



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

- COURSE NAME : PHYSICAL CHEMISTRY
- COURSE CODE : BWD 11203
- PROGRAMME CODE : BWD
- EXAMINATION DATE : JULY/AUGUST 2023
- DURATION : 3 HOURS
- INSTRUCTIONS :
1. ANSWER ALL QUESTIONS
 2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 - Open book
 - Closed book
 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

TERBUKA

CONFIDENTIAL

Q1 A gas (A) in a closed container has a volume of 0.25 L at a temperature of 273 K.

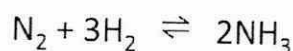
- (a) Write down the relationship between volume and temperature for ideal gas. (4 marks)
- (b) If the temperature of the gas is then increased to 10 °C, what will be the new volume of the balloon. (6 marks)
- (c) Later, another gas component (B) was added into the same container. Calculate the total pressure. Refer **Table Q1(c)**. ($R = 0.08205 \text{ L.atm.mol}^{-1}.\text{K}^{-1}$)

Table Q1(c): Details for gas A and B

Gas sample/ Details	Gas A	Gas B
No. of mole, n	0.15	0.05

(10 marks)

Q2 Consider the following reversible reaction.



- (a) State the equilibrium constant for the reversible reaction. (4 marks)
- (b) In a 3.00 L container, 0.0420 mole N_2 , 0.5160 mole H_2 and 0.0357 mole NH_3 are found in equilibrium at 400 °C. Calculate K_c . (8 marks)
- (c) According to le Chatelier's principle, identify the reaction that occurs when...
- (i) NH_3 is removed. (4 marks)
- (ii) Volume of the container is reduced. (4 marks)

Q3 For a reaction of $\text{H}_2\text{O}_2(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$;

- (a) Write the rate expression in terms of each reactant and product. (6 marks)
- (b) Identify **THREE (3)** potential rate laws for the reaction. For each proposed rate law, determine the overall order. (6 marks)

- (c) At 20 °C, the half-life for a first-order reaction is 3.92×10^4 s. If the initial concentration of hydrogen peroxide is 0.52 M, determine the concentration after 7 days.

(8 marks)

Q4 For the cell notation, $\text{Al(s)} \mid \text{Al}^{3+}(\text{aq}, 1 \text{ M}) \parallel \text{Cu}^{2+}(\text{aq}, 1 \text{ M}) \mid \text{Cu(s)}$,

- (a) Write which is the anode, the cathode and determine the half-reaction at the anode and the cathode. (4 marks)
- (b) By referring to the standard reduction potential, calculate E_{cell}° and determine the spontaneity. (6 marks)
- (c) Calculate the mass of palladium produced by the reduction of palladium (II) ions during the passage of 3.20 amperes of current through a solution of palladium (II) sulfate for 30 minutes. (Relative atomic mass (Pd) = 106.42 u) (10 marks)

- END OF QUESTIONS -

APPENDIX A

Standard reduction potential at 1 atm, 1 M, 298 K

Half Reaction	Potential E°
$\text{Li}^+(\text{aq}) + \text{e}^- \rightarrow \text{Li}(\text{s})$	-3.05
$\text{Mg}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Mg}(\text{s})$	-2.36
$\text{Al}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Al}(\text{s})$	-1.67
$\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g}) + 2\text{OH}^-(\text{aq})$	-0.83
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$	-0.76
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Fe}(\text{s})$	-0.44
$\text{Ni}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Ni}(\text{s})$	-0.23
$\text{Pb}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Pb}(\text{s})$	-0.13
$\text{Fe}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Fe}(\text{s})$	-0.036
$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$	0
$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$	0.34
$\text{Cu}^+(\text{aq}) + \text{e}^- \rightarrow \text{Cu}(\text{s})$	0.52
$\text{Hg}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Hg}(\text{l})$	0.8
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$	0.8
$\text{Pt}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Pt}(\text{s})$	1.2
$\text{O}_2(\text{g}) + 4\text{H}^+(\text{aq}) + 4\text{e}^- \rightarrow 2\text{H}_2\text{O}(\text{l})$	1.23
$\text{Au}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Au}(\text{s})$	1.5
$\text{F}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{F}^-(\text{aq})$	2.87