

**CONFIDENTIAL**



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2015/2016**

COURSE NAME : CHEMISTRY  
COURSE CODE : DAS 12203  
PROGRAMME : 1 DAM  
EXAMINATION DATE : DECEMBER 2015/JANUARY 2016  
DURATION : 3 HOURS  
INSTRUCTION : A) ANSWER **ALL** QUESTIONS IN  
SECTION A.  
B) ANSWER **TWO (2)**  
QUESTIONS ONLY IN  
SECTION B.

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

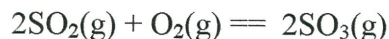
**CONFIDENTIAL**

**CONFIDENTIAL****SECTION A**

- Q1** (a) An equilibrium mixture contains 2.00 moles of bromine, 1.25 moles of hydrogen and 0.50 mole of hydrogen bromide in a 4.0 dm<sup>3</sup> container. Calculate  $K_c$  for the reaction.



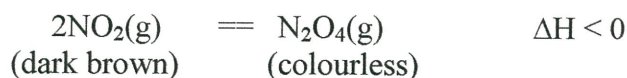
- (b) The oxidation of sulphur dioxide to sulphur trioxide is reversible reaction.



An equilibrium mixture in a container contains 0.40 mole of sulphur dioxide, 0.80 mole of oxygen and 4.8 moles of sulphur trioxide. If the total pressure in the container is  $1.50 \times 10^6$  Pa, calculate the value of  $K_p$  for the reaction.

(9 marks)

- (c) With reference to the following equilibrium reaction



Explain what will happen if a small sealed tube which contains a mixture of  $\text{NO}_2(\text{g})$  and  $\text{N}_2\text{O}_4(\text{g})$  is immersed in

- (i) a beaker containing an ice-water mixture, (3 marks)
- (ii) a conical flask half-filled with hot water. (3 marks)

- Q2** (a) Identify the Lewis acid and Lewis base in the following reaction. Explain your answer.

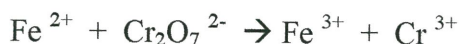


- (b) The pH of a detergent is 8.30. Calculate the hydroxonium ion ( $\text{H}_3\text{O}^+$ ). (3 marks)

**CONFIDENTIAL**

- (c) Calculate the pOH of a 0.360 M  $\text{Ca}(\text{OH})_2$  solution. (3 marks)
- (d) A 0.0560 g quantity of acetic acid,  $\text{CH}_3\text{COOH}$  is dissolved in enough water to make 50.0 mL of solution. Calculate the concentration of  $\text{H}^+$ ,  $\text{CH}_3\text{COO}^-$  and  $\text{CH}_3\text{COOH}$  at equilibrium. [Atomic mass, A: C=12, H=1, O=16;  $K_a = 1.8 \times 10^{-5}$ ] (9 marks)

**Q3** (a) Given the unbalanced ionic equation



Write the balanced ionic equation in acidic solution.

(4 marks)

(b) A galvanic cell consists of a Mg electrode in a 1.0 M  $\text{Mg}(\text{NO}_3)_2$  solution and an Ag electrode in a 1.0 M  $\text{AgNO}_3$  solution.

(i) Determine the anode and cathode.

(2 marks)

(ii) Write the half cell reactions for both electrodes.

(4 marks)

(iii) Calculate the standard emf of the cell at 25°C.

Given:  $E^\circ \text{Ag}^+ / \text{Ag} = 0.80\text{V}$

$$E^\circ \text{Mg}^{2+} / \text{Mg} = -2.37\text{V}$$

(2 marks)

(c) Calculate how much copper (Cu) will be produced in an electrochemical cell of molten  $\text{CuCl}_2$  if a current of 11.0 A is passed through the cell for two hours.

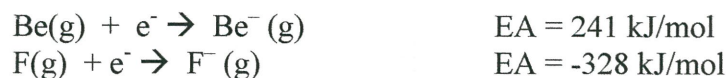
[Molar mass: Cu = 63.5, Cl = 35.5, 1 Faraday = 96 500 C]

(8 marks)

## SECTION B

- Q4** (a) Mass of  $7.88 \times 10^{20}$  molecules of ethylene glycol is 0.0681 g. Find the molar mass of the compound.  
[ $N_A = 6.022 \times 10^{23}$ ]  
(4 marks)
- (b) Pure magnetite is composed of an iron-oxygen binary compound. It contains 72.41% of iron atom and 27.59% of oxygen atom. Find the empirical formula of the compound.  
(Relative atomic mass: Fe = 56, O = 16)  
(6 marks)
- (c) Given a balance reaction
- $$2\text{HNO}_3(aq) + 3\text{H}_2\text{S}(aq) \rightarrow 2\text{NO}(g) + 3\text{S}(s) + 4\text{H}_2\text{O}(l)$$
- (i) Calculate the volume of 0.350 M  $\text{HNO}_3$  that will completely react with 275 mL of 0.100 M  $\text{H}_2\text{S}$ .  
(5 marks)
- (ii) Calculate the volume of NO gas measured at 27 °C and 1 atm released in (i).  
[ $R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$ .]  
(5 marks)
- Q5** (a) (i) Explain the meaning of the term *orbital* and describe the shape and symmetries of *s* and *p* orbitals.  
(3 marks)
- (ii) Write the electronic structure for the  $\text{Ca}^{2+}$  and  $\text{O}^{2-}$  ions.  
[Atomic number, Z: Ca = 20, O = 8]  
(4 marks)
- (iii) A lithium atom has three electrons. Write the four quantum numbers for the electrons of the lithium atom.  
(3 marks)

- (b) (i) The electron affinities, EA of beryllium and fluorine are shown below.



Explain which reaction requires more energy by referring to their valence electron configurations.

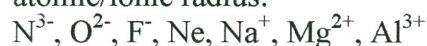
[Atomic number, Z: Be = 4, F = 9]

(6 marks)

- (ii) Define isoelectronic.

(1 mark)

- (iii) Rearrange the following species in order of the decreasing of atomic/ionic radius:



[Atomic number, Z: Al = 13, F = 9, Mg = 12, N = 7, Na = 11, Ne = 10, O = 8]

(3 marks)

- Q6** (a) (i) When aluminium chloride gas is cooled, two  $\text{AlCl}_3$  molecules unite to form a dimer with the molecular formula  $\text{Al}_2\text{Cl}_6$ . Name the type of bond exist in  $\text{AlCl}_3$ .

(1 mark)

- (ii) Draw Lewis dot diagram to show the formation of  $\text{AlCl}_3$ .

(2 marks)

- (iii) State the types of bond exist in  $\text{Al}_2\text{Cl}_6$ .

(2 marks)

- (iv) Explain how the dimer was formed.

(5 marks)

- (b) At 741 torr and  $44^\circ\text{C}$ , 7.10 g of a gas occupy a volume of 5.40 L. Calculate the molar mass of the gas.

[ $R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$ .]

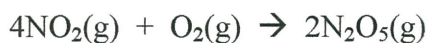
(5 marks)

- (c) A sample of gas occupies a volume of 1.88 L at  $22.0^\circ\text{C}$  and 0.979 atm pressure. Calculate the volume of this sample at STP.

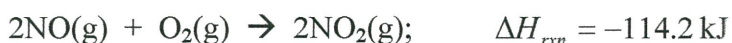
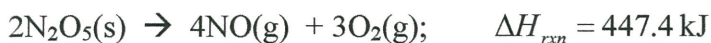
(5 marks)



**Q7** (a) Nitrogen dioxide undergoes many interesting reactions such as:

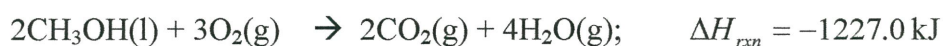


From the following information, calculate for the above reaction.



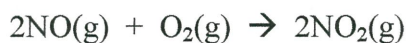
(7 marks)

(b) Use the following information to find the  $\Delta H_f^\circ$  of methanol,  $\text{CH}_3\text{OH}$ .



(6 marks)

(c) Consider the reaction



Suppose that at a particular moment during the reaction, nitric oxide, NO is reacting at the rate of 0.066 M/s. Calculate the rate of reaction

(i) when  $\text{NO}_2$  is being formed,

(3 marks)

(ii) oxygen and nitrogen monoxide molecules that are reacting.

(4 marks)

- END OF QUESTIONS -

CONFIDENTIAL

**CONFIDENTIAL****FINAL EXAMINATION**

SEMESTER: 1

SESSION : 2015/2016

PROGRAMME: 1 DAM

COURSE : CHEMISTRY

COURSE CODE: DAS 12203

**FORMULAE**

1. Number of moles =  $\frac{MV}{1000}$

2.  $\text{pH} = -\log [\text{H}^+]$

3.  $\text{pH} + \text{pOH} = 14$

4.  $P_1V_1 = P_2V_2$

5.  $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

6.  $PV=nRT$

**CONFIDENTIAL**