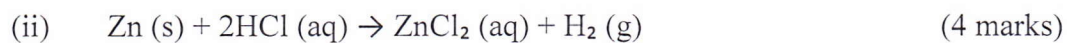
(d) Determine whether oxidation or reduction occurred and explain by using **changes in oxidation numbers**.





(e) For each of the following oxidation-reduction reactions of metals with non-metals identify which element is being oxidized and which is being reduced. Write half equations to show electrons lost/gained.

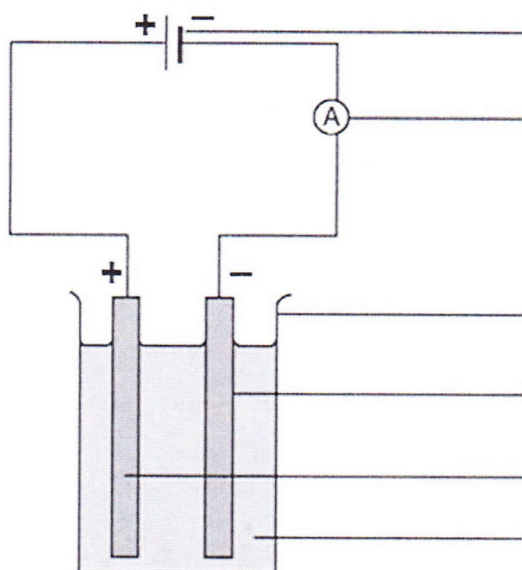






Total 25 marks

4. The figure below shows a simplified diagram of the apparatus used for the electrolysis of copper (II) sulphate solution using inert electrodes.



- (a) What is electrolysis? (1 mark)

- (b) Label the parts of the electrolytic cell above. The label lines have been provided for you. (6 marks)

- (c) Suggest a substance that can be used as electrodes in the electrolytic cell above. (1 mark)

- (d) Identify the ions present at the anode and cathode during this process. (2 marks)

Anode: _____

Cathode: _____

- (e) (i) What is an electrolyte? (1 mark)

- (ii) Write half equations to show the products formed at the cathode and anode for the electrolysis of aqueous copper (II) sulphate. (4 marks)

- (f) (i) What changes would you observe during the electrolysis of the copper (II) sulphate solution? (3 marks)

- (ii) Identify the ions left in solution that will not take part in the reaction (1 mark)

- (iii) At the end of the reaction, blue litmus paper was dipped in the solution found in the beaker containing the electrodes of the electrolytic cell. The blue litmus paper turned red. Account for this result. (1 mark)

- (g) If 5A of current was passed through the electrolytic cell containing the aqueous copper (II) sulphate solution for half an hour, determine the mass of product deposited at the cathode. (5 marks)

Total 25 marks

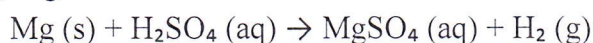
5. (a) Define the following terms as they relate to reaction kinetics. (3 marks)

- (i) Rate of reaction

- (ii) Activation Energy

- (iii) Catalyst

- (b) Magnesium powder dissolves in dilute sulphuric producing a salt and hydrogen gas.



- (i) Describe using a diagram how you could measure the rate of this chemical reaction (5 marks)

- (ii) Explain using the collision theory how the rate will be affected by increasing the concentration of the hydrochloric acid (2 marks)

- (iii) A chemistry student decided to do the same experiment, however magnesium ribbon was used instead of magnesium powder. Explain using the collision theory how the rate of the reaction will be affected. (2 marks)

- (c) The Boltzmann distribution is a graph that that shows the distribution of energy among molecules in a chemical reaction at a particular temperature.

- (i) Draw the Boltzmann distribution curve for a given chemical reaction. Ensure all parts of the graph are labelled. (3 marks)

(ii) Modify the Boltzmann distribution curve drawn in part (c) (i) above to show how the energy of particles affected by the addition of a catalyst to a chemical reaction. (2 marks)

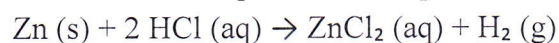
(d) Identify THREE properties of enzymes (3 marks)

Total 20 marks

6. (a) Distinguish between exothermic and endothermic reactions (2 marks)

(b) Provide TWO examples of exothermic reactions and TWO examples of endothermic reactions (4 marks)

(c) 6.54g of zinc were added to 50 cm³ of 4.0 mol dm⁻³ of hydrochloric acid. When the reaction was completed the temperature rose by 28°C.



(i) Is the reaction exothermic or endothermic? Give a reason for your answer. (2 marks)

(ii) Calculate the heat transferred for the reaction using the equation $Q = mc\Delta T$ (3 marks)

- (iii) Hence, calculate the enthalpy change for the reaction when 1 mole of zinc is dissolved in HCl in KJmol^{-1} (4 marks)

- (iv) Draw an enthalpy profile diagram for this chemical reaction. Include the value you calculated in part (iii) above in your diagram. (3 marks)

- (d) Draw a well labelled diagram to show the equipment and set up that can be used to measure enthalpy changes for a chemical reaction. (2 marks)

Total 20 marks

END OF EXAMINATION

