

**UNIVERSITY COLLEGE TATI (UCTATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	: FSC 1084
COURSE	: CHEMISTRY II
SEMESTER/SESSION	: 2 - 2024/2025
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 4 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 8 PRINTED PAGES INCLUDING COVER PAGE

CHEMISTRY II (FSC 1084)

QUESTION 1

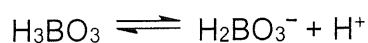
(25 MARKS)

- a) By applying Brønsted-Lowry theory, identify the conjugate acid-base pairs for the following chemical equation:



- b) There are three primary theories of acid and bases; Arrhenius, Brønsted-Lowry and Lewis theory. Interpret these three theories based on their definition. (6 marks)

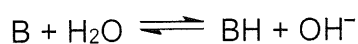
- c) Boric acid, H_3BO_3 is a weak acid. The concentration of solution used for the experiment is 0.2 M and the K_a value is 7.3×10^{-10} M.



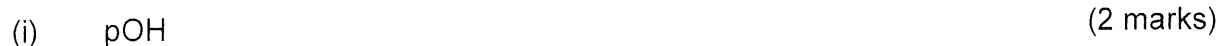
Solve the following:



- d) Solution B is a weak base. The pH of 0.024 M of solution B is 11.06.



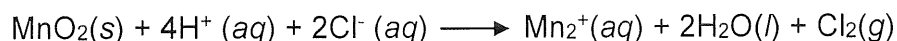
Solve the following:



QUESTION 2

(25 MARKS)

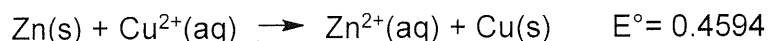
a) Given the redox reaction:



- (i) Predict the oxidation number for Mn in MnO_2 . (4 marks)
- (ii) Choose the oxidizing agent and the reducing agent. (4 marks)

b) For the following voltaic cell reaction (at standard condition), Zn and Cu are used as the electrodes in their respective ionic solution (ZnSO_4 and CuSO_4):

- (i) Construct the schematic diagram for the voltaic cell. (4 marks)
- (ii) Write two half-cell reactions that takes place at anode and cathode. (4 marks)
- (iii) State the total cell reaction. (2 marks)

d) Calculate the cell potential (E_{cell}) of this reaction at 25°C .The concentration are $[\text{Zn}^{2+}] = 0.020 \text{ M}$, $[\text{Cu}^{2+}] = 0.004 \text{ M}$ (5 marks)e) State **two (2)** similarities between galvanic cell and electrolytic cell. (2 marks)

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QUESTION 3

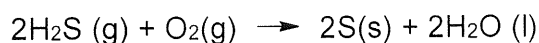
(25 MARKS)

- a) A reaction below has a first order reaction. The rate constant of the reaction is $4.5 \times 10^{-3} \text{ s}^{-1}$.



- (i) Write the rate expression for the reaction. (2 marks)
- (ii) Find the rate of reaction if concentration of N_2O_5 is 2.5M. (3 marks)
- (iii) Calculate the concentration of N_2O_5 remaining after 450s if the initial concentration of N_2O_5 is 2.0 M. (3 marks)
- (iv) Discover the half-life ($t_{1/2}$) of the reaction. (3 marks)

- b) The oxidation of hydrogen sulphide by oxygen is first order with respect to both H_2S and O_2 .



Compute:

- (i) The rate expression for reaction. (2 marks)
- (ii) The reaction rate if the concentration of H_2S and O_2 are $5 \times 10^{-6} \text{ M}$ and $2.0 \times 10^{-4} \text{ M}$, respectively. The rate constant, k is $4.0 \times 10^{-5} \text{ mol}^{-1} \text{ s}^{-1}$. (4 marks)

- c) The following data were obtained for the following reaction.



Experiment	$[\text{CH}_4]$	$[\text{O}_2]$	Rate of reaction ($\text{mol L}^{-1} \text{ s}^{-1}$)
A	0.20	0.30	6.73×10^{-3}
B	0.20	0.40	8.97×10^{-3}
C	0.40	0.30	2.69×10^{-2}

- (i) Identify the order of the reaction with respect to CH_4 , O_2 and overall. (6 marks)
- (ii) Write the rate expression for the reaction. (2 marks)

QUESTION 4

(25 MARKS)

- a) Show **three (3)** steps in free radical polymerization process by using ethylene as monomer. (6 marks)
- b) Differentiate the properties of High-Density Polyethylene (HDPE) and Low-Density Polyethylene (LDPE). (6 marks)
- c) Describe composite material in term of definition and give **two (2)** examples of composite materials. (5 marks)
- d) Water pollution is a serious problem in Malaysia and impacts negatively on the sustainability of water resources. Analyze **four (4)** causes that might contribute to water pollution and justify **four (4)** ways to overcome this issue. (8 marks)

-----End of question-----

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APPENDIX I

THE PERIODIC TABLE

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		SYMBOL											
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APPENDIX II

$$K_a = \frac{[A^-][H^+]}{[HA]}$$

$$E^0_{\text{cell}} = E^0_{\text{red}} - E^0_{\text{oxid}}$$

$$E = E^0 - \frac{0.0592}{n} \log Q_c$$

Common Prefixes For Organic Chemistry Nomenclature	
Prefix	Carbon Atom Number
Meth-	1
Eth-	2
Prop-	3
But-	4
Pent-	5
Hex-	6
Hept-	7
Oct-	8
Non-	9
Dec-	10

Summary of the Kinetics of Zero-Order, First-Order and Second-Order Reactions

Order	Rate Law	Concentration-Time Equation	Half-Life
0	rate = k	$[A] - [A]_0 = -kt$	$t_{1/2} = \frac{[A]_0}{2k}$
1	rate = $k[A]$	$\ln[A] - \ln[A]_0 = -kt$	$t_{1/2} = \frac{\ln 2}{k}$
2	rate = $k[A]^2$	$\frac{1}{[A]} - \frac{1}{[A]_0} = kt$	$t_{1/2} = \frac{1}{k[A]_0}$

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APPENDIX III

13.5 STANDARD CELL emf's AND STANDARD ELECTRODE POTENTIALS 799

Cathode (Reduction) Half-Reaction	Standard Potential, E°, (V)
$\text{Li}^+(aq) + e^- \rightleftharpoons \text{Li}(s)$	-3.04
$\text{Na}^+(aq) + e^- \rightleftharpoons \text{Na}(s)$	-2.71
$\text{Mg}^{2+}(aq) + 2e^- \rightleftharpoons \text{Mg}(s)$	-2.38
$\text{Al}^{3+}(aq) + 3e^- \rightleftharpoons \text{Al}(s)$	-1.66
$2\text{H}_2\text{O}(l) + 2e^- \rightleftharpoons \text{H}_2(g) + 2\text{OH}^-(aq)$	-0.83
$\text{Zn}^{2+}(aq) + 2e^- \rightleftharpoons \text{Zn}(s)$	0.76
$\text{Cr}^{3+}(aq) + 3e^- \rightleftharpoons \text{Cr}(s)$	-0.74
$\text{Fe}^{2+}(aq) + 2e^- \rightleftharpoons \text{Fe}(s)$	-0.41
$\text{Co}^{2+}(aq) + 2e^- \rightleftharpoons \text{Co}(s)$	-0.40
$\text{Ni}^{2+}(aq) + 2e^- \rightleftharpoons \text{Ni}(s)$	0.23
$\text{Sn}^{2+}(aq) + 2e^- \rightleftharpoons \text{Sn}(s)$	-0.14
$\text{Pb}^{2+}(aq) + 2e^- \rightleftharpoons \text{Pb}(s)$	-0.13
$\text{Fe}^{3+}(aq) + 3e^- \rightleftharpoons \text{Fe}(s)$	-0.04
$2\text{H}^+(aq) + 2e^- \rightleftharpoons \text{H}_2(g)$	0.00
$\text{Sn}^{4+}(aq) + 2e^- \rightleftharpoons \text{Sn}^{2+}(aq)$	0.15
$\text{Cu}^+(aq) + e^- \rightleftharpoons \text{Cu}(s)$	0.16
$\text{Cu}^{2+}(aq) + 2e^- \rightleftharpoons \text{Cu}(s)$	0.34
$\text{HO}^-(aq) + \text{H}_2\text{O}(l) + 2e^- \rightleftharpoons \text{H}^-(aq) + 2\text{OH}^-(aq)$	0.49
$\text{Cu}^+(aq) + e^- \rightleftharpoons \text{Cu}(s)$	0.52
$\text{I}_2(s) + 2e^- \rightleftharpoons 2\text{I}^-(aq)$	0.54
$\text{Fe}^{3+}(aq) + e^- \rightleftharpoons \text{Fe}^{2+}(aq)$	0.77
$\text{Hg}_2^{2+}(aq) + 2e^- \rightleftharpoons 2\text{Hg}(l)$	0.80
$\text{Ag}^+(aq) + e^- \rightleftharpoons \text{Ag}(s)$	0.80
$\text{Hg}_2^{2+}(aq) + 2e^- \rightleftharpoons \text{Hg}(l)$	0.85
$\text{ClO}^-(aq) + \text{H}_2\text{O}(l) + 2e^- \rightleftharpoons \text{Cl}^-(aq) + 2\text{OH}^-(aq)$	0.90
$2\text{Hg}^{2+}(aq) + 2e^- \rightleftharpoons \text{Hg}_2^{2+}(aq)$	0.90
$\text{NO}_2^-(aq) + 4\text{H}^+(aq) + 3e^- \rightleftharpoons \text{NO}(g) + 2\text{H}_2\text{O}(l)$	0.96
$\text{Br}_2(l) + 2e^- \rightleftharpoons 2\text{Br}^-(aq)$	1.07
$\text{O}_2(g) + 4\text{H}^+(aq) + 4e^- \rightleftharpoons 2\text{H}_2\text{O}(l)$	1.23
$\text{Cr}_2\text{O}_7^{2-}(aq) + 14\text{H}^+(aq) + 6e^- \rightleftharpoons 2\text{Cr}^{3+}(aq) + 7\text{H}_2\text{O}(l)$	1.33
$\text{Cl}_2(g) + 2e^- \rightleftharpoons 2\text{Cl}^-(aq)$	1.36
$\text{MnO}_4^-(aq) + 8\text{H}^+(aq) + 5e^- \rightleftharpoons \text{Mn}^{2+}(aq) + 4\text{H}_2\text{O}(l)$	1.49
$\text{H}_2\text{C}_2\text{O}_4(aq) + 2\text{H}^+(aq) + 2e^- \rightleftharpoons 2\text{H}_2\text{C}_2\text{O}_4^{2-}(aq)$	1.78
$\text{S}_2\text{O}_8^{2-}(aq) + 2e^- \rightleftharpoons 2\text{SO}_4^{2-}(aq)$	2.01
$\text{F}_2(g) + 2e^- \rightleftharpoons 2\text{F}^-(aq)$	2.87

*See Appendix I for a more extensive table.