

## DECEMBER2010 EXAM

### PCHEM 011- BASIC PHYSICAL AND INORGANIC CHEMISTRY

Attempt all questions

Total Marks = 70 %

#### QUESTION ONE

- (a) Explain the following terms: (i) Heterogeneous mixture (ii) Homogenous mixture?  
Give an example. ( 2 marks )
- (b) Distinguish between a chemical change and physical change. Give examples.  
( 2 marks )
- c) Aspartame is an artificial sweetener that is 160 times sweeter than sucrose (table sugar) when dissolved in water. The molecular formula of aspartame is  $C_{14}H_{18}N_2O_5$ .  
(5 marks)
- Calculate the molecular weight of aspartame.
  - How many moles are there in 10.0 gm of aspartame?
  - What is the mass in grams of 1.56 moles of aspartame?
  - How many particles (molecules) are in 5.0 gm of aspartame?
  - What is the mass in grams of  $1.0 \times 10^9$  molecules of aspartame?
- d) (i) Express the composition of each compound as the mass percentages of its elements for Formaldehyde  $CH_2O$  and Glucose  $C_6H_{12}O_6$ . (2.5) marks
- (ii) A compound that contains Nitrogen and Oxygen only has 30.4 % N by mass; the molecular mass of the compound is 92. Calculate empirical and molecular formula of the compound. (6 marks)

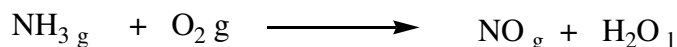
#### QUESTION TWO

- a) (i). Lead arsenate, an inorganic insecticide used against the potato beetle, is usually produced using the following reaction:



Balance the equation. (3 marks)

- (ii). Consider the reaction:



Balance the equation and use it for the following:

For every 1.5 moles of  $\text{NH}_3$ ,

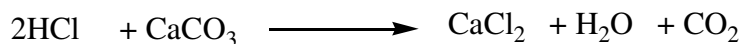
- a. How many moles of  $\text{O}_2$  are required ?  
b. How many moles of  $\text{NO}$  and  $\text{H}_2\text{O}$  are produced? (4.5mks)

b) i) Define an acid, a base and a salt.

ii) Write a balanced: (a). Formula equation (b). Total ionic equation

(c). Net ionic equation for the reactions that occur between hydrochloric acid and Barium hydroxide. (5marks)

- c) An anti-acid tablet containing calcium carbonate as an inactive ingredient requires  $22.6 \text{ cm}^3$  of  $0.0932\text{M}$   $\text{HCl}$  for complete reaction. What mass of  $\text{CaCO}_3$  did the tablet contain? ( $\text{Ca} = 40$ ,  $\text{Cl} = 35.5$ ,  $\text{H} = 1$ ,  $\text{O} = 16$ ) (5 marks)



### **QUESTION THREE**

- a) (i) What does the 'Group' and 'periods' in the periodic table represent ? (2.5 marks)
- (ii) Give the electronic configuration of two elements A and B having the atomic numbers of 15 and 28 respectively. Identify the group and period in which you find the two elements in the periodic table. (4mks)
- b) (i). Explain why the atomic radii of elements decrease from left to right within a period in the periodic table.
- (ii). Arrange the following atoms of elements in order of increasing atomic radii; N, Mg, Al and Si. Explain the order.
- (iii). Compare the sizes of anion and the neutral atoms from which they are formed by citing an example. (6 marks)
- c) (i). Define an ionic bond and covalent bond. Give examples.
- (ii). Differentiate between van-der-waals forces and hydrogen bond using appropriate examples. (5 marks)

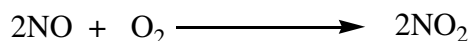
#### **QUESTION FOUR.**

a) (i). State Boyle's law and Charles Law.

(ii) A 326 cm<sup>3</sup> of a gas exerts a pressure of 1.67 atm at 12 °C. What volume would it occupy at 100 °C and 1.00 atm ? (4 marks)

b) (i) Discuss on four factors that affect the rate of a chemical reaction. (4 marks)

(ii) The experimental data given below are for the reaction of:



<b>Expt:</b>	<b>[NO] (Mol/l)</b>	<b>[O<sub>2</sub>] (mol/l)</b>	<b>Reaction rates (R ) in M/s</b>
<b>1.</b>	<b>0.2</b>	<b>0.1</b>	<b>1.0 x 10<sup>-4</sup></b>
<b>2.</b>	<b>0.4</b>	<b>0.1</b>	<b>4.0 x 10<sup>-4</sup></b>
<b>3.</b>	<b>0.2</b>	<b>0.4</b>	<b>4.0 x 10<sup>-4</sup></b>

(a) Using the general rate law equation, calculate the reaction orders for NO & O<sub>2</sub>

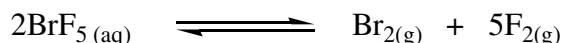
(b) Give the rate law equation for the reaction and calculate the rate constant.

(c) Calculate the rate of reaction when [NO] = 0.045M and [O<sub>2</sub>] = 0.025 M

( 5 marks)

c).(i) Explain what is meant by chemical reaction being at equilibrium (1.5 mark)

(ii) At elevated temperatures, BrF<sub>5</sub> establishes the following equilibrium



The equilibrium concentrations of the gases at 1500 °K are 0.0064 mol/l for BrF<sub>5</sub>, 0.0018 mol/l for Br<sub>2</sub> and 0.0090 mol/l for F<sub>2</sub>. Calculate the value of K<sub>c</sub>.

(3 marks)

