KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE CERTIFICATE OF PRE-UNIVERSITY CHEMISTRY

COURSE CODE: PCHEM 011

COURSE TITLE: BASIC PHYSICAL AND INORGANIC CHEMISTRY

STREAM: SEMESTER ONE

- DAY: THURSDAY
- TIME: 2.00 4.00 P.M.

DATE: 12/08/2010

INSTRUCTIONS:

- Answer all questions: (70 % Marks)
- Each Question = 17.5 Marks

PLEASE TURN OVER

- 1. (a) (i). Define matter and energy.
 - (ii). Explain the difference between mass and weight?
 - (iii). Name two intensive properties that you could use to distinguish between water and gasoline?(6 Marks)
- (b) (i) Define an element, a compound and a mixture. Give examples of each.
 - (ii) What is the difference between an atom and a molecule?
 - (iii) How many electrons, protons, and neutrons are in each of the following particles?

$${}^{81}_{35}$$
 Br and ${}^{58}_{26}$ Fe³⁺ (6 Marks)

- (c) (i) The percentage by mass of carbon in carbon dioxide is 27.29%. What is the percentage of oxygen? How many grams of carbon are in 50.0g of carbon dioxide gas?
 - (ii) Balance the following equation:

 $Pb(NO_3)_2 + Na_2SO_4 \longrightarrow PbSO_4 + NaNO_3$

(iii) The octane in gasoline burns according to the following equation:

 $2C_8H_{18} + 25O_2 \longrightarrow 16CO_2 + 18H_2O$

- I. How many moles of O_2 are needed to react fully with 6 mol of octane?
- II. How many moles of CO2 can form from 0.5 moles of octane? (5.5 Marks)
- 2 (a) (i) Calculate the molarity of a solution containing 6.45 g. of NH_3 in 125 ml of the solution. (N = 14, H = 1)
 - (ii) Calculate the number of grams of a solute that has been used to make 250 ml of 0.4 M NaCl (Na = 23, Cl = 35.5)
 - (iii) What is the molarity of an aqueous sulphuric acid solution if 12.88 ml is neutralized by 26.04 ml of 0.1024 M NaOH? Write a balanced equation for the reaction.(9 Marks)

- (b) (i) What is co-ordinate covalent bond? Give an example.
 - (ii) Define a single, double and triple bond.
 - (iii) Define electronegativity? Which elements in the periodic table have low and high electronegativity?
 - (iv) Name two types of intermolecular bonds that can be formed by covalent compounds? (8.5 Marks)
- 3. (a) (i) What does the "periods" and 'groups' represent in the periodic table?
 - (ii) Given that an atom T has atomic number of 23, give its electronic configuration, the group and the period of the element in the periodic table.
 - (iii) Arrange the following cations in order of their increasing ionic radii: K^+ , Ca⁺ and Ga⁺³.
 - (iv) Compare and explain the relative sizes of H^+ , H, and H^- . (8 marks)
 - (b) (i) What is an electrolyte? Give an example.
 - (ii) Write ionic and net ionic equations for the following reactions.

 $(NH_4)_2CO_{3(aq)} + MgCl_{2(aq)} \longrightarrow 2NH_4Cl_{(aq)} + MgCO_{3(s)}$

- (iii) State the following laws both in words and in the forms of equations. By what name is each law known?
 - I. Temperature volume law
 - II. Temperature pressure law.
- (iv) If 625 ml of Oxygen at 925 mmHg is allowed to expand at constant

temperature until its pressure is 748 mmHg, what will be the volume?

(9.5 Marks)

- 4. (a) Give the factors that affect rate of reaction?
 - (b) The following data were collected for the reaction below at a temperature of

530 °C:
$$CH_3CHO \longrightarrow CH_4 + CO$$

[CH ₃ CHO] (mol/l)	Time (s).
0.200	0
0.153	20
0.124	40
0.104	60
0.090	80
0.079	100
0.070	120
0.063	140
0.058	160
0.053	180
0.049	200

Plot a graph of concentration versus time and determine the rate of CH₃CHO at 60 seconds and at 140 seconds. (8 marks)

- (c) (i) State Le Chatelier's principle in your words.
 - (ii) How will the equilibrium of the following reaction are affected by addition of H₂ gas and the removal of CS₂ gas respectively?

Heat +
$$CH_{4(g)}$$
 + $2H_2S_{(g)}$ \longrightarrow $CS_{2(g)}$ + $4H_{2(g)}$

(iii) At 773 0 C, a mixture of CO gas, H₂ gas, and CH₃OH gas was allowed to come to equilibrium. The following equilibrium concentrations were then measured: [CO] = 0.105 M, [H₂] = 0.250 M, [CH₃OH] = 0.0050 M. Calculate K_c for the reaction:

$$CO_{(g)} + 2H_{2(g)} \longrightarrow CH_3OH_{(g)}$$

(9.5 Marks)