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

Spring 2024-25

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: 18 Jun 2025
Program: DO

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Student Information

Name: _____ ID: _____

Signature: _____

Invigilator

Initials: _____ ☐ Student ID checked

Time received: _____

Section A **(6 marks)**

Circle the correct option for the following questions given below

(a) Identify the **Arrhenius base** from the choices given below.

i) H_2SO_4 iii) HCL

ii) NH_3 iv) KOH

(b) Element X has 5 protons the correct **electronic configuration** of this element is

i) $1S^2 2S^2 2P^1$ iii) $1S^2 2P^2 2S^1$

ii) $1S^1 2S^2 2P^2$ iv) $1S^2 2S^1 2P^2$

(c) The ion product of water at 100 °C is$7.50x10^{-14}$. What are the concentrations of hydronium ions and hydroxide ions in pure water at 100 °C

i) 7.44 x10^{-7} iii) 7.55 x10^{-7}

ii) 8.33 x10^{-7} iv) 8.66 x10^{-7}

(d) A 60 g sample of industrial wastewater was determined to contain 0.50 mg of mercury. Express the mercury concentration of the wastewater in **ppm units**.

i) 9.3 iii) 8.3

ii) 7.3 iv) 9.5

(e) concentrated sulfuric acid is typically available at 18.0 M. How much of this concentrated acid (in mL) is required to prepare 250.0 mL of a 0.500 M aqueous solution of H_2SO_4?

i) 6.94 ml iii) 7.84 ml

ii) 8.45 ml iv) 9.50 ml

(f) The molecular formula of **alkene** from the following options is.

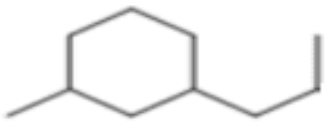
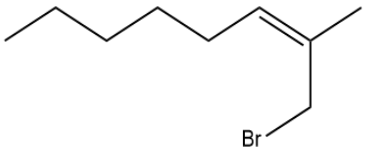
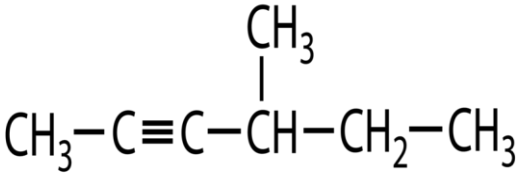
i) C_3H_8 iii) C_3H_4

ii) C_3H_6 iv) C_3H_5

Section B

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 formula for the following organic compound given below.

i) 1,3dichlorocyclohexane. (2 marks)

ii) Trans2,3-dibromo-2-pentene. (2 marks)

2. a) Find the concentration of hydronium ion [H_3O^+], the pH, and the pOH of a 0.5M solution of hydrofluoric acid HF, a **weak ACID.** (5 marks)

$$HF_{aq} + H_2O_{(L)} \leftrightarrow H_3O^+_{(aq)} + F^-_{(aq)} \qquad k_a = 7.1 \times 10^{-4}$$

b) Calculate the percentage ionization of HF and explain why the value of 'x' in the ionization expression is often neglected. (3 marks)

c) What is the pH of calcium hydroxide, $Ca(OH)_2$ solution with a concentration of $2.4x10^{-2}$M? (3 marks)

d) Determine whether hydrochloric acid (HCl) is a strong or weak acid. Provide a suitable justification for your answer. (3 marks)

3. a) Determine the empirical formula and the molecular formula of a compound with a percent composition of 49.47% C, 5.201% H, 28.84% N, and 16.48% O, and a molecular mass of 194.2 g/mol? (3 marks)

b) Name of the compound N_2F_4 and describe the type of bonds present between the atoms in this compound. (2 marks)

1. When aqueous solution of silver nitrate [$AgNO_3(aq)$] and sodium carbonate [$Na_2CO_3(aq)$] are mixed, a precipitation reaction occurs, forming solid silver carbonate (Ag_2CO_3) and an aqueous solution. (4 marks)

   Write the following equations for the reaction:

   i) The balanced molecular equation.

   ii) Full ionic equation.

   iii) The net ionic equation.

   iv) Identify spectator ions in the reaction.

1 H 1.00794																	2 He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.581538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6534	29 Cu 63.545	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.504	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 196.56655	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.94.79	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.56655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.58038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)		114 (289) (287)		116 (289)		118 (293)

58 Ce 140.116	59 Pr 140.50765	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.92534	66 Dy 162.50	67 Ho 164.93032	68 Er 167.26	69 Tm 168.93421	70 Yb 173.04	71 Lu 174.967
90 Th 232.0381	91 Pa 231.035888	92 U 238.0289	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

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-1,2	**MLO2**	Apply	**6**	
2-4-a-1,2,3,4	**MLO 3**	Analyse	**4**	