



EXAMINATION SESSION : **End of Semester Final Examination**
Alternate Paper

DATE :

SEMESTER : **Two (2025)**

PROGRAMME TITLE : **Kickstart**

COURSE TITLE : **Fundamentals of Chemistry II**

COURSE CODE : **CHM003**

LEVEL : **Access**

PAPER : **Two**

DURATION : **2 Hours**

STUDENT ID NO: _____

INSTRUCTIONS

1. This is a TWO hour examination consisting of TWO Sections and a Periodic Table.
Section A – 25 Multiple Choice Questions
Section B – 3 Structured Questions
2. Answer ALL questions for each section in the SPACES provided.
3. For numerical problems, ALL working must be shown for full marks.
4. Use of pocket electronic calculators is permitted.

Section	Number	Marks Earned	Maximum Marks
Section A Multiple choice	1 – 25		25 marks
Section B Structured Questions	1		25 marks
	2		25 marks
	3		15 marks
	TOTAL		90 marks

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A – MULTIPLE CHOICE

Shade the letter that corresponds to the correct answer for each question. All working should be done on the examination paper!

1. Which of the following chemical equations are balanced?

- (A) $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{C}(\text{s}) \longrightarrow 2\text{Fe}(\text{s}) + \text{CO}(\text{g})$
(B) $\text{NH}_3(\text{g}) + \text{O}_2(\text{g}) \longrightarrow \text{NO}(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
(C) $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \longrightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})$
(D) $\text{Cr}(\text{s}) + 4\text{HCl}(\text{aq}) \longrightarrow \text{CrCl}_3(\text{aq}) + 3\text{H}_2(\text{g})$

2. The products of a combustion reaction do NOT include _____.

- (A) water
(B) carbon dioxide
(C) heat
(D) hydrogen

3. The reaction, $2\text{Mg} + \text{FeCl}_2 \rightarrow \text{MgCl}_2 + \text{Fe}$ is an example of which type of reaction?

- (A) Synthesis
(B) Precipitation
(C) Double displacement
(D) Single replacement

4. In the following reaction: $2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$, what is the ratio of ethane to oxygen?

- (A) 2:7 (B) 4:7 (C) 7:4 (D) 7:6

5. Which formula is the correct one for finding the number of moles of a substance?

- (a) Moles = $\frac{\text{molar mass}}{\text{volume}}$ (C) Moles = $\frac{\text{molar mass}}{\text{mass}}$
(b) Moles = $\frac{\text{volume}}{\text{molar mass}}$ (D) Moles = $\frac{\text{mass}}{\text{molar mass}}$

6. What is the number of moles found in a 125 cm^3 sample of 0.25M nitric acid (HNO_3)?

- (A) 0.00200 mols
(B) 0.0313 mols
(C) 1.98 mols
(D) 15.8 mols

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7. Which of the following is a neutralization reaction?
- (A) Magnesium oxide + hydrochloric acid $\rightarrow$ magnesium chloride + water
 - (B) Magnesium + hydrochloric acid $\rightarrow$ magnesium chloride + hydrogen gas
 - (C) Magnesium + nitrogen $\rightarrow$ magnesium nitride
 - (D) Magnesium + copper (II) sulfate $\rightarrow$ magnesium sulfate + copper
8. What is the number of moles found in 18 g of glucose, $C_6H_{12}O_6$?
- (A) 0.100
 - (B) 0.190
 - (C) 10.0
 - (D) 180
9. The mass of 1 mole of the compound $Al_2(SO_4)_3$ is:
- (A) 198.1 g
 - (B) 315.3 g
 - (C) 278.1 g
 - (D) 342.3 g
10. What is the percentage composition of oxygen in magnesium nitrate?
- (A) 31%
 - (B) 48%
 - (C) 57%
 - (D) 66%
11. Which of the following statements BEST describes Avogadro's law?
- (A) Equal masses of gases and the same temperature and pressure contain the same number of molecules
 - (B) Equal volumes of gases at the same temperature and pressure contain the same number of molecules
 - (C) Equal volumes of gas with the same mass at the same temperature contain the same number of moles
 - (D) Equal moles of gases at the same temperature and pressure have the same mass
12. Determine the mass concentration in $g\,dm^{-3}$ when 45g of sodium hydroxide was dissolved in 250 cm^3 of solution.
- (A) 3.37 $g\,dm^3$
 - (B) 5.56 $g\,dm^3$
 - (C) 74.1 $g\,dm^3$
 - (D) 180 $g\,dm^3$

13. Which of the following represents the CORRECT reduction half of a redox reaction?

- (A) $\text{Na (s)} \rightarrow \text{Na}^+ + 2\text{e}^- \text{ (aq)}$
- (B) $\text{Fe}^{3+} + 2\text{e}^- \text{ (aq)} \rightarrow \text{Fe}^{2+} \text{ (aq)}$
- (C) $2\text{Cl}^{1-} \text{ (aq)} + 2\text{e}^- \rightarrow \text{Cl}_2 \text{ (g)}$
- (D) $\text{Sn}^{2+} \text{ (aq)} \rightarrow \text{Sn}^{4+} + 2\text{e}^- \text{ (aq)}$

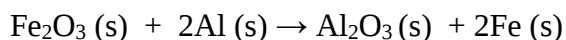
14. In $\text{K}_2\text{Cr}_2\text{O}_7$, the oxidation number of Oxygen is:

- (A) +2
- (B) +4
- (C) +6
- (D) - 2

15. In a reaction between $\text{CuSO}_4\text{(aq)}$ and Zn(s) , what happens to zinc?

- (A) Zinc experiences an increase in the oxidation state.
- (B) Zinc experiences a decrease in oxidation number.
- (C) Zinc undergoes reduction.
- (D) Zinc is a spectator ion.

16. Which of the following ions is the spectator ion in the following redox reaction?



- (A) Fe^{3+}
- (B) O^{2-}
- (C) Al^{3+}
- (D) Cl^{1-}

17. Which statement is TRUE of BOTH electrolytes and metals?

- (A) They do not conduct electricity.
- (B) They contain free moving charged particles.
- (C) They conduct electricity only in the solid state.
- (D) They are the only substances that conduct electricity.

18. Which of the following substances would serve as an active electrode in electrolysis?

- (A) Copper
- (B) Carbon
- (C) Platinum
- (D) Graphite

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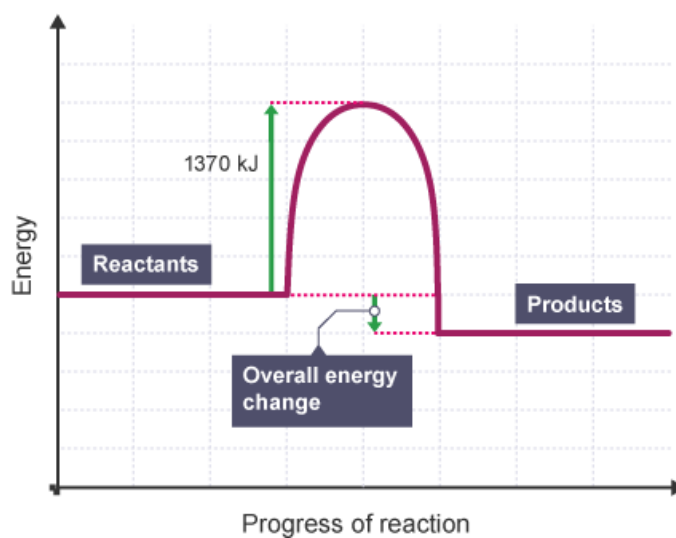
19. Which of the following factors will increase the rate of a chemical reaction involving gases?
- (A) Decreasing the temperature
 - (B) Adding less reactants to the mixture
 - (C) Adding a catalyst
 - (D) Increasing the volume of the container
20. Which of the following statements BEST describes how a catalyst works?
- (A) Catalysts increase the rate of a chemical reaction by increasing the activation energy.
 - (B) Catalysts increase the rate of a chemical reaction by providing a different low energy mechanism for the reaction.
 - (C) Catalysts increase the rate of a chemical reaction by increasing the concentrations of the reactants.
 - (D) Catalysts increase the rate of a chemical reaction by increasing the temperature of the reaction mixture.
21. As the temperature of a reaction is increased, the rate of the reaction increases because the_____
- (A) number of effective collisions are reduced.
 - (B) reactant molecules collide more frequently and with greater energy per collision.
 - (C) reactant molecules collide less frequently and with greater energy per collision.
 - (D) activation energy is lowered.
22. A chemical reaction that releases energy to the surroundings is called a/ an _____.
- (A) Endothermic Reaction
 - (B) Exothermic Reaction
 - (C) Redox Reaction
 - (D) Reversible Reaction
23. Which of the following reactions are endothermic?
- (A) The test tube feels cooler when ammonium nitrate dissolves in water.
 - (B) The temperature changes from -10°C to 0°C when a salt was added to the water.
 - (C) Magnesium ribbon when burnt in oxygen releases light energy.
 - (D) The test tube feels warmer when sodium chloride dissolves in water.

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24. When solutions of HCl and NaOH are mixed, the temperature increases. The reaction is:

- (A) Endothermic with a positive enthalpy energy
- (B) Endothermic with a negative enthalpy of energy
- (C) Exothermic with a positive enthalpy energy
- (D) Exothermic with a negative enthalpy energy

25. The diagram shows the Energy profile diagram of an exothermic reaction.



What does the energy value of 1370 kJ represent?

- (A) Released energy
- (B) Products energy
- (C) Activation energy
- (D) Reactants energy

TOTAL 25 MARKS

END OF MULTIPLE-CHOICE QUESTIONS

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SECTION B

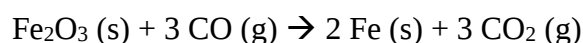
Answer ALL questions in the spaces provided. Show ALL working to be awarded full marks.

1. (a) Write chemical equations to represent the following chemical reactions. (4 marks)

(i) Potassium reacts with water to form potassium hydroxide solution and hydrogen gas.

(ii) Sodium metal explodes in air, reacting with oxygen to produce solid sodium oxide.

(b) A chemistry student reacted **0.560 g of carbon monoxide gas** with iron (III) oxide at room temperature and pressure. The equation for the reaction is shown below.



Calculate:

(i) The number of moles of carbon monoxide (3 marks)

(ii) The volume of carbon monoxide (*molar volume* = $24.0 \text{ dm}^3 \text{ mol}^{-1}$). (2 marks)

(iii) The mass of iron that would be produced from the reaction (4 marks)

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(c) Define the following terms in relation to redox reactions (2 marks)

(i) Oxidation

(ii) Oxidation number

(d) Find the oxidation number of chlorine in the following substances:

(i) ClO_3^- (3 marks)

(ii) HClO_4 (3 marks)

(d) Determine whether oxidation or reduction occurred and explain by using **changes in oxidation numbers**.

(i) $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$ (2 marks)

(ii) $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^-$ (2 marks)

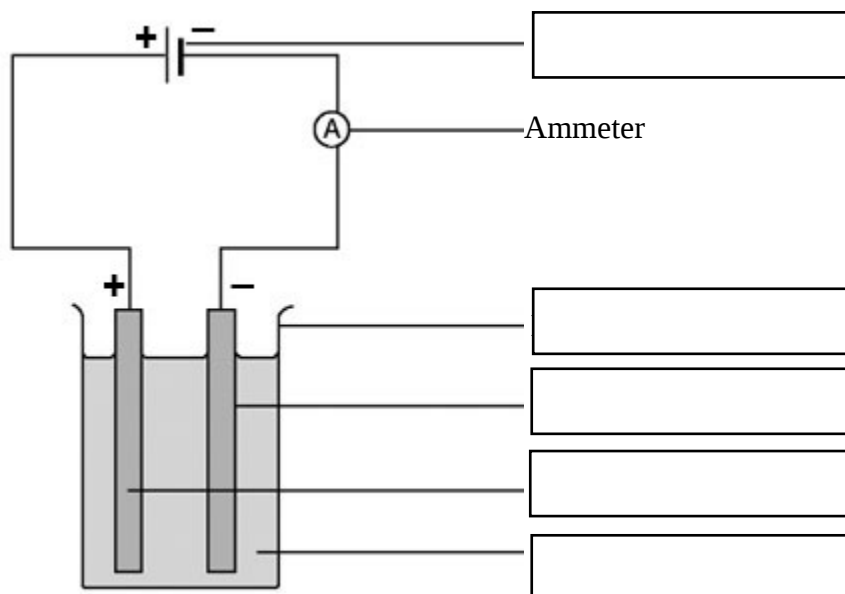
Total 25 marks

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2. (a) During the electrolysis of aqueous dilute copper (II) sulfate, a current of 3.5A was passed through the electrolytic cell for two hours.

(i) Explain what is meant by Electrolysis. (2 marks)

(ii) Label the diagram of the electrolytic cell below! (5 marks)



(iii) Write a half equation to show the substance produced at the cathode. (2 marks)

(iv) Determine the quantity of electricity that passed through the cell
($1F = 96500C$) (5 marks)

(v) Determine the mass of product deposited at the cathode. (2 marks)

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- (b) Chalk dust (CaCO_3) dissolves in diluted sulfuric acid producing salt, water and carbon dioxide gas.



- (i) What type of chemical reaction is this? _____ (1 mark)

- (ii) Explain the collision theory of reactivity (2 marks)

- (iii) Explain using the collision theory how the rate will be affected by decreasing the temperature of the reaction mixture (3 marks)

Rate would _____

Reason(s): _____

- (ii) A chemistry student decided to do the same experiment using chalk dust instead of the stick of chalk. Explain using the collision theory how the rate of the reaction will be affected. (3 marks)

Rate would _____

Reason(s): _____

TOTAL 25 MARKS

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3. 2.43g of magnesium metal was added to 50 cm³ of a 1.0 mol dm⁻³ solution of hydrochloric acid. When the reaction was complete, the temperature changed from 27.2°C to 36.4°C.

(i) Write a balanced chemical equation for the reaction. (2 marks)

(ii) Is this reaction exothermic or endothermic? _____ (1 mark)

(i) Calculate the heat transferred for the reaction using the equation $Q = mc\Delta T$
($c = 4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$) (4 marks)

(ii) Calculate the number of moles of magnesium used in this experiment. (2 marks)

(iii) Hence, calculate the enthalpy change per mole of magnesium in KJ mol^{-1} (3 marks)

(iv) Draw an enthalpy profile diagram for this chemical reaction. Include the value you calculated in part (v) above in your diagram. (3 marks)

TOTAL 15 MARKS

END OF EXAMINATION!!

Group

Group																			
I	II												III	IV	V	VI	VII	0	
							1.0 H hydrogen 1												4.0 He helium 2
6.9 Li lithium 3	9.0 Be beryllium 4												10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10	
23.0 Na sodium 11	24.3 Mg magnesium 12												27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18	
39.1 K potassium 19	40.1 Ca calcium 20	45.0 Sc scandium 21	47.9 Ti titanium 22	50.9 V vanadium 23	52.0 Cr chromium 24	54.9 Mn manganese 25	55.8 Fe iron 26	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36		
85.5 Rb rubidium 37	87.6 Sr strontium 38	88.9 Y yttrium 39	91.2 Zr zirconium 40	92.9 Nb niobium 41	95.9 Mo molybdenum 42	— Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54		
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57	— *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	— Po polonium 84	— At astatine 85	— Rn radon 86	
— Fr francium 87	— Ra radium 88	— Ac actinium 89	— *	— Rf rutherfordium 104	— Db dubnium 105	— Sg seaborgium 106	— Bh bohrium 107	— Hs hassium 108	— Mt meitnerium 109	— Unu ununillium 110	— Uuu unununium 111	— Uub ununbium 112		— Uuq ununquadium 114		— Uuh ununhexium 116		— Uuo ununoctium 118	

lanthanides *	140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	163 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
	– Th thorium 90	– Pa protactinium 91	– U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lw lawrencium 103