TEVETA

Technical Education, Vocational and Entrepreneurship Training Authority

DIPLOMA IN SCIENCE LABORATORY

LEVEL 6 YEAR III EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATIONS

SITTING: NOVEMBER / DECEMBER 2025

SUBJECT: CHEMISTRY III

TIME: THREE (3) HOURS **TOTAL MARKS: 100**

PASS MARK: 50

INSTRUCTIONS TO CANDIDATE

1. Write your Examination number and National Registration Card (NRC) number on the answer booklet provided. Ensure you append your signature in the space provided on the answer booklet.
2. Write the ANSWER SCRIPT SERIAL NUMBER on the examination register and on the entry slip.
3. This paper has seven (7) questions. Answer Five (5) questions.
4. Diagrams may be used where necessary to clarify your answer.
5. Cell phone and programmable calculators are not allowed in the examination room

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

QUESTION 1

(a) Define the terms below:

(i) Contaminant. (2 marks)

(ii) Pollutant (2 marks)

(iii) Non-biodegradable pollutants. (2 marks)

(b) Explain the **3Rs** that can be used to combat accumulation of land pollutants such as plastics. (6 marks)

(c) Explain what causes:

(i) Global warming (4 marks)

(ii) Ozone deletion. Give relevant chemical equation. (4 marks)

Total: (20 Marks

QUESTION 2

(a) Define the following terms:

(i) Biochemical oxygen demand (BOD). (2 marks)

(ii) Chemical oxygen demand (COD). (2 marks)

(b) State four (4) differences between BOD and COD. (8 marks)

(c) Explain the following terms:

(i) Coagulation. (2 marks)

(ii) Sedimentation. (2 marks)

(iii) Chlorination. (2 marks)

(iv) Filtration. (2 marks)

Total: (20 Marks)

QUESTION 3

In an experiment, a spirit burner is used to heat 250 cm^3 of water by burning methanol (CH_3OH). Specific heat capacity of water = 4.18 J g^{-1} $°C^{-1}$)

Results:

starting temperature of water = 20.0 °C

starting mass of burner + fuel = 248.8 g

final temperature of water = 43.0 °C

final mass of burner + fuel = 245.9 g

(a) How many joules of heat energy went into the water? (4 Marks)

(b) How many moles of fuel were burnt? (4 Marks)

(c) Calculate an experimental value for the enthalpy change of combustion of methanol from these results. (4 Marks)

(d) Suggest three reasons why your answer is much smaller than the accepted standard enthalpy of combustion of methanol. (8 Marks)

Total: (20 Marks)

QUESTION 4

(a) Define a sample. (2 marks)

(b) Explain three (3) sampling techniques. (6 marks)

(c) Explain the difference between sample size reduction and sample particle size reduction. (4 marks)

(d) Describe how a moist solid sample of varying particle sizes would be prepared once delivered to Sample Preparation until it is submitted into the Analytical Section for chemical analysis. (8 marks)

Total: (20 Marks)

QUESTION 5

(a) Draw the skeletal formulae or structure of:

(i) Pentan-2-one (3 marks)
(ii) Pentan-3-one (3 marks)
(iii) Pentanal. (3 marks)

(b) State the reagent would you add to an unknown compound to see if it contains a carbonyl group (2 marks)

(c) Explain the result would you get if the unknown compound did contain a carbonyl group. (2 marks)

(d) Give reason(s) for the usefulness of finding the melting point of the product of this test? (1 marks)

(e) Explain the term racemate and draw the structure with **one (1)** example. (3 marks)

(f) Explain the term meso compound and draw the structure with one **(1)** example. (3 marks)

QUESTION 6

(a) Explain the meaning of the term waste. (2 marks)

(b) State **three (3)** types of waste. (3 marks)

(c) Describe how hydrochloric acid waste is disposed off in the laboratory. (4 marks)

(d) Describe **three (3)** industrial waste disposal methods. (6 marks)

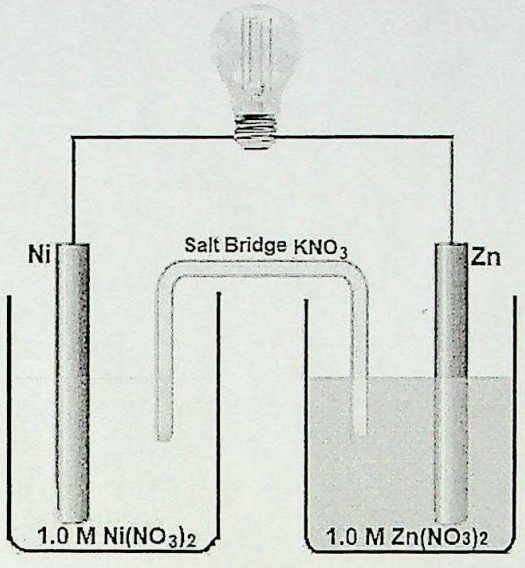
(e) Explain the term greenhouse effect. (2 marks)

(f) State **three (3)** greenhouse gases. (3 marks)

Total: (20 Marks

QUESTION 7

Answer the following questions that refer to the galvanic cell shown in the diagram. The two reduction half-reaction that occur in the cell are shown in the table



Reaction	$E°$ (V)
$Ni^{2+} + 2e^- \rightarrow Ni$	-0.23
$Zn^{2+} + 2e^- \rightarrow Zn$	-0.76

(a) Redraw the diagram, and indicate the anode, and the cathode (including their charges), and the direction of electron flow in the wire. between the electrodes. (6 Marks)

(b) Write the net ionic equation for the overall reaction that occurs as the cell operates. (2 Mark)

(c) Calculate the value of the standard cell potential ($E°_{cell}$) (4 Marks)

(d) Determine the value of the standard free energy. $\Delta G°_{cell}$, for the cell. (4 Marks)

(e) Indicate how the value of the $E°_{cell}$ would be affected if the concentration of $Ni(NO_3)_{2(aq)}$ was changed from 1.0 M to 0.1 M and the concentration of $Zn(NO_3)_{2(aq)}$ remained at 1.0 M. Justify your answer. (4 Marks)

Total: (20 Marks)

Useful data

R = 8.315 J/kg.K or 0.0821 atm.L/mol.K

Avogadro`s constant = 6.02×10^{23}

Speed of light = 3×10^{8} m/s

Ryberg constant for hydrogen atom = $1.097 \times 10^{7} m^{-1}$

Faradays constant = 96 486 C/mol

Plank`s constant = $6.6260755 \times 10^{-34}$ J·s