



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY

BACHELOR OF SCIENCE HONOURS DEGREE

END OF SEMESTER EXAMINATIONS – AUGUST 2009

GENERAL CHEMISTRY - SCH 1217 FOR SBB & ESH

TIME : THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

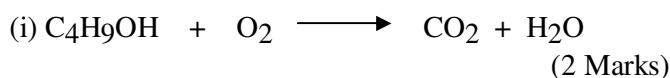
1. ANSWER ***ALL QUESTIONS*** FROM ***SECTION A*** AND ***ANY THREE*** FROM ***SECTION B***. SECTION A CARRIES 40 MARKS AND EACH QUESTION IN SECTION B CARRIES 20 MARKS. MARKS ARE ALLOCATED AS INDICATED IN BRACKET.
2. START EACH QUESTION ON A NEW PAGE. (NOT EACH PART OF A QUESTION).
3. GRAPH PAPER WILL 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) What do you understand by
(i) homogeneous catalyst
(ii) heterogeneous catalyst
(2x2 Marks)
- (b) With an appropriate example, describe the law of composition.
(3 Marks)
- (c) How many protons, neutrons and electrons are in the following atoms?
(i) ${}_{28}^{59}\text{Ni}$ (ii) ${}_{56}^{137}\text{Ba}$ (iii) ${}_{92}^{238}\text{U}$
(6 Marks)
- (d) Explain briefly Pauli's exclusion principle.
(2 Marks)
- (e) Define mole
(2 Marks)
- (f) How many mole of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, are in 22.5g?
(2 Marks)
- (g) Balance the following equation:



- (h) Define Molarity.
(2 Marks)
- (k) Calculate the molarity of a solution made by dissolving 5.00g of glucose $\text{C}_6\text{H}_{12}\text{O}_6$, in 100ml of solution.
(3 Marks)
- (l) What do you understand by energy?
(2 Marks)
- (m) Define (i) Lewis acid/base theory
(ii) Bronsted/Lowry theory of acid/base.
Give one example each.
(3x2 Marks)
- (n) Write electronic configurations for the following elements.
Use sub-orbital with boxes for the answers.



(3x2 Marks)

SECTION B:

2. (a) Define isotope. (2 Marks)

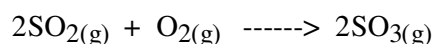
(b) The element zinc has five isotopes distributed as follows in nature.

$$\text{Zn}(64) = 48.89\%, \text{Zn}(66) = 27.81\%, \text{Zn}(67) = 4.11\%; \\ \text{Zn}(68) = 18.77\% \text{ and } \text{Zn}(70) = 0.62\%$$

Calculate average atomic mass of zinc. (5 Marks)

- (c) Briefly explain entropy. (3 Marks)

(d) Calculate ΔH and ΔS at 298K for the following reaction and estimate ΔG° at 400K.

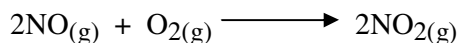


$$\begin{array}{ll} \Delta H^\circ \text{ for SO}_2 = -296.9 \text{ kJ} & \Delta S^\circ \text{ for SO}_2 = +248.5 \text{ J/K} \\ \Delta H^\circ \text{ for SO}_3 = -395.2 \text{ kJ} & \Delta S^\circ \text{ for SO}_3 = +256.2 \text{ J/K} \\ \Delta H^\circ \text{ for O}_2 = 0.00 & \Delta S^\circ \text{ for O}_2 = +205 \text{ J/K} \end{array}$$

(10 Mark)

3. (a) Write equation for:
the (i) first order reaction and (ii) second order reaction. (2x2 Marks)

(b) The following data were collected for the rate of disappearance of NO in the reaction



Exp. No	[NO] M	[O ₂] M	Initial rate (M/s)
1	0.0126	0.125	1.41×10^{-2}
2	0.0252	0.250	1.13×10^{-1}
3	0.0252	0.125	5.64×10^{-2}

Determine:

- (i) rate law for the reaction. (2 Marks)
- (ii) calculate the rate constant. (3 Marks)
- (iii) determine the overall order of reaction from the results given. (Use rate Law). (3 Marks)

(c) The popular 100g Saucy pasta contains 62.0g carbohydrate, 12.0g protein and 5.0g total fat. What is the fuel value in kilojoules in a 60g 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.)

(6 Marks)

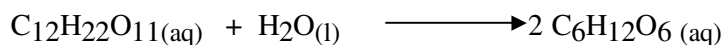
(d) If pH = 6.3, what are the molar concentrations of H^+ and HO^- in the solution?

(2 Marks)

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

(4 Marks)

(b) Sucrose, $C_{12}H_{22}O_{11}$, which is commonly known as table sugar, reacts in dilute acid solutions to form two simple sugars, glucose and fructose, both of which have the formula $C_6H_{12}O_6$.



At 23°C and in 0.5 M HCl. The following data were obtained for the rate of disappearance of sucrose.

Time (min)	0	39	80	140	210
$[C_{12}H_{22}O_{11}]$ M	0.316	0.274	0.238	0.190	0.146

(i) Draw the graphs of (a) $\ln [C_{12}H_{22}O_{11}]$ versus time

(b) $1/[C_{12}H_{22}O_{11}]$ versus time.

(5x2 Marks)

(ii) From the graph deduce whether the reaction is first order or second order with respect to the concentration of sucrose.

(2 Marks)

(iii) Write rate law for the reaction

(2 Marks)

(iv) From the graph, calculate rate constant, k.

(2 Marks)

5. (a) What is the difference between 5.0g and 5.00g? Which one of these two is more precise?

(3 Marks)

(b) What do you understand by “common ion effect”?

(3 Marks)

(c) What do you understand by buffer or buffer solution?

(3 Marks)

(c) A buffer solution contains 0.11 mol of ethanoic acid and 0.15 mol of sodium ethanoate in 1.0 dm³.

(i) What is the pH of the buffer?

(ii) What is the pH of the buffer after addition of 0.02 mol of KOH?

(iii) What is the pH of the buffer after addition of 0.02 mol of HCl?

(3+4+4 Marks)

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