NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY

END OF SEMESTER EXAMINATIONS – JUNE 2010

GENERAL CHEMISTRY: SCH 1217 FOR SBB & ESH

TIME : THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

1. **ANSWER *ALL QUESTIONS* FROM *SECTION A* AND *ANY THREE* FROM *SECTION B.* SECTION A CARRIES 40 MARKS AND EACH QUESTION IN SECTION B CARRIES 20 MARKS. MARKS ARE ALLOCATED IS INDICATED IN BRACKET.**

2. **START EACH QUESTION ON A NEW PAGE. (NOT EACH PART OF THE QUESTION).**

3. **GRAPH PAPER WILL BE PROVIDED ON REQUEST.**

TOTAL MARKS = 100

THIS QUESTION PAPER CONSISTS OF *FOUR PRINTED PAGES* (ONE SIDE ONLY) INCLUDING THE TOP PAGE WITH THE INSTRUCTIONS.

SECTION A

1.

(a) With an appropriate example, describe the law of composition.

(4 Marks)

(b) How many protons, neutrons and electrons are in the following atoms?

(i) $^{74}_{184}W$ (ii) $^{47}_{108}Ag$ (iii) $^{83}_{209}Bi$

(6 Marks)

(c) Explain briefly Pauli's exclusion principle.

(2 Marks)

(d) Define mole.

(2 Marks)

(e) How many mole of fructose, $C_6H_{12}O_6$, are in 45g?

(2 Marks)

(f) Balance the following equation:

(i) $C_2H_5OH + O_2 \longrightarrow CO_2 + H_2O$

(ii) $Fe_2(SO_4)_3 + Ca(OH)_2 \longrightarrow CaSO_4 + Fe(OH)_3$

(2+2 Marks)

(g) Define Molarity. What is the unit of molarity?

(2+1 Marks)

(h) Calculate the molarity of a solution made by dissolving 5.00g of fructose $C_6H_{12}O_6$, in 100ml of solution.

(3 Marks)

(i) What do you understand by energy?

(2 Marks)

(j) Define with an appropriate example:

(i) Lewis acid/base theory

(ii) Bronsted/Lowry theory of acid/base.

(4+4 Marks)

(k) Write electronic configurations for the following elements. Use sub-orbitals with boxes for the answers.

(i) $^{74}_{184}W$ (ii) $^{47}_{108}Ag$

(2+2 Marks)

SECTION B

2. (a) Define isotope.

(2 Marks)

(b) An unknown element Nu has five isotopes distributed as follows in nature.
Nu (58) = 67.82; Nu (60) = 26.23; Nu (61) = 1.19; Nu (62) = 3.66; and Nu (64) = 1.08.

Calculate average atomic mass of Nu.

(5 Marks)

(c) Briefly explain entropy.

(3 Marks)

(d) Predict the direction in which ΔG^o for the equilibrium will change for the following reaction:

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$$

at (i) 773Kand (ii) at 298K

$\Delta H^o = -92.38$ kJ and $\Delta S^o = -198.3$ J/K

(5x5 Marks)

3. (a) Write equations for:
(i) first order reaction and
(ii) second order reaction.

(2x2 Marks)

(b) The initial rate of reaction A + B $\longrightarrow$ C was measured for various concentrations of A and B. Results are given below:

Exp. No	[A] M	[B] M	Initial rate M
1	**0.6**	**0.3**	**12.6**
2	**0.2**	**0.3**	**1.4**
3	**0.6**	**0.1**	**4.2**
4	**0.17**	**0.25**	**?**

(i) Determine the order of reaction with respect to each reactant, and the overall order of reaction?

(5 Marks)

(ii) Determine the rate law for the reaction.

(2 Marks)

(iii) Calculate the rate constant.

(3 Marks)

(iv) Use the data to predict the rate for experiment 4.

(2 Marks)

(c) What do you understand by:

(i) endothermic reaction (2 Marks)

(ii) exothermic reaction (2 Marks)

4. (a) State at least four factors that influence the rate of chemical reaction. (4 Marks)

(b) A serving of cream of mushroom soup contains 7.0g fat, 9.0g carbohydrate and 1.0g protein. What is the fuel value in kilojoules in a100g serving. How many calories does it provide?
The average fuel value of carbohydrate is 17 kJ/g, protein is 17 kJ/g and fat is 38 kJ/g. (1 kJ = 4.18 cal.)

(8 Marks)

(c) How much 3.0 M sulphuric acid would be required to make 450 cm^3 of 0.1 M sulphuric acid? (4 Marks)

(d) (i) Define first law of thermodynamics and
(ii) What do you understand by enthalpy? (2+2 Marks)

5. (a) What is the difference between 2.0g and 2.00g? Which one of these two is more precise? (3 Marks)

(b) What do you understand by "common ion effect"? (3 Marks)

(c) What is the pH of a solution prepared by adding 0.30 mol of acetic acid, CH_3COOH, and 0.30 mol of sodium acetate, CH_3COONa, to enough water to make 1.0 dm^3 (litre) of solution? For acetic acid Ka = 1.8×10^{-5} (7 Marks)

(d) What is the name given to the solution prepared in 5(c). (1 Mark)

(e) Calculate the pH of the solution in 5(c) after adding0.0200 mol of HCl. (6 Marks)

**********END OF PAPER**********