

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

	<b>40</b>
	<b>10</b>

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 glucose,  $C_6H_{12}O_6$  is

- i) 90 g/mol.
- ii) 144 g/mol.
- iii) 180 g/mol.
- iv) 156 g/mol.

**(b)** Which type of corrosion occurs when two dissimilar metals are connected in presence of an electrolyte?

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

**(c)** What is the pH of stomach acid, if its hydronium ion concentration  $[H_3O^+]$  is  $1.2 \times 10^{-3}$  M?

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

**(d)** Which fraction is collected at the top of a distillation column?

- i) Gasoline
- ii) Bitumen
- iii) Diesel
- iv) Fuel Oil

**(e)** A non-spontaneous redox reaction occurs in\_\_\_\_\_.

- i) Galvanic Cell
- ii) Electrolytic Cell
- iii) Salt Bridge
- iv) Fuel Cell

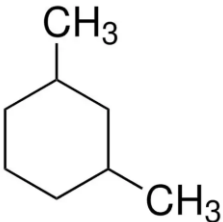
**(f)** The chemical formula of rust is

- i)  $Fe_3O_4$
- ii) FeO
- iii)  $Fe_2O_3$
- iv)  $Fe_2O_3 \cdot H_2O$

**Question 2****[6 marks]**

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

- a) Write the **IUPAC** name the following components in the crude oil and classify them as Alkane, Alkene, Alkyne or cyclic hydrocarbon. **[3 marks]**

Organic Compound	Name of the component	Category
Example: CH <sub>4</sub>	Methane	Alkane
H-C≡C-H		
$  \begin{array}{ccccccc}  \text{CH}_3 & \text{CH} & \text{CH}_2 & \text{CH} & \text{CH}_2 & \text{CH}_2 & \text{CH}_3 \\    & & &   & & & \\  \text{CH}_3 & & & \text{CH}_2\text{CH}_3 & & &   \end{array}  $		
		

**b)** Draw the structure of each of the following organic compound given below.

**[3 marks]**

**i)** 1,3,5- trimethyl benzene

**ii)** 2,4- difluorohexane

**iii)** Propane



**Question 4****[4 marks]**

A packet of an artificial sweetener contains 40.0 mg of saccharin ( $C_7H_5NO_3S$ ). Given that saccharin has a molar mass of 183.18 g/mol.

- a) How many saccharin molecules are in a 40.0 mg sample of saccharin?
- b) How many carbon atoms are in the same sample?

**Question 5****[6 marks]**

Nicotine contains 74.02% C, 8.710% H, and 17.27% N by mass. Given that 40.57 g of nicotine contains 0.25 mol nicotine, calculate its molar mass and determine its molecular formula.

**Question 6****[6 marks]**

a) A teaspoon of table sugar contains about 0.133 mol sucrose. What is the molarity of sucrose if a teaspoon of sugar has been dissolved in a cup of tea with a volume of 355 ml.

b) A lab experiment requires a 0.125 M solution of  $\text{HNO}_3$ . If you have 0.25 L of 1.88 M  $\text{HNO}_3$ , what volume of 0.125 M  $\text{HNO}_3$  can you prepare?

**Question 7****[6 marks]**

A food science student is analyzing the acidity of commercial vinegar. The hydronium ion concentration measured is  $3.7 \times 10^{-3}$  M.



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

**Given: Avogadro's Number ( $N_A$ ) =  $6.022 \times 10^{23}$  atoms or molecules**

Polyatomic Ions Chart

Formula	Name	Formula	Name
$\text{NH}_4^+$	Ammonium	$\text{CrO}_4^{-2}$	Chromate
$\text{NH}_3$	Ammonia	$\text{Cr}_2\text{O}_7^{-2}$	Dichromate
$\text{C}_2\text{H}_3\text{O}_2^-$	Acetate	$\text{MnO}_4^-$	Permanganate
$\text{CH}_3\text{COO}^-$	Acetate	$\text{MnO}_4^{-2}$	Manganate
$\text{CN}^-$	Cyanide	$\text{NO}_2^-$	Nitrite
$\text{CO}_3^{-2}$	Carbonate	$\text{NO}_3^-$	Nitrate
$\text{HCO}_3^-$	Bicarbonate	$\text{OH}^-$	Hydroxide
$\text{C}_2\text{O}_4^{-2}$	Oxalate	$\text{PO}_4^{-3}$	Phosphate
$\text{ClO}^-$	Hypochlorite	$\text{SCN}^-$	Thiocyanate
$\text{ClO}_2^-$	Chlorite	$\text{Fe}(\text{CN})_6^{-3}$	Ferricyanide
$\text{ClO}_3^-$	Chlorate	$\text{SO}_3^{-2}$	Sulfite
$\text{ClO}_4^-$	Perchlorate	$\text{SO}_4^{-2}$	Sulfate
$\text{S}_2\text{O}_3^{-2}$	Thiosulfate	$\text{HSO}_4^-$	Hydrogen sulfate
$\text{BrO}^-$	Hypobromite	$\text{IO}_3^-$	Iodate
$\text{AsO}_2^{-3}$	Arsenite	$\text{SeO}_4^{-2}$	Selenate
$\text{BrO}_3^-$	Bromate	$\text{HSO}_3^-$	Hydrogen sulfite

1 <b>H</b> Hydrogen 1.008	2 <b>He</b> Helium 4.003																																
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012	5 <b>B</b> Boron 10.811	6 <b>C</b> Carbon 12.011	7 <b>N</b> Nitrogen 14.007	8 <b>O</b> Oxygen 15.999	9 <b>F</b> Fluorine 18.998	10 <b>Ne</b> Neon 20.180																										
11 <b>Na</b> Sodium 22.990	12 <b>Mg</b> Magnesium 24.305	13 <b>Al</b> Aluminum 26.982	14 <b>Si</b> Silicon 28.086	15 <b>P</b> Phosphorus 30.974	16 <b>S</b> Sulfur 32.066	17 <b>Cl</b> Chlorine 35.453	18 <b>Ar</b> Argon 39.948																										
19 <b>K</b> Potassium 39.098	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.956	22 <b>Ti</b> Titanium 47.867	23 <b>V</b> Vanadium 50.942	24 <b>Cr</b> Chromium 51.996	25 <b>Mn</b> Manganese 54.938	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933	28 <b>Ni</b> Nickel 58.693	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.38	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.631	33 <b>As</b> Arsenic 74.922	34 <b>Se</b> Selenium 78.971	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.798																
37 <b>Rb</b> Rubidium 85.468	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.906	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.906	42 <b>Mo</b> Molybdenum 95.95	43 <b>Tc</b> Technetium 98.907	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.906	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.868	48 <b>Cd</b> Cadmium 112.414	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.711	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.6	53 <b>I</b> Iodine 126.904	54 <b>Xe</b> Xenon 131.294																
55 <b>Cs</b> Cesium 132.905	56 <b>Ba</b> Barium 137.328	57-71	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.948	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.217	78 <b>Pt</b> Platinum 195.085	79 <b>Au</b> Gold 196.967	80 <b>Hg</b> Mercury 200.592	81 <b>Tl</b> Thallium 204.383	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.980	84 <b>Po</b> Polonium [208.982]	85 <b>At</b> Astatine 209.987	86 <b>Rn</b> Radon 222.018																
87 <b>Fr</b> Francium 223.020	88 <b>Ra</b> Radium 226.025	89-103	104 <b>Rf</b> Rutherfordium [261]	105 <b>Db</b> Dubnium [262]	106 <b>Sg</b> Seaborgium [266]	107 <b>Bh</b> Bohrium [264]	108 <b>Hs</b> Hassium [269]	109 <b>Mt</b> Meitnerium [278]	110 <b>Ds</b> Darmstadtium [281]	111 <b>Rg</b> Roentgenium [280]	112 <b>Cn</b> Copernicium [285]	113 <b>Nh</b> Nihonium [286]	114 <b>Fl</b> Flerovium [289]	115 <b>Mc</b> Moscovium [289]	116 <b>Lv</b> Livermorium [293]	117 <b>Ts</b> Tennessine [294]	118 <b>Og</b> Oganesson [294]																
57 <b>La</b> Lanthanum 138.905	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.908	60 <b>Nd</b> Neodymium 144.243	61 <b>Pm</b> Promethium 144.913	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.925	66 <b>Dy</b> Dysprosium 162.500	67 <b>Ho</b> Holmium 164.930	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.934	70 <b>Yb</b> Ytterbium 173.055	71 <b>Lu</b> Lutetium 174.967																			
89 <b>Ac</b> Actinium 227.028	90 <b>Th</b> Thorium 232.038	91 <b>Pa</b> Protactinium 231.036	92 <b>U</b> Uranium 238.029	93 <b>Np</b> Neptunium 237.048	94 <b>Pu</b> Plutonium 244.064	95 <b>Am</b> Americium 243.061	96 <b>Cm</b> Curium 247.070	97 <b>Bk</b> Berkelium 247.070	98 <b>Cf</b> Californium 251.080	99 <b>Es</b> Einsteinium [254]	100 <b>Fm</b> Fermium 257.095	101 <b>Md</b> Mendelevium 258.1	102 <b>No</b> Nobelium 259.101	103 <b>Lr</b> Lawrencium [262]																			

**MLO and Bloom's Level of Complexity**

<b>Q #</b>	<b>MLO Addressed</b>	<b>Complexity Level</b>	<b>Mark</b>	<b>Remark</b>
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	