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

Final Exam
DCHEM-1: GENRAL CHEMISTRY+FUELS AND LUBRICATION
Fall 2024

Points of attention:

- For each question, the maximum earned points are specified in the question.
- Write clearly! Answers that are not readable are not marked and don't earn marks!
- All answers should be written in English using **blue or black pens** only.
- Use the pencil only for diagrams and graphs.
- Show all the calculation steps in the given space.
- When finished, submit the question paper, together with the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration:	2 hours
Instructor's Name:	ASIM HAMDAN
Exam Date:	5 JAN 2025
Program:	DO

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Student Information

Name: _____ ID: _____

Signature: _____

Invigilator

Initials: _____ ☐ Student ID checked

Time received: _____

Question 1

Circle the correct option for the following question given below. (6 Marks)

(a) Identify the Arrhenius **BASE** from the choices given below

i) H_2SO_4 iii) HCL

ii) NH_3 iv) KOH

(b) How many moles of caffeine, $\mathbf{C_8H_{10}N_4O_2}$ are there in 150 g?

i) 0.663 mol iii) 1.42×10^{-4} mol

ii) 0.773 mol iv) 1.348 mol

(c) Which is the **weakest** acid from the list.

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

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

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

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

i) HI iii) HSO_4^-

ii) $HOCH_3$ iv) HCH_3

(d) Conjugate acid for base HPO_4^{-2}

i) $H_2PO_4^-$ iii) OH^-

ii) PO_4^{-3} iv) H_3O^+

(e) Which of the following compounds would you expect to be formed **covalent** bond.

i) NaCl iii) NH_3

ii) $MgCl_2$ iv) CaO

(f) The hydroxide ion concentration of NaOH is approximately 0.05M. What are the corresponding values of PH

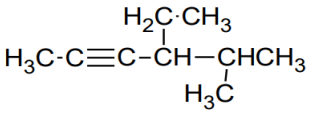
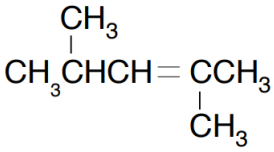
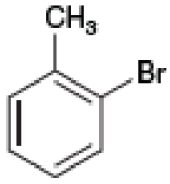
i) 7.9 iii) 12.7

ii) 13.1 iv) 11.6

Question 2

ANSWER ALL THE QUESTIONS IN THE SPACE PROVIDED

1. The petroleum crude distillation process separates various oils, fuels, and lubricants from the raw oil extracted from wells.
   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
		
		
		

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

i) 3-ethyl-2,4-dimethylhexane.

ii) cyclopropene.

2. (a) Formic acid (weak acid), HCO_2H, is one irritant that causes the body's reaction to some ant bites and stings. What is the concentration of hydronium ion and the pH of a 0.450M solution of formic acid? (5 marks)

$$HCO_2H_{(aq)} + H_2O_{(L)} \leftrightarrow H_3O^+_{(aq)} + HCO^-_{2(aq)} \quad K_a = 1.8 \times 10^{-4}$$

(b) calculate the percent of ionization of this formic acid HCO_2H? (3 marks)

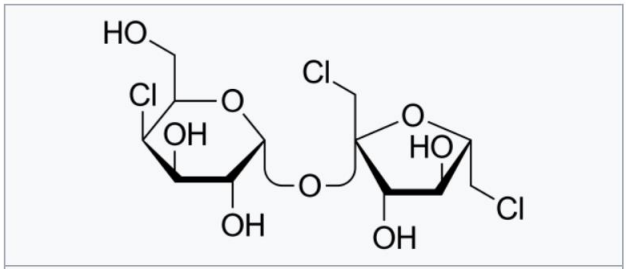
(c) What is the POH of calcium hydroxide, a solution of Ca $(OH)_2$ with a concentration of 0.1 M? (3 marks)

(d) Decide whether the given solution H_2SO_4 is a strong or weak acid. Justify your answer with a suitable reason. (3 marks)

3- (a) A major textile dye manufacturer developed a new yellow dye. The dye has a percent composition of 75.95% C, 17.72% N, and H by mass with a molar mass of about 148g/mol. Determine the molecular formula of the dye. (3marks)

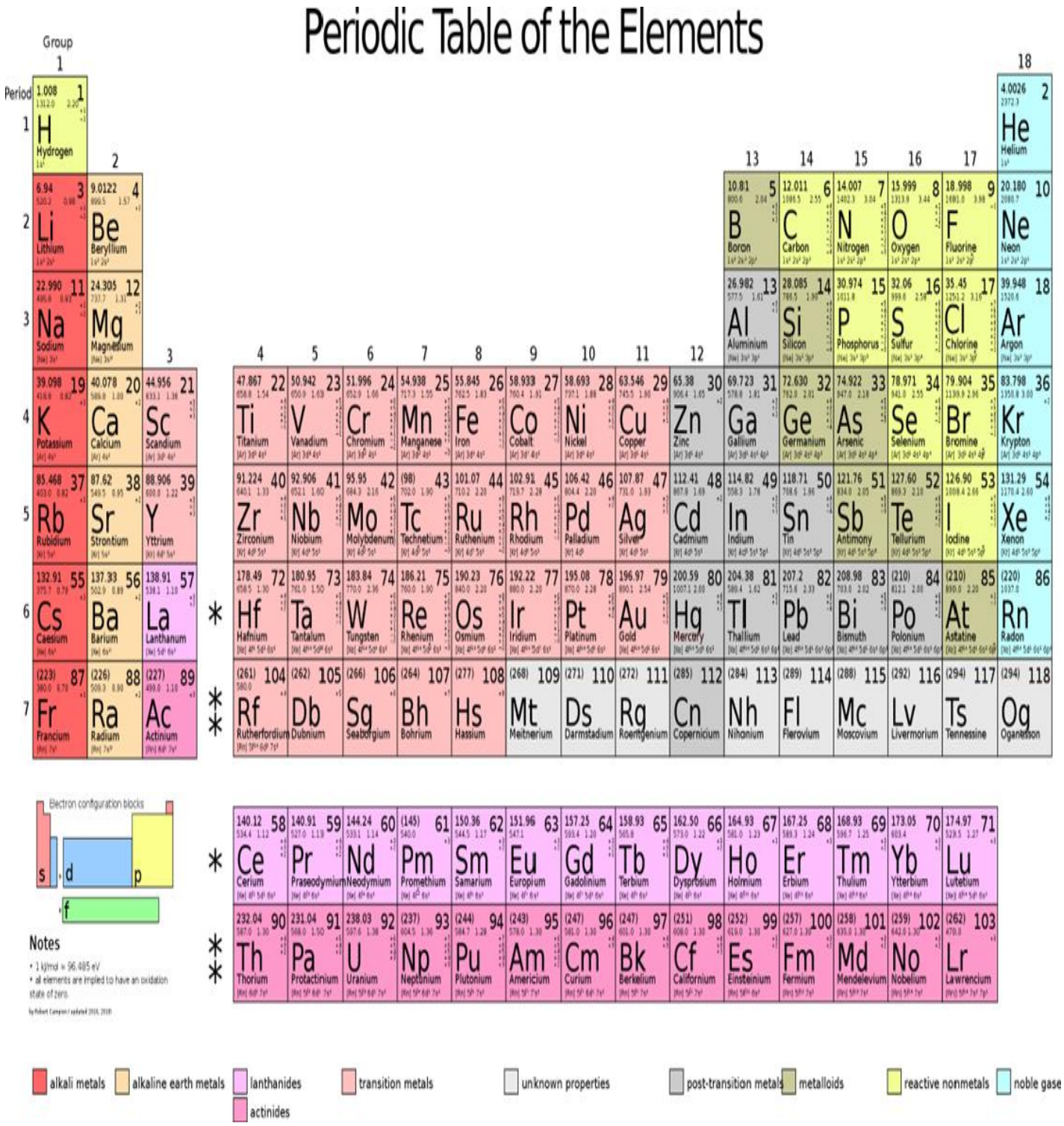
(b) What is the concentration of the solution that results from diluting 25.0 mL of a 2.04M solution of CH_3OH to 500.0 mL? (3 marks)

(c) **Sucralose** is an artificial sweetener contains 50.0 mg of saccharin ($C_{12}H_{19}CL_3O_3$), which has the structural formula



(Tran, N.H., Reinhard, M. and Gin, K.Y.H., 2018)

Given that saccharin has a molar mass of 317.5 g/mol, how many saccharin molecules are in a 50.0 mg (0.0500 g) sample of saccharin? How many carbon atoms are in the same sample? (4 marks)


Periodic Table of the Elements
Group
Period
Electron configuration blocks
s
d
p
f
Notes
• 1 kJ/mol = 96.485 eV
• all elements are implied to have an oxidation state of zero.
alkali metals
alkaline earth metals
lanthanides
actinides
transition metals
unknown properties
post-transition metals
metalloids
reactive nonmetals
noble gase

Q #	MLO Addressed	Complexity Level	Mark	Remark
1-b,c,f	**MLO 2**	Apply	**3**	
1-a,d,e	**MLO 3**	Knowledge	**3**	
2-1-a	**MLO 2**	analyse	**6**	
2-1-bi+ii	**MLO 2**	Apply	**4**	
2-2-a,b,c	**MLO2**	Apply + knowledge	**11**	
2-2-d	**MLO3**	knowledge	**3**	
2-3-a,b	**MLO2**	Apply	**6**	
2-3-c	**MLO 3**	Analyse	**4**	