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|---------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------|-------------------|
| REGISTRATION CENTRE NUMBER                                                                                                            |  | CENTRE NAME                                                                         |                   |
| CANDIDATE'S FULL NAMES                                                                                                                |  |                                                                                     |                   |
| CANDIDATE IDENTIFICATION NUMBER                                                                                                       |  | SUBJECT CODE<br>0715                                                                | PAPER NUMBER<br>2 |
| <b>LICTA MOCK 2026</b>                                                                                                                |  |                                                                                     |                   |
| FOR EXAMINER'S USE ONLY<br>(Candidate Random CODE):  |  |  |                   |
| <b>LITTORAL CHEMISTRY TEACHERS ASSICATION</b>                                                                                         |  |                                                                                     |                   |
| SUBJECT TITLE<br><b>CHEMISTRY</b>                                                                                                     |  | SUBJECT CODE<br>0715                                                                | PAPER NUMBER<br>2 |
|                                                                                                                                       |  | EXAMINATION DATE: March, 2026                                                       |                   |

**THREE HOURS**

Enter the information required in the boxes of the flap

Answer ALL the SIX questions in this booklet.

The mark allocated is indicated for each question. Each question carries 20 marks

You are reminded of the necessity for good English and orderly presentation in your answers.

Blank spaces in this question booklet may be used for rough work.

In calculations, you are advised to show all steps in your working giving your answer at each stage.

*All necessary working must be shown. No marks will be awarded for answers without brief statements showing how the answers have been obtained.*

Noiseless non-programmable calculators may be used.

**USEFUL DATA:**

Cu = 64, O = 16, H = 1, N = 14, C = 12

Volume of 1mol of gas at STP = 22,400cm<sup>3</sup>

| <b>FOR EXAMINER'S USE ONLY</b>                                         |                     |
|------------------------------------------------------------------------|---------------------|
| <b>Marked by:</b> .....<br><b>Signature:</b> ..... <b>Date:</b> .....  | <u><b>SCORE</b></u> |
| <b>Checked by:</b> .....<br><b>Signature:</b> ..... <b>Date:</b> ..... |                     |

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SECTION A : PHYSICAL AND GENERAL CHEMISTRY

1.

(a)

(i) Define the following;

A: Atomic number

B: Mass number

(ii) Radioactive fermium  $^{258}_{100}\text{Fm}$  decays into the nuclide Z by emitting two alpha particles. Give the atomic number and mass number of Z.

Atomic number

Atomic mass

(4 marks)

(b) The Daniel cell is a voltaic cell composed of zinc and copper half cells. Given:

$\text{Zn}^{2+}_{(\text{aq})} / \text{Zn}_{(\text{s})}$ ,  $E^\ominus = -0.76\text{V}$ ;  $\text{Cu}^{2+}_{(\text{aq})} / \text{Cu}_{(\text{s})}$ ,  $E^\ominus = +0.34\text{V}$

(i) What is a Voltaic cell?

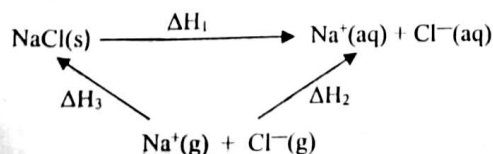
(ii) Write the conventional cell diagram of the Daniel cell.

(iii) Calculate the e.m.f of the cell.

(iv) Write the overall balanced redox equation for the cell.

(4 marks)

(c) Considered the energy cycle below;



- (i) Identify the enthalpy changes represented by  $\Delta H_1$ ,  $\Delta H_2$  and  $\Delta H_3$

$\Delta H_1$

$\Delta H_2$

$\Delta H_3$

- (ii) Determine  $\Delta H_3$  if  $\Delta H_1 = +6 \text{ kJmol}^{-1}$  and  $\Delta H_2 = -770 \text{ kJmol}^{-1}$

(4 marks)

(d)

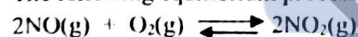
- (i) Differentiate between a strong acid and a weak acid.

- (ii) Calculate the pH of a 0.1 M sulphuric acid ( $\text{H}_2\text{SO}_4$ ).

- (iii) State two uses of a buffer solution.

(5mks)

- (c) The following equilibrium process has been studied at  $230^\circ\text{C}$ .



The concentrations of the reacting species at equilibrium are found to be :

$[\text{NO}] = 0.05 \text{ mol dm}^{-3}$ ,  $[\text{O}_2] = 0.13 \text{ mol dm}^{-3}$  and  $[\text{NO}_2] = 15.50 \text{ mol dm}^{-3}$ .

- (i) Calculate the equilibrium constant ( $K_c$ ) of the reaction at this temperature.

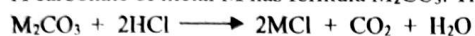
- (ii) How does a decrease in pressure affects the equilibrium position of the above reaction?

(3mks)

(Total=20marks)

2.

- (a) A carbonate of metal M has formula  $M_2CO_3$ . The equation for the reaction of  $M_2CO_3$  with hydrochloric acid is given below.



0.245g of  $M_2CO_3$  was found to exactly neutralize 23.6 cm<sup>3</sup> of 0.15M hydrochloric acid.

- (i) Calculate the number of moles of hydrochloric acid.

.....

.....

.....

- (ii) Calculate the number of moles of  $M_2CO_3$

.....

.....

.....

- (iii) Calculate the relative molecular mass of  $M_2CO_3$

.....

.....

.....

- (iv) Calculate the relative atomic mass of the metal M.

.....

.....

..... (4 marks)

(b)

- (i) Name the theory that is used to explain the shapes of simple covalent molecules and ions.

.....

.....

- (ii) Complete the table below by either giving the shapes, bond angle or the species.

| Species | Shape | Bond angle |
|---------|-------|------------|
| $CH_4$  |       |            |
|         |       | 120°       |

(3 marks)

- (c) Identify the types of intermolecular forces in each of the following substances.

| Substance         | Intermolecular force |
|-------------------|----------------------|
| Ammonia           |                      |
| Hydrogen chloride |                      |

(2 marks)

- (d) Water and ethanol mixture deviate positively from Raoult's law and forms an azeotropic mixture.

- (i) What is an azeotropic mixture?

.....

.....

(ii) Give two experimental evidence for positive deviation from Raoult's law

.....

.....

.....

(iii) State one method that can be used to separate the azeotropic mixture of water and ethanol.

..... (4 marks)

(c) State the coordination number of the chloride ions in the following;

(i) NaCl

.....

.....

(ii) CsCl

.....

.....

(iii) Which type of unit cell exists in a crystal of NaCl?

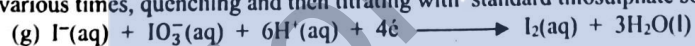
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(iv)

..... (3 marks)

(f) The progress of the reaction between iodide ions and potassium iodate(v) can be followed by withdrawing samples of the reaction mixture at various times, quenching and then titrating with standard thiosulphate solution. The equation for the reaction is



(i) List one other method that can be used to follow up this reaction?

.....

(ii) What is the name of the indicator for the titration?

.....

(iii) In one such experiment the following data were obtained.

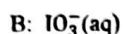
|   | Initial Concentration (mol dm <sup>-3</sup> ) of |                       | Initial reaction                          |
|---|--------------------------------------------------|-----------------------|-------------------------------------------|
|   | I <sup>-</sup> (aq)                              | KIO <sub>3</sub> (aq) | Rate/mol dm <sup>-3</sup> s <sup>-1</sup> |
| 1 | 0.019                                            | 0.015                 | 3.5 x 10 <sup>-6</sup>                    |
| 2 | 0.038                                            | 0.015                 | 7.0 x 10 <sup>-6</sup>                    |
| 3 | 0.038                                            | 0.030                 | 28.0 x 10 <sup>-6</sup>                   |

Determine the order of the reaction with respect to

A: I<sup>-</sup>(aq)

.....

.....



(4 marks)

(Total = 20 marks)

### SECTION B: INORGANIC CHEMISTRY

3.

(a) The elements in period 2 (Li to Ne) of the periodic table show periodic trends in their properties.

(i) What is meant by the term "periodic trend"?

(ii) How does melting points vary across the period?

Explain

(iii) Complete the table below by giving the formulae of the oxides of the elements.

| Li | Be | B | C | N | O | F | Ne |
|----|----|---|---|---|---|---|----|
|    |    |   |   |   |   |   |    |

How does the nature of the bonding vary from left to right?

(iv) Select one acidic oxide and one basic oxide and write equations to show their acid/base properties

(8 marks)

(b) State one reason for each of the following observations.

(i) Mg is harder, denser and has a higher melting point than Na

(ii)  $\text{MgCl}_2$  exists in the hydrated form while  $\text{NaCl}$  does not.

(2marks)

(c)

(i) Write an equation in each case to represent the change that occurs when the following carbonates are heated.

A:  $\text{Na}_2\text{CO}_3$

B:  $\text{MgCO}_3$

(ii) Lithium and Magnesium show diagonal relationship. Give one reaction in which lithium and magnesium show this relationship by means of chemical equations

Why are the two elements said to be diagonally related?

(iii) State and explain the trend in the solubility of the S-block sulphates down the group.

(6 marks)

(d) Nitric acid is prepared industrially by the catalytic oxidation of ammonia.

(i) By means of balance chemical equations, give the steps involved in converting ammonia to nitric acid

(ii) State two uses of nitric acid.

(iii) Write down the formula of nitrogenous compound with -1 oxidation state.

(4 marks)

(Total = 20marks)

4.

(a) The elements of group IV of the periodic table are carbon, silicon, germanium, Tin and Lead.

(i) State the general electronic structure in the outer shell of the atoms.

(ii) What are the principal oxidation states of the elements in their chlorides?

(iii) Aqueous sodium hydroxide reacts with carbon dioxide and lead(II)oxide. In each case state the products of the reaction between aqueous sodium hydroxide and;

A: Carbondioxide

B: Lead(II) oxide

(iv) Explain why silicon dioxide exist as a solid of high melting point whereas Carbon dioxide is a gas even though silicon and carbon belong to the same group.

(v) State two ways in which carbon differs from the rest of the elements in group IV.

( 6 marks)

(b) The elements fluorine, chlorine, Bromine and Iodine are found in group 17 (Group VII) of the periodic table.

(i) Give the physical state and colour of the elements at room temperature and atmospheric pressure.

| Element  | Physical state | Colour |
|----------|----------------|--------|
| Chlorine |                |        |
| Bromine  |                |        |
| Iodine   |                |        |

(ii) Concentrated sulphuric acid reacts with sodium chloride and sodium iodide to give different products.

Give the equation for the reaction of concentrated sulphuric acid with

A: NaCl

B: NaI

Explain the difference between the two reactions

(iii) Give the balance equation of the reaction between aqueous Iodide(I<sup>-</sup>) and Iodate (IO<sub>3</sub><sup>-</sup>) in an acid medium.

(iv) How is the reaction in (iii) above called?

(v) Fluorine has a lower bond dissociation energy than chlorine.

Explain this anomalous property.

(8 marks)

(c) The elements from scandium to zinc are known as d-block elements, some of them are also known as transition elements.

(i) Differentiate between a d-block element and a transition element.

(ii) State and explain how first ionization energy varies across the first transition series from Scandium to Zinc?

(iii) The two isomers of Co(NH<sub>3</sub>)<sub>5</sub>BrSO<sub>4</sub> are [Co(NH<sub>3</sub>)<sub>5</sub>Br]<sup>2+</sup>SO<sub>4</sub><sup>2-</sup> and [Co(NH<sub>3</sub>)<sub>5</sub>SO<sub>4</sub>]<sup>+</sup>Br<sup>-</sup>

A: Describe simple chemical test to distinguish between the two isomers

B: What is the coordination number and oxidation state of cobalt in each of the isomers above?

[Co(NH<sub>3</sub>)<sub>5</sub>SO<sub>4</sub>]<sup>+</sup>Br<sup>-</sup>

[Co(NH<sub>3</sub>)<sub>5</sub>Br]<sup>2+</sup>SO<sub>4</sub><sup>2-</sup>

Name the complex [Co(NH<sub>3</sub>)<sub>5</sub>Br]<sup>2+</sup>SO<sub>4</sub><sup>2-</sup>

(6 marks)

(Total = 20marks)

# SECTION C: ORGANIC CHEMISTRY

5.

- (a) An organic compound of molecular mass 339 was found to be made up of 70.8% Carbon, 4.1% nitrogen, 6.2% hydrogen. Determine

(i) The empirical formula of the compound.

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.....

(ii) The molecular formula of the compound.

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.....

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(iii) How will you confirm the presence of nitrogen in the compound?

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.....

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(7 marks)

- (b) Consider compounds A, B, C and D below

A:  $C_2H_5CH=CH_2$ ,

B:  $CH_3CH(OH)CH_2CH_3$ ,

C:  $(CH_3)_3CBr$ ,

D:  $(CH_3)_2C=CH_2$

Which of the compounds

(i) Shows optical isomerism

.....

.....

.....

(ii) Undergoes  $S_N1$  reactions

.....

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.....

(iii) When A reacts with hydrogen bromide, 1-bromobutane is obtained as the major product.

A: State the conditions under which the reaction takes place

.....

.....

.....

B: Write the mechanism for the reaction

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.....

(iv) Give the structure of the major product obtained when D reacts with hydrogen bromide.

.....

.....

.....

(7 marks)

(c) Compound D below can be prepared following the scheme below



(i) Give the names of compounds B, C and D

B

C

D

(ii) Give the reagents and reaction conditions represented by X, Y and Z.

| Reaction | Reagent | Reaction condition |
|----------|---------|--------------------|
| X        |         |                    |
| Y        |         |                    |
| Z        |         |                    |

(6 marks)

(Total 20marks)

6.

(a) Aminoethanoic acid ( $\text{H}_2\text{NCH}_2\text{COOH}$ ) is an example of an amino acid.

(i) What is an amino acid?

(ii) Give the structure of aminoethanoic acid when in a neutral solution of pH = 7.

(iii) State the type of hybridization and bond angle of the carbon atom with an asterick(\*)

(iv) Which techniques would you use to identify the following in aminoethanoic acid?

A: the amino group

B: the position of hydrogen atom

(5 marks)

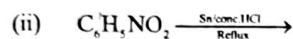
(b) Suggest a chemical test to distinguish between the following compounds.

(i)  $\text{CH}_3\text{COCl}$  and  $\text{CH}_3\text{COOH}$

(ii)  $C_6H_6$  and  $C_6H_5OH$

( 6 marks)

(c) Give the products of the following reactions



( 2 marks)

(d) Give the systematic names of the following



(2 marks)

(e) Draw the structural formulae of each of the following.

(i) 2-methyl-2-chloropropane

(ii) 2-bromo-3-phenyl butane

(f) Methylbenzene is obtained by reacting benzene with a suitable reagent.

(i) Give the formula of this reagent.

(ii) What is (are) the condition(s) of the reaction?

(iii) Give the special name of the reaction in which methylbenzene is obtained from benzene

(Total 20marks)

**END!!!**

STOP: GO BACK AND CHECK YOUR WORK