الجامعة الوطنية
National University
Science & Technology للعلوم والتكنولوجيا
كلية عمان البحرية الدولية
International Maritime College Oman

ACADEMIC YEAR 2023 - 2024

Program	Year	Semester	Paper
DO	1	2	MAIN

MODULE NAME:	**GENERAL CHEMISTRY + FUELS AND LUBRICATION**		
MODULE CODE:	**DCHEM-I**	**EXAM DATE:**	**26 – 5 – 2024**
INSTRUCTOR's NAME:	**Ranjit V**	**DURATION:**	**2 hrs**

Questions to be answered on:	**Allowed tools:**	**Number of pages**
✓ Space provided on the question paper	Pen, Pencil & Calculator	(Incl. cover page): **9**

Points of attention:

- For each question, the maximum earned points are mentioned between brackets at the end of each question.
- Write very clearly! Answers that are not readable are not marked and don't get points!
- Make sure your answers are written to the point.
- All answers should be written **in English.**
- Write all the answers in **blue or black pen only.**
- Use the **pencil** only for **diagrams & graphs.**
- Show all the calculation steps in the given space.
- When finished submit the question paper, the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

		FINAL MARKS
STUDENT NAME:		**40**
STUDENT ID:		**10**

Number of answer scripts:……..…….. **Invigilator:**……..……..…..

Student's signature: …… **Time of receipt:**……..…..

INSTRUCTIONS

- *Express the **CORRECT** SI units for all the dimensional quantities or ½ **MARK** will be **deducted** from each **answer***

ANSWER ALL THE QUESTIONS IN THE SPACE PROVIDED

1. Circle the correct option for the following questions given below: [6 marks]

i) Which is not the weakest base from the options given below

a) LiOH with pH 12 b) $Zn(OH)_2$ with 8.8

c) $Al(OH)_3$ with pH 7.7 d) Aniline with pH 10.72

ii) Identify the Arrhenius base from the choices given below

a) HCl b) H_3PO_4

c) NH_4OH d) H_2SO_4

iii) The pH of **1.88 × 10 $^{-13}$** M of hydroxide ions in KOH is

a) 12.7 b) 7.12

c) - 2.17 d) 1.72

iv) The chemical formulae of Pentene is

a) C_4H_{12} b) C_5H_{10}

c) C_5H_{12} d) C_5H_8

v) Choose the weakest acid from the list

$HI \leftrightarrows H^+ + I^-$ $k_a = 1 \times 10^{-10}$

$HOCH_3 \leftrightarrows H^+ + OCH_3^-$ $k_a = 3.2 \times 10^{-16}$

$HCH_3 \leftrightarrows H^+ + CH_3^-$ $k_a = 1 \times 10^{-50}$

$HSO_4^- + H_2O \leftrightarrows H_3O^+ + SO_4^{2-}$ $k_a = 4.6 \times 10^{-4}$

a) HI b) $HOCH_3$

c) HCH_3 d) HSO_4^-

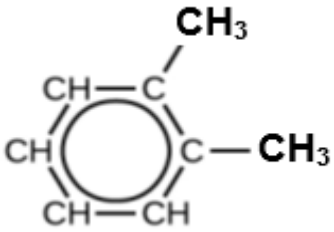
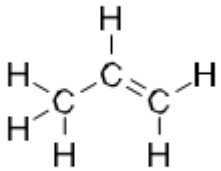
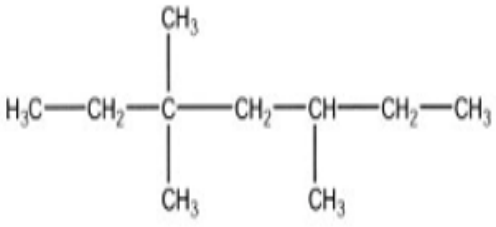
vi) The chemical formulae of rust is

a) $Fe_2O_3.H_2O$ b) Fe_3O_4

c) FeO d) Fe_2O_3

2. The petroleum crude distillation process separates various oils, fuels, and lubricants from the raw oil extracted from wells. [10 marks]

a) Name the following components in the crude oil and classify them as Alkane, Alkene, Alkyne or cyclic hydrocarbon. (6 marks)

Organic Compound	***Name of the component***	***Category***
Example: CH_4	Methane	Alkane
H–C≡C–H		
		
		
		

b) Write the structural formulae for the following organic compound given below. (4 marks)

i) 2,2 – diethyl -3-methyl heptane

ii) 2 – propene

3. Corrosion represents a significant challenge within the marine industry, impacting various structures and equipment used in maritime operations. **[7 marks]**

a) Define the term " Corrosion in marine industry". (1 mark)

b) Write a chemical equation representing the process of corrosion. (2 marks)

c) Write a brief paragraph (not more than 300 words) on the factors that enhance corrosion in maritime operations. (4 marks)

4. Lubricants are crucial in maintaining marine operations' efficiency, reliability, and safety. [7 marks]

a) Define the term “Lubricants”. Give some examples. (2 marks)

b) List any four key characteristics (properties) of the lubricants. (2 marks)

c) Name any three lubricants and their application. (3 marks)

5. Potassium hydroxide, sometimes called caustic potash, is a common ingredient in the Chemical industry. It's white, deliquescent (absorbs moisture from the air and becomes liquid), and odourless flakes, pellets, or a colourless solution. As shown in the equation below, potassium hydroxide undergoes dissociation when dissolved in water. **[10 marks]**

$$KOH\ (s) + H_2O\ (l) \rightarrow K^+ + OH^- + H_2O$$

a) Determine the ionisation constant of KOH (K_b) if the concentrations at equilibrium are $[KOH] = 0.1\ M$, $[K^+] = 1.16 \times 10^{-3}$, and $[OH^-] = 1.9 \times 10^{-2}\ M$ (3 marks)

b) Determine the pH of the solution at equilibrium. (3 marks)

c) Determine the % of ionization of the solution at equilibrium. (2 marks)

d) Decide whether the given solution KOH is a strong or weak base. Justify your answer with a suitable reason. (2 marks)

Bloom Taxonomy

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	**MLO 1** **MLO 2**	MCQ (Application, Analyse and Understanding)	**6**	
2 a) b)	**MLO 3** **MLO 4**	Analyse Evaluate	**6** **4**	
3 a) b) c)	**MLO 1** **MLO 2** **MLO 3**	Understand and knowledge Apply Analyse	**1** **2** **4**	
4 a) b) c)	**MLO 1** **MLO 1** **MLO 3**	Understand and knowledge Understand and knowledge Analyse	**2** **2** **3**	
5 a) b) c) d)	**MLO 1** **MLO 2** **MLO 2** **MLO 3**	Apply Apply Apply Analyse	**3** **3** **2** **2**	