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

Final Exam
TCHEM: GENERAL CHEMISTRY
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: Dr. G. CHANDRASEKAR
Exam Date: 25/12/2025
Program: PE

	40
	10

Student Information			
Name:		ID:	
Signature:			

Invigilator			
Initials:		☐ Student ID checked	
Time received:			

Instructions:

Periodic Table enclosed at the end of the question paper

SI units should be followed.

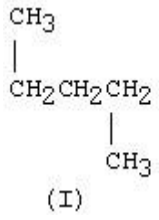
Choosing more than one answer for one question in MCQ section will not carry any marks

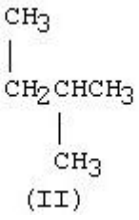
PART -A

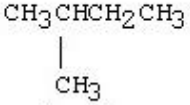
Answer <u>All</u> Questions

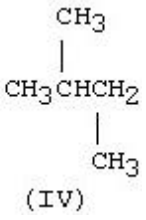
Multiple Choice Questions (MCQ) [10 x 1 = 10] Marks

1.From the structure given below, choose the one that is *not similar* to the remaining three.


(I)

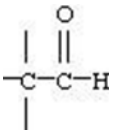

(II)


(III)


(IV)

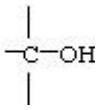
(a) I (b) II (c) III (d) IV

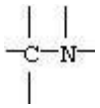
2. Identify the functional group:

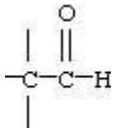


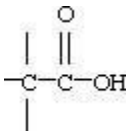
(a) Ketone (b) ether (c) amide (d) aldehyde

3. Select the functional group below representing the amine.

(a) 

(b) 

(c) 

(d) 

4. How many H^+ ions can the acid H_2SO_4 donate per molecule?

(a) 0, (b) 1, (c) 2, (d) 3

5. Which of the following compounds is an Arrhenius base in water?

(a) CH_3CH_3, (b) CH_3SH, (c) HOCl, (d) KOH

6. What is the concentration of $FeBr_3$ in a solution prepared by dissolving 10.0 g of $FeBr_3$ in enough water to make a final volume of 275 mL of solution?

(a) 1.23 × 10-4 M, (b) 0.123 M, (c) 1.23 M, (d) 1.23 × 103 M

7. How many milliliters of a 6.0 M HNO_3 solution are needed to make 0.25 L of a 3.5 M HNO_3 solution?

(a) 686 mL (b) 428 mL (c) 146 mL (d) 119 mL

8. Identify the alcohol from the given below.

(a) $CH_3CH_2OCH_3$, (b) $CH_3CH_2CH{=}CH_2$

(c) CH_3CH_2OH (d) $CH_3CH_2NHCH_3$

9. Choose the correct balanced net ionic equation for the reaction of $AgNO_3(aq)$ with Cu(s).

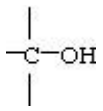
(a) $AgNO_{3(aq)} + Cu_{(s)} \rightarrow Ag_{(s)} + CuNO_{3(aq)}$

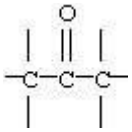
(b) $Ag^{+}_{(aq)} + Cu_{(s)} \rightarrow Ag_{(s)} + Cu^{+}(aq)$

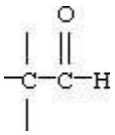
(c) $2\ AgNO_{3(aq)} + Cu_{(s)} \rightarrow 2\ Ag_{(s)} + CuNO_{3(aq)}$

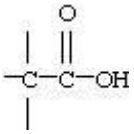
(d) $2Ag^{+}_{(aq)} + Cu_{(s)} \rightarrow 2\ Ag_{(s)} + Cu^{2+}_{(aq)}$

10. Which functional group below represents a Ketone?

(a) 

(b) 

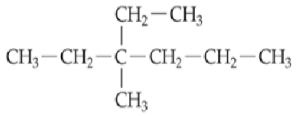
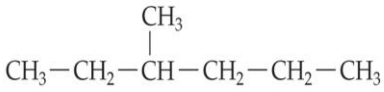
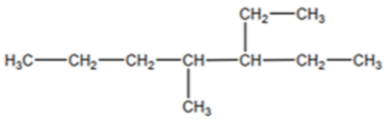
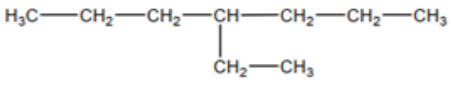
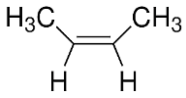
(c) 

(d) 

PART -B **[6 x 5 = 30] Marks**

Answer <u>Any Six</u> Questions

11. Name the following compounds according to IUPAC nomenclature. (5 Marks)

(a)		
(b)		
(c)		
(d)		
(e)		

12. In an acid-base titration, 22.6 mL of a 0.100 M NaOH solution is needed to react with 20.0 mL of an unknown HCl concentration.

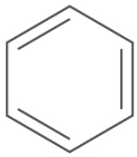
$$HCl + NaOH \rightarrow NaCl + H_2O$$

Using this information,

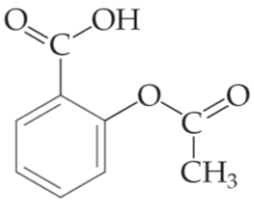
(i) Determine the concentration of HCl present in 250 ml (3 Marks)

(ii) Calculate the amount of HCl in the same solution. (2 Marks)

13. Classify the compounds shown below based on Huckles rule as aromatic, non-aromatic and anti-aromatic with detailed explanations. (1.25 x 4 = 5 Marks)

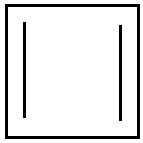


Benzene



Aspirin

Cyclohexene



Cyclobutadiene

14. Using any five criteria differentiate between aromatic and aliphatic compounds. (5 Marks)

15. A sample of 20.4 g of $MgCl_2$ is dissolved in water and diluted to three different volumetric flasks: 250 mL, 500 mL, and 1.0 L. Calculate the molarity of chloride ions in each solution. (5 Marks)

16. A titration is performed using a solution containing 0.150 g of oxalic acid ($H_2C_2O_4$). The titration requires 20.5 mL of a potassium permanganate ($KMnO_4$) solution of unknown concentration to reach the endpoint.

    $5H_2C_2O_{4(aq)} + 2MnO^{4-}_{(aq)} + 6H^+_{(aq)} \rightarrow 10CO_{2(g)} + 2Mn^{2+}_{(aq)} + 8H_2O_{(l)}$

    (a) Calculate the concentration of the $KMnO_4$ solution. (3 Marks)

    (b) Using the calculated concentration, determine the amount of $KMnO_4$ present in 500 mL of the same solution. (2 Marks)

17. Draw the structures of the following organic compounds:

(a) n-hexylchloride (2 Marks)

(b) n-butylamine (2 Marks)

(c) di-n-pentyl ether (1 Mark)

IUPAC Periodic Table of the Elements
Key:
atomic number
Symbol
name
abridged standard atomic weight
1 H hydrogen 1.0080 ±0.0002
2 He helium 4.0026 ±0.0001
3 Li lithium 6.94 ±0.06
4 Be beryllium 9.0122 ±0.0001
5 B boron 10.81 ±0.02
6 C carbon 12.011 ±0.002
7 N nitrogen 14.007 ±0.001
8 O oxygen 15.999 ±0.001
9 F fluorine 18.998 ±0.001
10 Ne neon 20.180 ±0.001
11 Na sodium 22.990 ±0.001
12 Mg magnesium 24.305 ±0.002
13 Al aluminium 26.982 ±0.001
14 Si silicon 28.085 ±0.001
15 P phosphorus 30.974 ±0.001
16 S sulfur 32.06 ±0.02
17 Cl chlorine 35.45 ±0.01
18 Ar argon 39.95 ±0.16
19 K potassium 39.098 ±0.001
20 Ca calcium 40.078 ±0.004
21 Sc scandium 44.956 ±0.001
22 Ti titanium 47.867 ±0.001
23 V vanadium 50.942 ±0.001
24 Cr chromium 51.996 ±0.001
25 Mn manganese 54.938 ±0.001
26 Fe iron 55.845 ±0.002
27 Co cobalt 58.933 ±0.001
28 Ni nickel 58.693 ±0.001
29 Cu copper 63.546 ±0.003
30 Zn zinc 65.38 ±0.02
31 Ga gallium 69.723 ±0.001
32 Ge germanium 72.630 ±0.008
33 As arsenic 74.922 ±0.001
34 Se selenium 78.971 ±0.008
35 Br bromine 79.904 ±0.003
36 Kr krypton 83.798 ±0.002
37 Rb rubidium 85.468 ±0.001
38 Sr strontium 87.62 ±0.01
39 Y yttrium 88.906 ±0.001
40 Zr zirconium 91.224 ±0.002
41 Nb niobium 92.906 ±0.001
42 Mo molybdenum 95.95 ±0.01
43 Tc technetium [97]
44 Ru ruthenium 101.07 ±0.02
45 Rh rhodium 102.91 ±0.01
46 Pd palladium 106.42 ±0.01
47 Ag silver 107.87 ±0.01
48 Cd cadmium 112.41 ±0.01
49 In indium 114.82 ±0.01
50 Sn tin 118.71 ±0.01
51 Sb antimony 121.76 ±0.01
52 Te tellurium 127.60 ±0.03
53 I iodine 126.90 ±0.01
54 Xe xenon 131.29 ±0.01
55 Cs caesium 132.91 ±0.01
56 Ba barium 137.33 ±0.01
57-71 lanthanoids
72 Hf hafnium 178.49 ±0.01
73 Ta tantalum 180.95 ±0.01
74 W tungsten 183.84 ±0.01
75 Re rhenium 186.21 ±0.01
76 Os osmium 190.23 ±0.03
77 Ir iridium 192.22 ±0.01
78 Pt platinum 195.08 ±0.02
79 Au gold 196.97 ±0.01
80 Hg mercury 200.59 ±0.01
81 Tl thallium 204.38 ±0.01
82 Pb lead 207.2 ±1.1
83 Bi bismuth 208.98 ±0.01
84 Po polonium [209]
85 At astatine [210]
86 Rn radon [222]
87 Fr francium [223]
88 Ra radium [226]
89-103 actinoids
104 Rf rutherfordium [287]
105 Db dubnium [288]
106 Sg seaborgium [269]
107 Bh bohrium [270]
108 Hs hassium [269]
109 Mt meitnerium [277]
110 Ds darmstadtium [281]
111 Rg roentgenium [282]
112 Cn copernicium [285]
113 Nh nihonium [286]
114 Fl flerovium [290]
115 Mc moscovium [290]
116 Lv livermorium [293]
117 Ts tennessine [294]
118 Og oganesson [294]
57 La lanthanum 138.91 ±0.01
58 Ce cerium 140.12 ±0.01
59 Pr praseodymium 140.91 ±0.01
60 Nd neodymium 144.24 ±0.01
61 Pm promethium [145]
62 Sm samarium 150.36 ±0.02
63 Eu europium 151.96 ±0.01
64 Gd gadolinium 157.25 ±0.03
65 Tb terbium 158.93 ±0.01
66 Dy dysprosium 162.50 ±0.01
67 Ho holmium 164.93 ±0.01
68 Er erbium 167.26 ±0.01
69 Tm thulium 168.93 ±0.01
70 Yb ytterbium 173.05 ±0.02
71 Lu lutetium 174.97 ±0.01
89 Ac actinium [227]
90 Th thorium 232.04 ±0.01
91 Pa protactinium 231.04 ±0.01
92 U uranium 238.03 ±0.01
93 Np neptunium [237]
94 Pu plutonium [244]
95 Am americium [243]
96 Cm curium [247]
97 Bk berkelium [247]
98 Cf californium [251]
99 Es einsteinium [252]
100 Fm fermium [257]
101 Md mendelevium [258]
102 No nobelium [259]
103 Lr lawrencium [262]

MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark
1	**4**	Understand	**1**
2	**1**	Apply	**1**
3	**5**	Understand	**1**
4	**2**	Knowledge	**1**
5	**1**	Understand	**1**
6	**1**	Knowledge	**1**
7	**2**	Apply	**1**
8	**1**	Apply	**1**
9	**5**	Knowledge	**1**
10	**1**	Understand	**1**
11	**2**	Apply	**5**
12	**1**	Analyze and Creative	**5**
13	**1**	Apply	**5**
14	**1**	Analyze	**5**
15	**2**	Apply	**5**
16	**4**	Analyze and Creative	**5**
17	**1**	Apply Creative	**5**