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. Sodium hydroxide, sometimes called caustic soda or lye, is a common ingredient in cleaners and soaps. At room temperature, it is a white, odourless solid. Liquid sodium hydroxide is colourless and has no odour. Socium hydroxide undergoes dissociation when dissolved in water, as shown in the equation below. [10 marks]

$$NaOH\ (s) + H_2O\ (l) \rightarrow Na^+ + OH^- + H_2O$$

a) Determine the ionisation constant of NaOH (K_b) if the concentrations at equilibrium are $[NaOH] = 0.54\ M$, $[Na^+] = 1.56 \times 10^{-3}$, and $[OH^-] = 2.9 \times 10^{-2}\ M$ (3 marks)

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

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

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

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

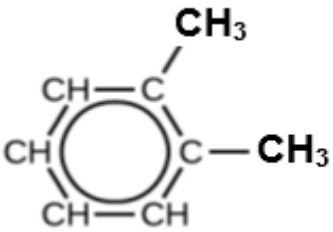
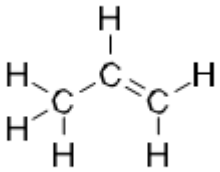
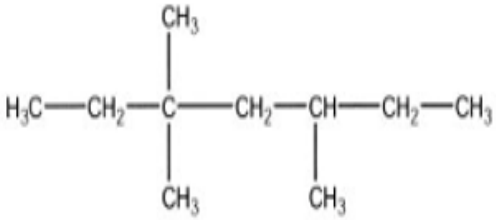
a) Define the term " Corrosion in marine industry". (1 mark)

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

c) Write a brief paragraph (not more than 300 words) on mitigating(overcoming) corrosion challenges in maritime operations. (4 marks)

3. 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) 3,3 – dimethyl -2-ethyl pentane

ii) 3 – pentyne

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 and properties of the marine lubricants. (2 marks)

c) Write any three lubricants' names with their application. (3 marks)

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

i) Choose the best amphiprotic material from the options given below

a) H_2O b) KOH

c) HCl d) CH_3COOH

ii) Identify the Arrhenius acid from the choices given below

a) KOH b) NaOH

c) NH_3 d) HCl

iii) The pH of 0.00035 M of HNO_3 is

a) - 3.46 b) 0.999

c) - 0.999 d) 3.46

iv) The chemical formulae of Butane is

a) CH_4 b) C_2H_6

c) C_4H_{10} d) C_3H_8

v) Which is the stronger 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 b) FeO

c) Fe_3O_4 d) $Fe_2O_3.H_2O$

Q #	MLO Addressed	Complexity Level	Mark	Remark
1 a)	**MLO 3**	Apply	**4**	
b)	**MLO 3**	Apply	**3**	
c)	**MLO 3**	Apply	**2**	
d)	**MLO 4**	Analyse	**1**	
2 a)	**MLO 1**	Knowldege & Understanding	**1**	
b)	**MLO 2**	Apply	**2**	
c)	**MLO 3**	Analyse	**4**	
3 a)	**MLO 3**	Analyse	**6**	
b)	**MLO 4**	Evaluate	**4**	
4 a)	**MLO 1**	Knowldege & Understanding	**2**	
b)	**MLO 1**	Knowldege & Understanding	**2**	
c)	**MLO 2**	Apply	**3**	
5 a)	**MLO 1** **MLO 2** **MLO 3**	MCQs	**6**	