

Final Exam
DCHEM-I: GENERAL CHEMISTRY + FUELS AND LUBRICATION
Fall 2025

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: 2.5 hours
Instructor's Name: Khadija Al Shibli
Exam Date: 21/12/2025
Program: DO

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	10

Student Information	
Name:	<input type="text"/>
Signature:	<input type="text"/>
ID:	<input type="text"/>

Invigilator	
Initials:	<input type="text"/>
Time received:	<input type="text"/>
<input type="checkbox"/> Student ID checked	

Question 1**[6 marks]****Choose the correct answers from the options given for the following questions.****(a)** The molar mass of ethanol, (C₂H₅OH) is

- | | |
|---------------|----------------|
| i) 34 g/mol. | iii) 60 g/mol. |
| ii) 46 g/mol. | iv) 74 g/mol. |

(b) _____ Occurs in confined spaces where access to oxygen is limited.

- | | |
|------------------------|------------------------|
| i) Uniform Corrosion | iii) Crevice Corrosion |
| ii) Galvanic Corrosion | iv) Corrosion Fatigue |

(c) What is the pH of stomach acid, if its hydronium ion concentration [H₃O⁺] is 1.2 x 10⁻³ M?

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|---------|----------|
| i) 5 | iii) 2.9 |
| ii) 3.5 | iv) 4.5 |

(d) Crude oil is separated in a distillation column based on differences in _____.

- | | |
|-------------------|----------------------------|
| i) Density | iii) Molecular Weight only |
| ii) Boiling Point | iv) Viscosity |

(e) A sample contains 117g of Sodium Chloride (NaCl). How many moles of NaCl are present in the sample?

- | | |
|------------|---------------|
| i) 1 mol. | iii) 0.5 mol. |
| ii) 2 mol. | iv) 3 mol. |

(f) Which is not the weakest base from the options given below:

- | | |
|---------------------------|--------------------------------------|
| i) LiOH with pH 12 | iii) Zn(OH) ₂ with pH 8.8 |
| ii) Aniline with pH 10.72 | iv) Al(OH) ₃ with pH 7.7 |

b) Write the structural formula for the following organic compound given below.

[3 marks]

i) 2-Pentyne

ii) 2,4- diBromohexane

iii) 2-ethylcyclohexane

Question 4**[4 marks]**

A researcher working in an environmental science lab is studying the release of gases from a portable camping stove. During the test, a small leak is detected in the fuel canister. The leaked gas is collected and identified as butane (C_4H_{10}). The total mass of leaked butane is measured to be 9.213 g.

- a) How many molecules of C_4H_{10} are contained in the 9.213 g of leaked butane?
- b) How many hydrogen atoms are present in this quantity of butane?

Question 5**[6 marks]**

Determine 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 amu.

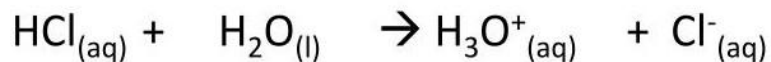
Question 6**[6 marks]**

a) Calculate the molarity of sucrose in a cup of tea if a teaspoon of table sugar containing 0.02 mol of sucrose is dissolved in 250 mL of tea.

b) What volume of 0.5 M H_2SO_4 can be prepared from 0.3L of 1.5 M H_2SO_4 ?

Question 7**[6 marks]**

A chemistry student is analyzing the acidity of a hydrochloric acid (HCl) solution. The hydronium ion concentration measured is $6.3 \times 10^{-3}\text{M}$.



- a) Determine the pH of the hydrochloric acid solution?
- b) Calculate the pOH of the solution using the appropriate relationship between pH and pOH.
- c) Analyze whether hydrochloric acid solution is a strong or weak acid and justify your answer based on its pH value and chemical behavior.

Given: Avogadro's Number (N_A) = 6.022×10^{23} atoms or molecules

Polyatomic Ions Chart

Formula	Name	Formula	Name
NH_4^+	Ammonium	CrO_4^{-2}	Chromate
NH_3	Ammonia	$\text{Cr}_2\text{O}_7^{-2}$	Dichromate
$\text{C}_2\text{H}_3\text{O}_2^-$	Acetate	MnO_4^-	Permanganate
CH_3COO^-	Acetate	MnO_4^{-2}	Manganate
CN^-	Cyanide	NO_2^-	Nitrite
CO_3^{-2}	Carbonate	NO_3^-	Nitrate
HCO_3^-	Bicarbonate	OH^-	Hydroxide
$\text{C}_2\text{O}_4^{-2}$	Oxalate	PO_4^{-3}	Phosphate
ClO^-	Hypochlorite	SCN^-	Thiocyanate
ClO_2^-	Chlorite	$\text{Fe}(\text{CN})_6^{-3}$	Ferricyanide
ClO_3^-	Chlorate	SO_3^{-2}	Sulfite
ClO_4^-	Perchlorate	SO_4^{-2}	Sulfate
$\text{S}_2\text{O}_3^{-2}$	Thiosulfate	HSO_4^-	Hydrogen sulfate
BrO^-	Hypobromite	IO_3^-	Iodate
AsO_2^{-3}	Arsenite	SeO_4^{-2}	Selenate
BrO_3^-	Bromate	HSO_3^-	Hydrogen sulfite

1	H Hydrogen 1.008	2	He Helium 4.003	3	Li Lithium 6.941	4	Be Beryllium 9.012	5	B Boron 10.811	6	C Carbon 12.011	7	N Nitrogen 14.007	8	O Oxygen 15.999	9	F Fluorine 18.998	10	Ne Neon 20.180	11	Na Sodium 22.990	12	Mg Magnesium 24.305	13	Al Aluminum 26.982	14	Si Silicon 28.086	15	P Phosphorus 30.974	16	S Sulfur 32.066	17	Cl Chlorine 35.453	18	Ar Argon 39.948	19	K Potassium 39.098	20	Ca Calcium 40.078	21	Sc Scandium 44.956	22	Ti Titanium 47.867	23	V Vanadium 50.942	24	Cr Chromium 51.996	25	Mn Manganese 54.938	26	Fe Iron 55.845	27	Co Cobalt 58.933	28	Ni Nickel 58.693	29	Cu Copper 63.546	30	Zn Zinc 65.38	31	Ga Gallium 69.723	32	Ge Germanium 72.631	33	As Arsenic 74.922	34	Se Selenium 78.971	35	Br Bromine 79.904	36	Kr Krypton 83.798	37	Rb Rubidium 85.468	38	Sr Strontium 87.62	39	Y Yttrium 88.906	40	Zr Zirconium 91.224	41	Nb Niobium 92.906	42	Mo Molybdenum 95.95	43	Tc Technetium 98.907	44	Ru Ruthenium 101.07	45	Rh Rhodium 102.906	46	Pd Palladium 106.42	47	Ag Silver 107.868	48	Cd Cadmium 112.414	49	In Indium 114.818	50	Sn Tin 118.711	51	Sb Antimony 121.760	52	Te Tellurium 127.6	53	I Iodine 126.904	54	Xe Xenon 131.294	55	Cs Cesium 132.905	56	Ba Barium 137.328	57-71		57	La Lanthanum 138.905	58	Ce Cerium 140.116	59	Pr Praseodymium 140.908	60	Nd Neodymium 144.243	61	Pm Promethium 144.913	62	Sm Samarium 150.36	63	Eu Europium 151.964	64	Gd Gadolinium 157.25	65	Tb Terbium 158.925	66	Dy Dysprosium 162.500	67	Ho Holmium 164.930	68	Er Erbium 167.259	69	Tm Thulium 168.934	70	Yb Ytterbium 173.055	71	Lu Lutetium 174.967	87	Fr Francium 223.020	88	Ra Radium 226.025	89-103		89	Ac Actinium 227.028	90	Th Thorium 232.038	91	Pa Protactinium 231.036	92	U Uranium 238.029	93	Np Neptunium 237.048	94	Pu Plutonium 244.064	95	Am Americium 243.061	96	Cm Curium 247.070	97	Bk Berkelium 247.070	98	Cf Californium 251.080	99	Es Einsteinium [254]	100	Fm Fermium 257.095	101	Md Mendelevium 258.1	102	No Nobelium 259.101	103	Lr Lawrencium [262]	80	Po Polonium [208.982]	81	At Astatine 209.987	82	Pb Lead 207.2	83	Bi Bismuth 208.980	84	Po Polonium [208.982]	85	At Astatine 209.987	86	Rn Radon 222.018	104	Rf Rutherfordium [261]	105	Db Dubnium [262]	106	Sg Seaborgium [266]	107	Bh Bohrium [264]	108	Hs Hassium [269]	109	Mt Meitnerium [278]	110	Ds Darmstadtium [281]	111	Rg Roentgenium [280]	112	Cn Copernicium [285]	113	Nh Nihonium [286]	114	Fl Flerovium [289]	115	Mc Moscovium [289]	116	Lv Livermorium [293]	117	Ts Tennessine [294]	118	Og Oganesson [294]
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MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	1	Knowledge	6	
	2	Apply		
2	3	Analyze	6	
	4	Evaluate		
3	1	Knowledge	6	
	2	Apply		
	1,3	Apply, Analyze		
4	1,3	Apply, Analyze	4	
5	1,3	Apply, Analyze	6	
6	1,3	Apply, Analyze	6	
7	2,4	Apply, Evaluate	6	