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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2017/2018**

COURSE NAME : CHEMISTRY  
COURSE CODE : DAS 12203  
PROGRAMME : DAA  
EXAMINATION DATE : JUNE/JULY 2018  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS IN  
SECTION A AND TWO (2)  
QUESTIONS IN SECTION B.

**TERBUKA**

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

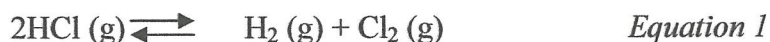
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**SECTION A**

**Q1** (a) Define the term *Homogeneous* and *Heterogeneous* equilibrium. (2 marks)

(b) At 80°C, a 5000 mL flask contains 2.6 M HCl, 2.0 M H<sub>2</sub> and 0.75 M Cl<sub>2</sub>. The equation for the reaction is:



(i) Identify whether the equilibrium in *Equation 1* is homogeneous or heterogeneous. (1 mark)

(ii) Find the K<sub>c</sub> for both forward and reverse reactions in *Equation 1*. (3 marks)

(iii) Calculate the K<sub>c</sub> for the given reaction in *Equation 1* if the value of K<sub>p</sub> at 270°C is 2.6 x 10<sup>-4</sup>. (3 marks)

(iv) Calculate K<sub>c</sub> if the partial pressures in *Equation 1* are 1.2 atm HCl, 1.0 atm H<sub>2</sub> and 1.5 atm Cl<sub>2</sub>. (4 marks)

(v) If the reaction in *Equation 1* is reduced to half, find K<sub>c</sub> for the forward reaction. (2 marks)

(c) (i) State the Le Chatelier's principle. (2 marks)

(ii) Given a system in equilibrium:



Predict the shift on the equilibrium position when

- (1) Pressure of the system is increased at constant temperature.
- (2) NO gas is removed.
- (3) Catalyst is added.

(3 marks)

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- Q2** (a) Define acid and base according to the theory of Arrhenius and give the related examples. (4 marks)
- (b) (i) The concentration of hydrogen ion,  $H^+$  for a sample of nitric acid is  $6.213 \times 10^{-3} M$ . Calculate the pH of the acid. (2 marks)
- (ii) Calculate the pOH of a sample of mineral water with the concentration of hydrogen ion  $7.415 \times 10^{-10} M$ . (3 marks)
- (c) A 0.0853 g quantity of acetic acid,  $CH_3COOH$  is dissolved in enough water to make 250.0 mL of solution. Calculate the concentration of  $H^+$ ,  $HCOO^-$  and  $CH_3COOH$  at equilibrium. [Atomic mass, A: C=12, H=1, O=16;  $K_a = 1.8 \times 10^{-5}$ ] (11 marks)

- Q3** (a) (i) Define oxidizing agent and reducing agent in terms of electron gain or loss. (2 marks)
- (ii) Write the relationship between the numbers of electrons gained and lost in a redox reaction. (1 mark)
- (b) Assume that a voltaic cell utilizes the redox reaction.



- (i) Write the reactions occur and identify the electrodes. (6 marks)
- (ii) Construct the cell diagram for the above reaction. (2 marks)

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- (c) Given an ionic equation for an electrochemical cell:



- (i) Write half – reaction for the anode and cathode. (4 marks)
- (ii) Determine the  $E^\circ_{\text{cell}}$  for this reaction. (2 marks)
- (iii) Calculate the cell potential,  $E_{\text{cell}}$  when  $[\text{Zn}^{2+}] = 1.0 \text{ M}$  and  $[\text{H}^+] = 6.3 \times 10^{-6} \text{ M}$ . (3 marks)

**SECTION B**

- Q4** (a) Given the combustion reaction of glucose in our daily meal:

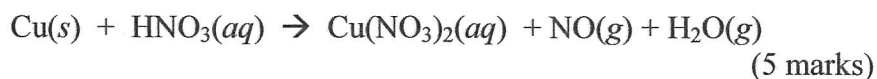


If 856.0 g of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$  is consumed by a person over a certain period, calculate the mass of carbon dioxide produced.

[Relative atomic mass: C = 12, H = 1, O = 16]

(5 marks)

- (b) (i) Write the balanced equation for:

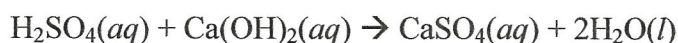


- (ii) Calculate the number of mole of  $\text{Cu}(\text{NO}_3)_2$  that can be produced by the reaction of 123.50 g Cu with 1.45 mole  $\text{HNO}_3$ .

[Relative atomic mass: Cu = 63.55, H = 1, N = 14.01, O = 16]

(6 marks)

- (c) Given a balanced neutralization reaction:



Calculate the volume of 0.125 M  $\text{H}_2\text{SO}_4$  that will completely react with 200 mL of 0.30 M  $\text{Ca}(\text{OH})_2$ .

[Relative atomic mass: Ca = 40, H = 1, O = 16, S = 32]

(4 marks)

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- Q5** (a) The atomic number of magnesium, Mg is 12.
- (i) Write the electron configuration for  $\text{Mg}^{2+}$  ion. (2 marks)
- (ii) Draw the orbital diagram for all electrons in  $\text{Mg}^{2+}$  ion according to Hund's rule. (2 marks)
- (iii) Determine the magnetic property of the ion. (1 mark)
- (iv) Determine the four quantum numbers of  $\text{Mg}^{2+}$  ion. (5 marks)
- (b) The following sets of quantum numbers are incorrect. Identify the incorrect quantum number and explain why it is incorrect.
- (i)  $(2, 1, 2, +\frac{1}{2})$  (3 marks)
- (ii)  $(1, 0, 0, 1)$  (3 marks)
- (c) Two electrons in the same atom have the following set of quantum numbers.
- Electron A :  $(3, 1, 0, +\frac{1}{2})$*   
*Electron B :  $(3, 1, -1, +\frac{1}{2})$*
- (i) Identify the subshell for these electrons. (2 marks)
- (ii) Verify that the electrons are in the same orbital. Give your reason. (2 marks)

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- Q6** (a) The atomic number of Silicon, Si is 14 and Oxygen, O is 8.
- (i) Write the Lewis dot symbol for Si and O atoms. (2 marks)
- (ii) Draw the Lewis dot symbol to show the formation of silicon dioxide,  $\text{SiO}_2$ . (4 marks)
- (iii) Calculate the formal charge for each atom of  $\text{SiO}_2$ . (4 marks)



- (b) Ethylene dibromide (EDB) was formerly used as a fumigant for fruits and grains, but now it is banned because it is a potential health hazard. EDB is a liquid that boils at 109 °C. Its molecular weight is 188 g/mol. Compute its density as at 165 °C and 1.00 atm.

(6 marks)

- (c) A 10 L flask contains 0.200 moles of methane, CH<sub>4</sub>, 0.300 mole of hydrogen, H<sub>2</sub> and 0.400 mole of nitrogen, N<sub>2</sub> at 25 °C.

- (i) Determine the pressure inside the flask (in *atmosphere*).

(2 marks)

- (ii) Calculate the partial pressure of each component in the mixture of gases

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

(2 marks)

- Q7 (a) (i) Sodium hydrogen carbonate, NaHCO<sub>3</sub> dissociates to Na<sub>2</sub>CO<sub>3</sub>(s), CO<sub>2</sub>(g) and H<sub>2</sub>O(l). From the following  $\Delta H_f^\circ$ , calculate  $\Delta H^\circ$  for the dissociation of NaHCO<sub>3</sub>(s).

$$\Delta H_f^\circ \text{ Na}_2\text{CO}_3(s) = -1429.0 \text{ kJ/mol,}$$

$$\Delta H_f^\circ \text{ NaHCO}_3(s) = -710.0 \text{ kJ/mol,}$$

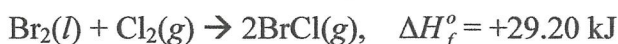
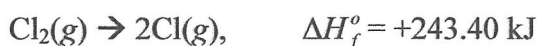
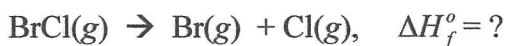
$$\Delta H_f^\circ \text{ CO}_2(g) = -393.0 \text{ kJ/mol,}$$

$$\Delta H_f^\circ \text{ H}_2\text{O}(l) = -286.0 \text{ kJ/mol.}$$

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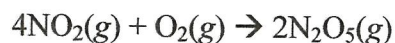
(4 marks)

- (ii) By using the following data, calculate the standard enthalpy change,  $\Delta H_f^\circ$  for the reaction of



(6 marks)

- (b) (i) Consider the reaction



Given, at a particular moment during the reaction, molecular oxygen is reacting at the rate of 0.0235 M/s. Determine at what rate is

- (1)  $\text{N}_2\text{O}_5$  being form.
- (2)  $\text{NO}_2$  reacting.

(3 marks)

- (ii) For the reaction of nitric oxide with hydrogen at 1280°C,



the following data are obtained.

Experiment	[NO] (mol.L <sup>-1</sup> )	[H <sub>2</sub> ] (mol.L <sup>-1</sup> )	Rates (mol.L <sup>-1</sup> .s <sup>-1</sup> )
1	0.005	0.002	1.3 X 10 <sup>-5</sup>
2	0.010	0.002	5.0 X 10 <sup>-5</sup>
3	0.010	0.004	10.0 X 10 <sup>-5</sup>

- Determine
- (1) the rate law,
  - (2) the rate constant,
  - (3) the rate of the reaction when [NO] = 0.012 M and [H<sub>2</sub>] = 0.006 M.

(7 marks)

- END OF QUESTIONS -

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## FINAL EXAMINATION

SEMESTER / SESSION : II 2017/2018  
COURSE NAME : CHEMISTRYPROGRAMME: DAA  
COURSE CODE: DAS 12203

## FORMULA

1.  $n = \frac{MV}{1000}$
2.  $M_1V_1 = M_2V_2$
3.  $\frac{M_aV_a}{a} = \frac{M_bV_b}{b}$
4.  $\text{pH} = -\log [\text{H}^+]$
5.  $\text{pH} + \text{pOH} = 14$
6.  $P_1V_1 = P_2V_2$
7.  $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
8.  $PV = nRT$
9.  $K_p = K_c(RT)^{\Delta n}$
10.  $Q = ms\Delta T$

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