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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019**

COURSE NAME : CHEMISTRY
COURSE CODE : DAM 10403
PROGRAMME CODE : DAM
EXAMINATION DATE : DECEMBER 2018 / JANUARY 2019
DURATION : 2 HOURS 30 MINUTES
INSTRUCTION : PART A: ANSWER **ALL** QUESTIONS
PART B: ANSWER **TWO (2)** QUESTIONS
ONLY

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THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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PART A

- Q1** (a) Write the conditions of a chemical reaction achieving an equilibrium state. (2 marks)
- (b) Name any **two (2)** factors that can affect the equilibrium state of a chemical system. (2 marks)
- (c) Write the equilibrium constant expression, K_c and K_p for the following equilibrium reactions:
- (i) $\text{COCl}_2(g) \rightleftharpoons \text{CO}(g) + \text{Cl}_2(g)$
- (ii) $2\text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{SO}_3(g)$
- (iii) $\text{CO}(g) + \text{C}(s) \rightleftharpoons \text{CO}_2(g)$ (6 marks)
- (d) Given the following reaction at equilibrium state,
- $$2\text{HCl}(g) \rightleftharpoons \text{H}_2(g) + \text{Cl}_2(g)$$
- At 20 °C and in the equilibrium state, a 1 L flask contains 1.2 M HCl, 1.0 M H_2 and 0.75 M Cl_2 . Find
- (i) K_c for the forward reaction.
- (ii) K_c' for the reverse reaction. (10 marks)
- Q2** (a) Write the dissociation constant equation of water, K_w when its molecule dissociated into ions $[\text{H}^+]$ and $[\text{OH}^-]$ at 25°C and assuming water concentration constant. (2 marks)
- (b) Identify the acid and base conjugate of the following acid-base pairs.
- (i) $\text{HSO}_4^- / \text{H}_2\text{SO}_4$
- (ii) $\text{H}_2\text{CO}_3 / \text{HCO}_3^-$ (4 marks)
- (c) Calculate the concentration of OH^- ion in a HCl solution whose hydrogen ion concentration is 1.3 M. (5 marks)
- (d) pH of milk of magnesia is 10.25. Find:
- (i) pOH
- (ii) Concentration of hydrogen ion $[\text{H}^+]$
- (iii) Concentration of hydroxide ion $[\text{OH}^-]$

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(9 marks)

Q3 (a) (i) Differentiate between an oxidation and a reduction process.

(ii) Define a redox reaction.

(4 marks)

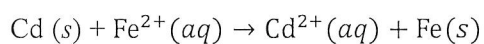
(b) Explain the redox reaction that occurs in

(i) a voltaic cell

(ii) an electrolytic cell

(6 marks)

(c) A voltaic cell is assembled as follows:



(i) Write the half cell reactions at the anode and cathode.

(ii) Draw the cell diagram notation.

(iii) Calculate the standard emf, E°_{cell} of this reaction at 298 K.

(iv) Calculate E_{cell} , when $[\text{Cd}^{2+}] = 0.010 \text{ M}$, and $[\text{Fe}^{2+}] = 0.60 \text{ M}$

(10 marks)

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PART B

- Q4** (a) 27 g of Al metal reacts with excess hydrochloric acid, HCl to produce AlCl₃ and hydrogen gas, H₂.
- (i) Write a balanced chemical equation of the above reaction.
- (ii) Calculate the mass (in gram) of AlCl₃ and H₂ formed. (12 marks)
- (b) 45.0 g of NaCl was used to prepare a 1.3 M solution. Calculate the volume of distilled water needed to dissolve the salt. (5 marks)
- (c) In a dilution experiment, water is added to a 0.885 M KBr solution. If the initial volume of KBr solution is 76.5 mL, calculate the final volume of solution so that the final concentration is 0.050 M. (3 marks)
- Q5** (a) Name the type of bond in the following compounds.
- (i) NaCl
- (ii) SO₂ (2 marks)
- (b) Draw the Lewis structure of PO₃³⁻ ion. (8 marks)
- (c) A metal can of volume 2.0 L contains 2.0 g of nitrogen gas and 6.0 g of hydrogen gas at 200 °C. Calculate the
- (i) number of mole of nitrogen and hydrogen gases.
- (ii) partial pressure of nitrogen and hydrogen gases.
- (iii) total pressure of gas in the can. (10 marks)

Q6 (a) Given the following set of four quantum numbers (n, l, m_l, m_s).

(i) (3, 3, 2, $\frac{1}{2}$)

(ii) (4, 1, 2, $-\frac{1}{2}$)

In each set, one of the quantum number is not correct. State the incorrect one, and then write the correct set.

(4 marks)

(b) Given a subshell of $4p^4$.

(i) Write the value of n and l .

(ii) Draw the orbital atom diagram of electrons in the subshell.

(4 marks)

(c) Atomic number of atom Sc is 21.

(i) Identify the group and period of Sc in the Periodic Table.

(ii) Which electrons will lose when ion Sc^{3+} is formed.

(4 marks)

(d) Atoms M and X lie in group 2 and 16 respectively. If M is a metal and X is a non-metal atom,

(i) Write the formula of the metal oxide formed.

(ii) State the property of the oxide.

(4 marks)

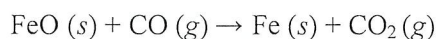
(e) Discuss the following change physical properties of atoms down a group and across a period in the Periodic Table.

(i) Ionic radius

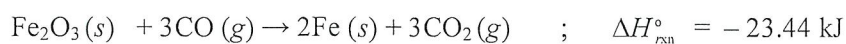
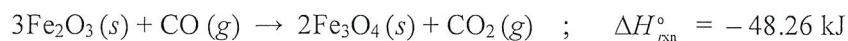
(ii) Ionization energy

(4 marks)

- Q7 (a) (i) State the Hess's Law.
- (ii) Determine the standard enthalpy of reaction ($\Delta H_{\text{rxn}}^{\circ}$) for the reduction of iron (II) oxide by carbon monoxide using Hess's Law.

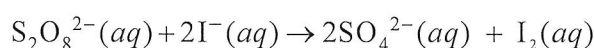


Given,



(9 marks)

- (b) The following data were measured for the reaction of $\text{S}_2\text{O}_8^{2-}$ ion with I^- ion.



Experiment	$[\text{S}_2\text{O}_8^{2-}] / \text{M}$	$[\text{I}^-] / \text{M}$	Initial rate / Ms^{-1}
1	0.080	0.034	2.2×10^{-4}
2	0.080	0.017	1.1×10^{-4}
3	0.160	0.017	2.2×10^{-4}

- (i) If x and y are reaction order of $\text{S}_2\text{O}_8^{2-}$ and I^- respectively, and k the rate constant, write the rate law, r of the reaction.
- (ii) Determine the value of x and y .
- (iii) Find k .
- (7 marks)
- (c) Explain the function of catalyst in a chemical reaction.
- (3 marks)

– END OF QUESTIONS –

FINAL EXAMINATION

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ATOMIC NUMBER OF ELEMENTS

Name of Atom	Atomic Symbol	Atomic Number
Hydrogen	H	1
Oxygen	O	8
Phosporus	P	15
Scandium	Sc	21

ATOMIC MASS OF ELEMENTS

Name of Element	Element Symbol	Atomic Mass /a.m.u
Aluminium	Al	27
Chlorine	Cl	35.5
Hydrogen	H	1
Natrium	Na	23

CHEMICAL CONSTANTS

Name	Symbol	Value
Water dissociation constant	K_w	1.0×10^{-14}
Standard reduction electrode Fe	$E^\circ (\text{Fe}^{2+}/\text{Fe})$	- 0.44 V
Standard reduction electrode Cd	$E^\circ (\text{Cd}^{2+}/\text{Cd})$	- 0.40 V
Gas constant	R	0.0821 L.atm/mol.K

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