



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017**

COURSE NAME : CHEMISTRY
COURSE CODE : DAS 12102
PROGRAMME : 2 DAE
EXAMINATION DATE : DECEMBER 2016 / JANUARY 2017
DURATION : 2 HOURS 30 MINUTES
INSTRUCTION : ANSWER **FIVE (5)** QUESTIONS ONLY

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THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

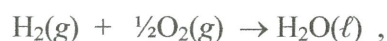
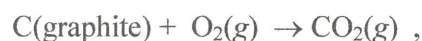
- Q1** (a) A sample of an oxide of nitrogen is found to contain 30.4 % nitrogen. Determine the empirical formula of the nitrogen oxide. Atomic mass/amu: N = 14, O = 16. (8 marks)
- (b) Element *X* consists of two isotopes with masses of 62.9 amu and 64.9 amu respectively. The relative atomic mass of *X* is 63.6 amu. Calculate the abundance percentage of the isotopes. (7 marks)
- (c) An iodized salt contains 0.5 % of NaI. A person consumes 3 g of salt every day. Calculate the number of iodide ions (in gram) going into his body every day. Atomic mass/amu: Na = 23, I = 127) (5 marks)
- Q2** (a) (i) Write the electron configuration of vanadium atom. Atomic number of vanadium is 23. (4 marks)
- (ii) Determine the magnetic property of vanadium atom. State your reason. (2 marks)
- (b) (i) Discuss the change in atomic radius down the group and across the period of periodic table. (4 marks)
- (ii) Define ionization energy of an atom. (2 marks)
- (c) (i) Determine the valence electrons of phosphorus and chlorine atoms. Atomic number: P = 15, Cl = 17. (4 marks)
- (ii) Draw the Lewis structural formula of PCl_3 molecule. (4 marks)

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- Q3**
- (a) A gas sample occupies a volume of 350 mL at 546 mmHg and 25 °C. Find the volume of the gas at 652 mmHg and 35 °C. (6 marks)
- (b) A birthday party balloon is filled with 0.045 g of helium gas. If the volume takes up 750 mL of space and has a pressure of 325 mmHg, determine the temperature (in °C) inside the balloon. Molar mass of helium = 4 g/mol and gas constant, $R = 0.0821 \text{ L.atm/mol.K}$ (8 marks)
- (c) (i) State the volume of one mole of any gas at STP? (1 mark)
- (ii) Calculate the number of mole contained in 2.5 L of CO_2 at STP. (5 marks)

- Q4**
- (a) Define
- (i) exothermic reaction. (2 marks)
- (ii) specific heat capacity. (2 marks)
- (b) Baking powder, NaHCO_3 dissociates to $\text{Na}_2\text{CO}_3(s)$, $\text{CO}_2(g)$ and $\text{H}_2\text{O}(g)$ when was heated.
- (i) Write a balance dissociation equation of NaHCO_3 . (2 marks)
- (ii) Calculate the enthalpy change (ΔH°) for the dissociation of $\text{NaHCO}_3(s)$.
Given:
- $\Delta H_f^\circ (\text{Na}_2\text{CO}_3)(s) = -1429.0 \text{ kJ mol}^{-1}$
- $\Delta H_f^\circ (\text{NaHCO}_3)(s) = -710.0 \text{ kJ mol}^{-1}$
- $\Delta H_f^\circ (\text{CO}_2)(g) = -393.0 \text{ kJ mol}^{-1}$
- $\Delta H_f^\circ (\text{H}_2\text{O})(l) = -286.0 \text{ kJ mol}^{-1}$.
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- (5 marks)

- (c) From the given thermochemical reaction data, calculate the $\Delta H_f^\circ (\text{C}_2\text{H}_2)$ from the formation reaction



$$\Delta H_{\text{rxn}}^\circ = -393.5 \text{ kJ}$$

$$\Delta H_{\text{rxn}}^\circ = -285.8 \text{ kJ}$$

$$\Delta H_{\text{rxn}}^\circ = -2598.8 \text{ kJ}$$

(9 marks)

- Q5** (a) (i) Write the equilibrium constant (K_c) expression for the reaction



(2 marks)

- (ii) 3 moles of N_2 gas and 9 moles H_2 gas were mixed in a 1 L vessel at a temperature T . There were 2 moles of ammonia in the vessel at equilibrium. Calculate the value of K_c of the reaction.

(10 marks)

- (b) Define acid and base according to Bronsted-Lowry theory.

(2 marks)

- (c) Calculate the pH of 0.5 M NaOH solution. Given $K_w = 1.0 \times 10^{-14}$.

(6 marks)

- Q6** (a) Define the following terms.

- (i) Voltaic cell.

(2 marks)

- (ii) Electrolytic cell.

(2 marks)

- (b) Given the following standard state reduction reactions.



- (i) If the given reactions forming a voltaic cell, write the oxidation and reduction reactions of the cell.

(3 marks)

- (ii) Determine the anode and cathode.

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(2 marks)

- (iii) Calculate the cell voltage.

(3 marks)

- (c) Given the following electrochemical cell reaction at 298 K.



- (i) Write the anode and cathode reactions.

(2 marks)

- (ii) Using Nernst's equation, calculate the cell voltage at 298 K when $[\text{Fe}^{2+}] = 0.68 \text{ M}$ and $[\text{Co}^{2+}] = 0.15 \text{ M}$. Given: $E^{\circ}_{\text{Co}^{2+}/\text{Co}} = -0.2$, $E^{\circ}_{\text{Fe}^{2+}/\text{Fe}} = -0.44 \text{ V}$.

(6 marks)

- Q7 (a) Consider the reaction below and the rate reaction data.



Experiment	Rate of reaction (M/s)	[X] (M)	[Y] (M)
1	1.35×10^{-1}	0.10	0.0050
2	2.70×10^{-1}	0.10	0.010
3	5.40×10^{-1}	0.20	0.010

Given the reaction rate equation is

$$R = k [X]^x [Y]^y$$

where k is the rate constant, x and y are the order of X and Y respectively.

- (i) Determine x and y . (8 marks)
- (ii) Calculate the rate constant, k . (3 marks)
- (iii) Calculate the rate of reaction when the concentration of X is 0.030 M and Y is 0.040 M. (3 marks)
- (b) (i) Define a catalyst. (2 marks)
- (ii) Draw the energy diagram showing the path of a reaction with and without a catalyst. (4 marks)

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– END OF QUESTION –