



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

**MODULE: Laboratory Communication and
Computer Applications**

PAPER NO: 360/24/M08

DURATION: 3 hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Answer all questions from Section A and any three (3) question from Section B.
2. Do not write anything on the question paper.
3. Do not write your name on or inside the answer booklet.
4. Each question carries 20 marks.

This paper consists of 3 printed pages.

SECTION A

Answer all questions.

QUESTION 1

- a) Explain the importance of effective communication in a laboratory setting. (10 marks)
- b) Identify common barriers to effective communication in laboratories. (5 marks)
- c) Suggest strategies to overcome these barriers. (5 marks)

QUESTION 2

- a) Describe the basic elements of the communication process and their functions (16 marks)
- b) State any four (4) types of laboratory work-related documents. (4 marks)

SECTION B

Answer any three (3) questions.

QUESTION 3

- a) State the main components of computer hardware. (8 marks)
- b) Explain the different types of software and their purposes. Give examples for each. (12 marks)

QUESTION 4

- a) Explain the use of “Mail Merge” in Word Processing software. (7 marks)
- b) Describe how to create databases of information using Access. (13 marks)

QUESTION 5

- a) State the importance and benefits of face-to-face communication. (10 marks)
- b) Give situation where face-to-face communication is beneficial. (5 marks)
- c) Explain the following terms:
- | | | |
|------|----------------------------|-----------|
| i) | Communication | (1 mark) |
| ii) | Visual communication | (2 marks) |
| iii) | Face to face communication | (2 marks) |

QUESTION 6

- a) Differentiate between intrapersonal and interpersonal communication. (10 marks)
- b) List the factors to consider when choosing channels of communication. (10 marks)

.../f



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

MODULE: Laboratory Sample Processing I PAPER NO: 360/24/M02

DURATION: 3 Hours

MAY/JUNE 2025 EXAMINATION

REQUIREMENTS

Scientific calculator, periodic table

INSTRUCTIONS TO CANDIDATE

- 1) Section A: Answer all questions (40 marks).**
- 2) Section B: Answer any three (3) questions (60 marks).**

This paper consists of 4 printed pages.

SECTION A

QUESTION 1

- a) Define the following terms:
- i) Compound (2 marks)
 - ii) Mole (2 marks)
 - iii) Electrolysis (2 marks)
 - iv) Secondary standard (2 marks)
 - v) Contaminant (2 marks)
- b) i) Calculate the mass of NaCl required to prepare 250ml of a 0,25M solution. Show working. (5 marks)
- ii) Explain the importance of standard solution in quantitative analyses (5 marks)

QUESTION 2

State the following laws mathematically and provide a brief explanation

- a) i) Boyle's law (4 marks)
- ii) Charles' law (4 marks)
- b) A student conducts an experiment to produce calcium chloride by reacting calcium carbonate with hydrochloric acid, according to the equation
- $$\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$$
- i) Calculate the mass of calcium chloride that can be obtained when 10.0g of calcium carbonate (CaCO_3) reacts completely with excess hydrochloric acid. (4 marks)
- ii) If the actual yield of calcium chloride in the experiment was 9.5g calculate the percentage yield. (4 marks)
- iii) Calculate the volume of CO_2 gas produced at room temperature and pressure (RTP) assuming that one mole of gas occupies 24.0dm^3 .

- iv) If the calcium chloride produce is dissolved in water to make 250cm^3 of solution and its concentration is found to be $0,6\text{ md/dm}^3$, calculate the mass of calcium chloride present in the solution. (3 marks)

SECTION B

QUESTION 3

- a) Describe the sampling of the following materials:
- i) Powders (2 marks)
 - ii) Liquids (2 marks)
 - iii) Rocks (2 marks)
 - iv) Gases (2 marks)
- b) i) Briefly explain any three (3) precautions to be taken during sample handling. (6 marks)
- ii) Describe the use of a sampling thief in industrial application. (2 marks)

QUESTION 4

- a) An electrochemical cell is constructed using a zinc electrode immersed in a 1.0M ZnSO_4 solution and a copper electrode immersed in a 1.0M CuSO_4 solution:
- i) Write the balanced half-cell reactions occurring at the zinc and copper electrodes. (4 marks)
 - ii) Identify the anode and cathode. (2 marks)
- b) Calculate the standard electromotive force (EMF) of the cell. $[E_{\text{cathode}} = 0.34\text{V}; E_{\text{anode}} = -0.76\text{V}]$ (2 marks)
- c) State Faraday's law of electrolysis. (2 marks)
- d) Distinguish between a galvanic and electrolytic cell. (10 marks)

QUESTION 5

- a) For each of the following, provide the correct IUPAC name and draw the structural formula:
- i) An alkane containing five (5) carbon atoms.

- ii) An aldehyde containing four (4) carbon atoms.
 - iii) A ketone containing six carbon atoms.
 - iv) An ester formed from acetic acid and methanol. (10 marks)
- b) Define:
- i) Structural isomerism (2 marks)
 - ii) Geometric isomerism (2 marks)
 - iii) Provide an example of each of the following:
 - Structural isomerism (3 marks)
 - Geometric isomerism (3 marks)

QUESTION 6

- a) Explain how the following properties change across two of the periodic table:
- i) Atomic radius (3 marks)
 - ii) Ionisation energy (4 marks)
 - iii) Electronegativity (3 marks)
- b) i) State four (4) key components of an HPLC system and briefly explain the function of each component in the analytical process. (8 marks)

..../fk



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABOATORY TECHNOLOGY

**MODULE: Safety, Health, Environmental and PAPER NO: 360/24/M03
Quality Management 360/24/M03**

DURATION: 3 Hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

Answer booklet

INSTRUCTIONS TO CANDIDATE

- 1) Do not write your name on the answer book.
- 2) Answer all questions in section A.
- 3) Answer any three (3) questions from section B.

This paper consists of 3 printed pages.

SECTION A

QUESTION 1

- a) Discuss any five (5) causes of fire accidents in the laboratory including precautionary measures. (10 marks)
- b) Explain the key principles of care, handling and storage of biological specimens in a laboratory. (10 marks)

QUESTION 2

Identify and describe five hazards associated with poor housekeeping in a laboratory. (20 marks)

SECTION B

QUESTION 3

Discuss any four (4) methods of waste disposal explaining the advantages and disadvantages of each. (20 marks)

QUESTION 4

- a) Discuss general laboratory rules and regulation under the following:
 - i) Working hours (5 marks)
 - ii) Maintaining safety systems (5 marks)
 - iii) Cleanliness and hygiene (4 marks)
- b) Describe the benefits of good housekeeping practice. (6 marks)

QUESTION 5

- a) Discuss engineering and administrative controls to the following physical hazards:
 - i) Ionising radiation (5 marks)
 - ii) High temperatures (5 marks)
 - iii) Noise (4 marks)

PAPER NO: 360/24/M03-SAFETY, HEALTH, ENVIRONMENTAL AND QUALITY
MANAGEMENT

PAPER NO: 360/22/M03-SAFETY, HEALTH, ENVIRONMENTAL AND QUALITY
MANAGEMENT

- b) Discuss negative effects of noise on technicians. (6 marks)

QUESTION 6

Discuss the importance of segregating waste according to laid down procedures in a laboratory setting to include prevention of contamination, reduction of waste volume and compliance with regulations. (20 marks)

..../fk



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

MODULE: Laboratory Sample Processing 1 PAPER NO: 360/24/M02

DURATION: 3 Hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Section A:(40 marks)-Answer all questions.
2. Section B:(60 marks)-Answer any three (3) questions.
3. Each question carries 20 marks.
4. Periodic table is attached at the back.

This paper consists of 5 printed pages.

SECTION A

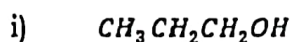
QUESTION 1

- a) Define the following terms
- i) Relative atomic mass
 - ii) Isotopes
 - iii) Electronegativity
 - iv) Primary standard
 - v) Functional group (10 marks))
- b) Compare ionic and covalent bonding providing one example for each. (4 marks)
- c) State the electronic configuration for:
- i) Na (1 mark)
 - ii) Cl (1 mark)
- d) Draw the Lewis structure for CO_2 (4 marks)

QUESTION 2

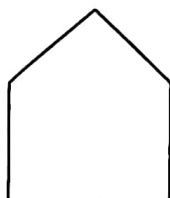
- a)
- i) A compound contains 40% sulphur, 60% of oxygen by mass. Determine its empirical formula. (6 marks)
 - ii) The molar mass of the compound in (i) is 160g/mol. Determine its molecular formula. (4 marks)
- b) State the functional groups for:
- i) Alkanes
 - ii) Alkenes
 - iii) Ethers (6 marks)

c) Name the following organic compounds

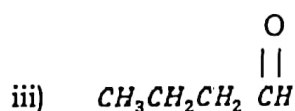


(1 mark)

ii)



(2 marks)



(1 mark)

SECTION B

QUESTION 3

A laboratory technician is tasked with processing a bulk environmental sample for chemical and biological analysis.

- a) Explain the importance of proper sampling techniques in ensuring the accuracy and reliability of chemical and biological analysis. (4 marks)
- b) Describe three different sampling tools used for chemical and biological sample collection. (6 marks)
- c) Compare coning and quartering with thermal size reduction. (6 marks)
- d) Briefly discuss the role of reagent used in sample decomposition. (4 marks)

QUESTION 4

- a) Define the term extraction. (3 marks)
- b) Describe the following extraction methods (15 marks)
 - i) Maceration
 - ii) Ultrasonic extraction
 - iii) Soxhlet extraction

PAPER NO: 360/24/M02- LABORATORY SAMPLE PROCESSING 1

- c) Name two (2) analytical techniques used to examine extracted samples. (2 marks)

QUESTION 5

A 100ml water sample is analysed for its chloride concentration. The water is treated with an excess of silver nitrate ($AgNO_3$) which reacts with chloride ions to form a white precipitate of silver chloride ($AgCl$). After the reaction, the $AgCl$ precipitate is filtered, dried and weighed, yielding a mass of 1.70g.

- a) Write the balanced chemical equation for the reaction between chloride ions and silver nitrate. (2 marks)
- b) Calculate the number of moles of $AgCl$ formed. (4 marks)
- c) Determine the number of moles of chloride ions in the water Sample. (4 marks)
- d) Calculate the concentration of chloride ions in the water sample in mg/L. (6 marks)
- e) Suggest one possible source of error in this procedure and briefly explain how it might affect results. (4 marks)

QUESTION 6

Describe the principles and application of the following analytical techniques.

- a) Ultraviolet- Visible Spectroscopy (UV-VIS) (10 marks)
- b) Thin layer chromatography (TLC) (10 marks)

The Periodic Table of Elements

Group																			
1	2													13	14	15	16	17	18
																			2
																			He helium 4.0



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

MODULE: Laboratory Sample Processing

PAPER NO: 360/22/M02

DURATION: 3 hours

OCTOBER/NOVEMBER 2024 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

- 1. Answer all questions in Section A - (40 marks).**
- 2. Answer any three (3) questions from Section B - (60 marks).**

This paper consists of 4 printed pages.

SECTION A

Answer all questions.

QUESTION 1

- a) Define the following terms:
- i) Sampling (2 marks)
 - ii) Random sampling (2 marks)
 - iii) Systematic sampling (2 marks)
- b) What is a Standard Operating Procedure (S. O. P.) and how does it help in quality control? (4 marks)
- c) Define the following:
- i) Primary standard (2 marks)
 - ii) Secondary standard (2 marks)
 - iii) Catalyst (2 marks)
 - iv) Dynamic equilibrium (2 marks)
 - v) Le-Chateliers principle (2 marks)

QUESTION 2

- a) Describe how the following can be done using Microsoft program.
- i) Create NEW DOCUMENT using Ms-Word (2 marks)
 - ii) Justify text in Ms-Word (4 marks)
 - iii) SAVE SPREADSHEET in a specified name. (4 marks)
- b) Simplify $\left(\frac{16x^2}{y-2}\right)^{\frac{1}{4}}$ (4 marks)
- c) Simplify $3 \log xy - 2 \log y - 2 \log x$ (3 marks)
- d) Solve the equation $10^{\log x} = 10^4$ (3 marks)

SECTION B

Answer any three (3) questions.

QUESTION 3

- a) Describe how the following material types can be sampled:
- i) Powders
 - ii) Liquids
 - iii) Rocks
 - iv) Gases
 - v) Metal blocks
- (10 marks)
- b) Explain oxidation and reduction in terms of:
- i) Electron
 - ii) Oxygen
 - iii) Hydrogen
- (2 marks)
(2 marks)
(2 marks)
- c) Describe the Standard Hydrogen Electrode (SHE).
- (4 marks)

QUESTION 4

- a) Define the following terms as used in organic chemistry:
- i) Functional Group
 - ii) Homolytic fission
 - iii) Heterolytic fission
 - iv) Isomerism
 - v) Homologous series
- (2 marks)
(2 marks)
(2 marks)
(2 marks)
(2 marks)
- b) State and explain five (5) factors that affect rate of reaction and how they effect it.
- (10 marks)

QUESTION 5

- a) Given the following set of numbers:

12, 10, 11, 05, 06, 10, 04, 03

Find:

- i) The range (1 mark)
 - ii) Mode (1 mark)
 - iii) Median (2 marks)
 - iv) Mean (3 marks)
 - v) Standard deviation (3 marks)
- b) Caffeine has the following percent composition:

Carbon	49.48%
Hydrogen	5.19%
Oxygen	16.48%
Nitrogen	28.85%

Its molecular formula mass is 194.19g.

Find its molecular formulae.

[Ar: C = 12, H = 1, O = 16, N = 28]

(5 marks)

- c) Using an example, describe the Electrophoresis Paper Method of analysis and separation. (5 marks)

QUESTION 6

- a) Draw a fully labelled Cu/Zn cell and calculate its *emf* value
($\text{Cu}/\text{Cu}^{2+} \quad \epsilon_{\text{cell}} = -0,34\text{V}$ $\text{Zn}/\text{Zn}^{2+} \quad \epsilon_{\text{cell}} = 0,76\text{V}$) (10 marks)
- b) Draw the UV-VIS Spectrophotometry Schematic/Block diagram fully labelled. (10 marks)

.../jl



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

MODULE: Laboratory Equipment Maintenance PAPER NO: 360/22/M04

DURATION: 3 Hours

MAY / JUNE 2024 EXAMINATION

REQUIREMENTS

1. Formula and constant booklet
2. Scientific calculator
3. Graph paper

INSTRUCTIONS TO CANDIDATE

1. Answer all questions from Section A.
2. Answer any three (3) questions from Section B.

This paper consists of 5 printed pages.

SECTION A

ANSWER ALL QUESTIONS – 40 MARKS

QUESTION 1

- a) Write in words not in symbol the correct SI unit of:
- i) Mass (1 mark)
 - ii) Length (1 mark)
 - iii) Density (2 marks)
- b) Define the following terms as they are used in Laboratory equipment.
- i) Maintenance (2 marks)
 - ii) Calibration (2 marks)
 - iii) Absolute equipment (2 marks)
 - iv) Diagnose equipment (2 marks)
 - v) Equipment inventory (2 marks)
- c) i) Recommend appropriate disposal method in line with an organisation working with high level radioactive materials. (4 marks)
- ii) Produce a disposal report for such an organisation. (5 marks)

QUESTION 2

- a) A 2kg object is kept in orbit by a 500N force and rotate at a frequency of 50Hz. Calculate the:
- i) Radius of the rotation (4 marks)
 - ii) Velocity of the object (2 marks)
- b) The speed of a train travelling between two station changes with time as shown in the table.

Time/s	0	50	100	150	200	250	300	350	400
Speed/	0	3	6	9	9	9	9	4.5	0

- i) Plot the speed time graph for the whole journey. (5 marks)
 - ii) Calculate the total distance covered by the train in 400 seconds. (3 marks)
- c) The specific heat capacity, c of water is $4200 \text{ J kg}^{-1} \text{ K}^{-1}$. Calculate the amount of heat energy required to raise the temperature of 10kg of water through 25°C . (3 marks)

SECTION B – (60 MARKS)

Answer any three (3) questions.

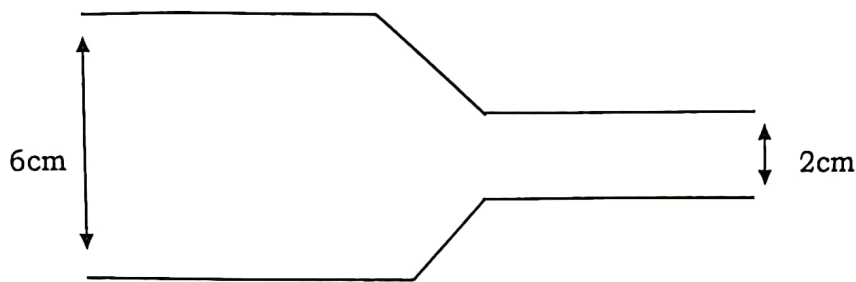
QUESTION 3

- a) i) State the Pascal's principle. (2 marks)
ii) Describe one application of Pascal's principle. (5 marks)
- b) i) State Ohm's law. (2 marks)
ii) Sketch a graph of an Ohmic conductor. (3 marks)
iii) A 10Ω resistor was connected across a battery of e.m.f 12V and negligible internal resistance. Calculate the current supplied by the battery. (2 marks)
- c) Describe the following:
 - i) P-type semiconductor (3 marks)
 - ii) N-type semiconductor (3 marks)

QUESTION 4

- a) i) Differentiate between systematic and random errors. (2 marks)
ii) State one example of Random error and explain how it can be avoided. (2 marks)
- b) i) Define radioactive decay process. (2 marks)
ii) State the three types of radiations emitted during radioactive decay process. (3 marks)
iii) For the radiations emitted in b(ii). Identify their main properties. (3 marks)

- c) Fig 4.1 shows a pipe carrying a fluid of density 1000kgm^{-3} . The end B is 2cm. At A the fluid speed is 2ms and has pressure of 180KPa.



The cross sectional areas and velocities of A and B are connected by equation $A_A V_A = A_B V_B$

- i) Calculate the velocity at B. (5 marks)
- ii) Calculate the pressure at end B. (3 marks)

QUESTION 5

- a) Design a Calibration report. (8 marks)
- b)
 - i) State two (2) laws of refraction. (2 marks)
 - ii) The critical angle of light moving from glass to air is 42.8° .
 - 1) Draw the ray diagram to show the path taken by light. When the angle of incident is 42.8° (3 marks)
 - 2) Calculate the refractive index of glass. (3 marks)
- c) State any four (4) advantages of optic fibre in communication over copper cable. (4 marks)

QUESTION 6

- a) State any three (3) application of nanotechnology. (3 marks)
- b) Discuss best practices for equipment maintenance. (7 marks)
- c)
 - i) State any two (2) examples of thermometric properties. (2 marks)
 - ii) A liquid in glass thermometer has a length of 6,0cm, 4,5cm and 1,0cm at the steam, unknown temperature and ice point respectively. Calculate the unknown temperature which correspond to 4.5cm. (5 marks)
- d)
 - i) Define rectification. (1 mark)
 - ii) Draw a circuit diagram for half wave rectification using a single diode. (2 marks)

...../pm



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

**MODULE: Laboratory Equipment
Maintenance**

PAPER NO: 360/22/M04

DURATION: 3 Hours

REQUIREMENTS

Non programmable calculator.

INSTRUCTIONS TO CANDIDATE

- 1. Answer all questions in Section A.**
- 2. Answer any three (3) questions in Section B.**
- 3. Do not write your name on the answer booklet.**
- 4. Formula booklet and constant booklet is attached at the end of the question paper.**

This paper consists of 6 printed pages.

SECTION A

QUESTION 1

- a) Define the following terms as applied in equipment calibration:
- i) Measurement traceability (2 marks)
 - ii) Standard (2 marks)
- b) i) State the difference between an accurate and precise measurement. (2 marks)
- ii) If the value of acceleration due to gravity (g) obtained in an experiment is 9.52ms^{-2} , determine the percentage error given that the true value of $g = 9.81\text{m/s}^2$ (2 marks)
- iii) Explain whether the result is accurate or precise. (2 marks)
- c) A 3 kg rock swings in a circle of radius 500cm at a frequency of 2Hz. Determine
- i) Angular velocity, ω (3 marks)
 - ii) Linear speed, v (3 marks)
- d) Convert the following temperatures:
- i) 1530°C to K (1 mark)
 - ii) 420K to $^{\circ}\text{C}$ (1 mark)
- e) State two (2) indications that show that a piece of equipment has been calibrated. (2 marks)

QUESTION 2

- a) Discuss briefly the advantages and disadvantages of field one-point calibration. (4 marks)
- b) Show that for a progressive wave $v = \lambda f$ (3 marks)
- c) Sketch the I-V graph of a p-n junction diode. (3 marks)

- d) Define the following terms, stating the units of measurement:
- i) Displacement (2 marks)
 - ii) Angular velocity (2 marks)
 - iii) Centripetal force (2 marks)
- e) A cylindrical piece of wire of area $3.14 \times 10^{-6} \text{m}^2$ and length 500mm is used as a sample in an experiment. If the wire has a resistance of $1\text{k}\Omega$. Calculate the resistivity of the wire. (2 marks)
- f) The specific heat capacity of lead is 128J/kg.K . State what is meant by this statement. (2 marks)

SECTION B

QUESTION 3

- a) Calculate the amount of heat (d) absorbed by ice of mass 720g at -10°C to take it 15°C . Given that specific heat capacity of ice = 2220J/kg.K Latent heat of fusion of ice $L_f = 333\text{kJ/kg}$ specific heat capacity of water C_p water = 4186.8J/kg.K . (10 marks)
- b) List any five (5) documents and records needed for maintaining a system of storage and handling of measuring instruments. (5 marks)
- c) Define the terms:
- i) Resistance (2 marks)
 - ii) Radioactivity (2 marks)
 - iii) ISOTOPE (1 mark)

QUESTION 4

- a) Copy and complete the table

Quantity	S.I Unit	Measuring Instruments
-----	-----	Measuring cylinder
Weight	-----	-----
-----	Seconds	-----
Temperature	-----	-----
-----	Pascals	-----

(10 marks)

- b) Define acceleration (2 marks)
- c) Identify vectors and scalars from the following list of quantities:
- Momentum
- Temperature
- Force
- Electric current
- Angular velocity (6 marks)
- d) State two requirements for estimating measurement uncertainty. (2 marks)

QUESTION 5

- a) Show that
- i) $v^2 = U^2 + 2as$ (6 marks)
- b) Explain the following
- i) N- type semiconductor (2 marks)
- ii) P- type semi conductor (2 marks)
- iii) Depletion region (2 marks)
- iv) Reverse bias (2 marks)
- v) Forward (2 marks)
- c) Distinguish the following
- i) Full wave rectification (2 marks)
- ii) Half wave rectification (2 marks)

QUESTION 6

- a) Discuss any three (3) disposal methods for obsolete equipment in an organisation. (10 marks)
- b) Show that $t_{1/2} = \frac{0.693}{\lambda}$ (4 marks)
- c) Explain the importance of calibrating laboratory equipment. (6 marks)

Data

acceleration of free fall	$g = 9.81 \text{ m s}^{-2}$
speed of light in free space	$c = 3.00 \times 10^8 \text{ m s}^{-1}$
elementary charge	$e = 1.60 \times 10^{-19} \text{ C}$
rest mass of proton	$m_p = 1.67 \times 10^{-27} \text{ kg}$
rest mass of electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
Avogadro constant	$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$
molar gas constant	$R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$
Boltzmann constant	$k = 1.38 \times 10^{-23} \text{ J K}^{-1}$

Formulae

uniformly accelerated motion	$s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
hydrostatic pressure	$\Delta p = \rho g \Delta h$
upthrust	$F = \rho g V$
resistors in series	$R = R_1 + R_2 + \dots$
resistors in parallel	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
capacitors in series	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \dots$
capacitors in parallel	$C = C_1 + C_2 + \dots$
radioactive decay	$x = x_0 e^{-\lambda t}$
decay constant	$\lambda = \frac{0.693}{t_{1/2}}$

.../f



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

MODULE: Laboratory Sample Processing

Paper No: 360/22/M02

DURATION: 3 Hours

MAY/JUNE 2024 EXAMINATION

REQUIREMENTS

- 1) Data booklet
- 2) Scientific calculator

INSTRUCTIONS TO CANDIDATE

- 1) Answer all questions in Section A.
- 2) Answer any three (3) questions in section B.
- 3) Do not write anything on this question paper.

This paper consists of 5 printed pages.

SECTION A

Answer all questions

QUESTION 1

Define the following terms as used in sample processing and analysis:

- a) Sampling. (2 marks)
- b) Accuracy. (2 marks)
- c) Precision. (2 marks)
- d) Sensitivity. (2 marks)
- e) Oxidation and reduction. (2 marks)

QUESTION 2

- a) Evaluate
 - i) $2^{-1} \times 32^{\frac{4}{5}}$ (2 marks)
 - ii) $\left(\frac{25}{9}\right)^{-3/2} \times \left(\frac{1}{81}\right)^{1/2}$ (2 marks)
- b) Evaluate
 - i) $\log_{1/25} 125$ (2 marks)
 - ii) $\frac{\log 25 - \log 125 + \frac{1}{2} \log 625}{3 \log 5}$ (3 marks)

QUESTION 3

- a) Outline all steps involved in making and saving a file Microsoft word. (3 marks)
- b) Explain the principle for gas chromatology with the aid of a diagram. (5 marks)
- c) Give two applications of gas chromatology. (2 marks)

QUESTION 4

- a) Name the following organic components.

PAPER NO: 360/22/M02 - SAMPLE PROCESSING

- i) C_2H_5OH (1 mark)
- ii) CH_3CO_2H (1 mark)
- iii) $CH_3 - C \begin{array}{l} \nearrow O \\ \searrow H \end{array}$ (1 mark)
- iv) $CH_3 - \underset{\underset{O}{\parallel}}{C} - CH_3$ (2 marks)
- b) Differentiate probability sampling from non probability sampling. (6 marks)

SECTION B

Answer any three (3) questions.

QUESTION 5

- a) i) Differentiate $f(x) = 2 + 5x - x^2$ from first principles. (4 marks)
- iii) Find the differential coefficient of $y = \frac{1}{(3x-2)^4}$. (3 marks)
- iv) Find $\int (2x - 7)^7 dx$ (3 marks)
- v) Show that $\int_2^4 \ln x \, dx = 6\ln 2 - 2$ (4 marks)
- b) Describe the steps involved in gravimetric analysis. (6 marks)

QUESTION 6

- a) List the steps to be followed once a laboratory sample is received. (5 marks)

PAPER NO: 360/22/M02 - SAMPLE PROCESSING

- b) Describe the following as used in paper chromatography.
- i) Stationery phase.
 - ii) Mobile phase.
 - iii) Solvent.
 - iv) Solute. (5 marks)
- c) With the aid of a diagram, state and describe the functions of the major parts of functions a UV- spectroscopy. (10 marks)

QUESTION 7

- a) The following masses were determined for 12 different laboratory sample. (All in grams.)

5,683	5,549	5,548	5,552
5,620	5,536	5,539	5,684
5,551	5,552	5,554	5,639

Determine the following for this data:

- i) Mean. (3 marks)
 - ii) Mode. (1 mark)
 - iii) Median (2 marks)
 - iv) Standard deviation. (4 marks)
- b) Write short notes on the following:
- i) Ms Word. (2 marks)
 - ii) Ms Power point. (2 marks)
- c) What power point feature will you will you use to apply motion effects to different object of a slide. (2 marks)
- d) How do you create a pivot table in excel? (4 marks)

QUESTION 8

- a) A student given a block of aluminium. The student measured the dimensions of the block and calculated the density of the block to be 2.68g/cm^3 . The student then looked up the density of the block from a reference book and found it to be 2.70g/cm^3 .
- i) Calculates the absolute error. (2 marks)
 - ii) Calculate percentage error. (2 marks)
 - iii) Calculate relative error. (3 marks)
 - iv) State any three ways in which error may be minimised. (3 marks)
- b) State four (4) requirements of a primary standard. (4 marks)
- c) Complete the following table.

Particle	Relative charge	Relative mass	Location in atom
Protons		1	
Electron	-1		
Neutron			In the nucleus

6 marks

.../fem



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

MODULE: Laboratory Equipment Maintenance

**PAPER NO: 360/24/M04
360/22/M04**

DURATION: 3 Hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

1. Scientific Calculator non programmable.
2. Answer booklet.

INSTRUCTIONS TO CANDIDATE

1. Section A- (40 marks)-Answer all questions.
2. Section B-(60 marks) -Answer any three (3) questions.
3. Formula sheet and data booklet is attached.

This paper consists of 5 printed pages.

PAPER NO: 360/24/M02/360/22/M04- LABORATORY EQUIPMENT
MAINTAINANCE

SECTION A-(40 marks)

QUESTION 1

- a) Define the following terms as they are applied in laboratory equipment.
- i) Uncertainty
 - ii) Tolerance
 - iii) Calibration
 - iv) Systematic error
 - v) Precision (10 marks)
- b) i) What do you understand by the term thermometric property of a substance, give two examples. (4 marks)
- ii) All thermometers are calibrated using the thermometric property, with reference to thermometric property describe how liquid in glass thermometer is calibrated. (5 marks)

QUESTION 2

- a) i) Define preventive maintenance in laboratory equipment. (2 marks)
- ii) Explain how preventive maintenance can be implemented. (4 marks)
- b) Discuss the importance of disposing off absolute equipment. (8 marks)
- c) Describe an experiment to measure the specific heat capacity of a liquid substance using electrical method. (7 marks)

PAPER NO: 360/24/M02/360/22/M04- LABORATORY EQUIPMENT
MAINTAINANCE

SECTION B -60 marks

QUESTION 3

- a) i) State ohm's law (3 marks)
- ii) Give the colour code of the four (4) band resistor marked $(2500 \pm 5\%) \Omega$. (4 marks)
- iii) A 12V power source is connected in parallel with 6Ω , and 5Ω and with 4Ω resistor. Determine the effective resistance of the network. (4 marks)
- iv) Using your answer in (iii), find the amount of current delivered by the battery. (4 marks)
- b) Name five (5) laboratory tools and state what physical quantity is measured by each. (5 marks)

QUESTION 4

A 2kg object kept in orbit by a 500N force. The force causes the object to rotate at 50 Hz.

- i) Calculate its period. (2 marks)
- ii) Calculate the radius of rotation. (3 marks)
- b i) Define friction (1 marks)
- ii) State two (2) desirable and one undesirable effect of friction in instruments. (3 marks)
- c) Explain the following
- i) Archimedes principle (2 marks)
- ii) Pascal's principle (2 marks)
- iii) Bernoulli's principle (2 marks)
- d) , Discuss the importance of keeping records in a laboratory. (5 marks)

PAPER NO: 360/24/M02/360/22/M04- LABORATORY EQUIPMENT
MAINTAINANCE

QUESTION 5

- a) A company bought a new machine to be used in a laboratory. As the company's technician discuss ways you can use to maintain the machine in a good working condition. (10 marks)
- b) Find the frequency of a radio wave whose wave length is 3m and speed $3 \times 10^8 \text{ m/s}$. (2 marks)
- c) i) $PV = NKT$ is an ideal gas equation. State the physical quantity each of the term in the equation. Represent (4 marks)
- ii) State the conclusions in which the equation in c(i) is valid. (4 marks)

QUESTION 6

- a) i) Define rectification. (2 marks)
- ii) Draw a circuit to show how full wave rectification can be done using four (4) diodes (4 marks)
- b) A radioactive nuclide has a half-life of 20 years. If a sample of this nuclide initially contains 9.0×10^{15} atoms. Calculate
- i) The decay constant (2 marks)
- ii) The number of atoms remains after 25 years. (4 marks)
- c) Discuss the duties of laboratory technician in a laboratory used for experimental works. (8 marks)

PAPER NO: 360/24/M02/360/22/M04- LABORATORY EQUIPMENT
MAINTAINANCE

Formulae

uniformly accelerated motion $s = ut + \frac{1}{2}at^2$
 $v^2 = u^2 + 2as$

work done on/by a gas $W = p\Delta V$

gravitational potential $\phi = -\frac{Gm}{r}$

hydrostatic pressure $p = \rho gh$

pressure of an ideal gas $p = \frac{1}{3} \frac{Nm}{V} \langle c^2 \rangle$

capacitors in series $1/C = 1/C_1 + 1/C_2 + \dots$

capacitors in parallel $C = C_1 + C_2 + \dots$

energy of charged capacitor $W = \frac{1}{2}QV$

electric current $I = Anvq$

resistors in series $R = R_1 + R_2 + \dots$

resistors in parallel $1/R = 1/R_1 + 1/R_2 + \dots$

Data

speed of light in free space $c = 3.00 \times 10^8 \text{ ms}^{-1}$

permeability of free space $\mu_0 = 4\pi \times 10^{-7} \text{ H m}^{-1}$

permittivity of free space $\epsilon_0 = 8.85 \times 10^{-12} \text{ F m}^{-1}$

$\left(\frac{1}{4\pi\epsilon_0}\right) = 8.99 \times 10^9 \text{ m F}^{-1}$

elementary charge $e = 1.60 \times 10^{-19} \text{ C}$

the Planck constant $h = 6.63 \times 10^{-34} \text{ J s}$

unified atomic mass unit $1 \text{ u} = 1.66 \times 10^{-27} \text{ kg}$

rest mass of electron $m_e = 9.11 \times 10^{-31} \text{ kg}$

rest mass of proton $m_p = 1.67 \times 10^{-27} \text{ kg}$

.../dk



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

MODULE: Laboratory Quality Controlling PAPER NO: 360/22/M01

DURATION: 3 Hours

OCTOBER/NOVEMBER 2024 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Answer all questions in Section A (40 marks)
2. Answer any three (3) questions from Section B (60 marks)
3. Do not write anything on the question paper
4. Do not write your name on the answer booklet.

This paper consists of 4 printed pages.

SECTION A

QUESTION 1

- a) Identify the advantages and disadvantages of acceptance sampling. (6 marks)
- b) Describe the purpose of the following total quality management techniques:
 - i) Control chart (4 marks)
 - ii) Histogram (4 marks)
 - iii) Scatter diagram (4 marks)
- c) Distinguish between quality controlling and quality assurance. (2 marks)

QUESTION 2

- a) Describe sample size reduction under the following:
 - i) Coning (3 marks)
 - ii) Quartering (3 marks)
 - iii) Rolling (3 marks)
- b) Explain any three (3) characteristics of living organism. (9 marks)
- c) List two types of clean – in – place (CIP). (2 marks)

SECTION B

QUESTION 3

- a) Discuss the functions of the following organelles:
 - i) Mitochondria (2 marks)
 - ii) Nucleus (2 marks)
 - iii) Plasma membrane (2 marks)
- b) Outline the importance of in-process checks during manufacturing. (12 marks)
- c) Distinguish between accuracy and precision. (2 marks)

QUESTION 4

- a) Describe the sampling of the following material:
- i) Gases (2 marks)
 - ii) Powders (2 marks)
 - iii) Liquids (2 marks)
- b) i) Outline the properties of enzymes. (4 marks)
- ii) Define aseptic techniques during microbiological analysis. (1 mark)
- c) Describe any three (3) functions of microorganisms in manufacturing industries. (9 marks)

QUESTION 5

- a) State the use of the following equipment in a laboratory:
- i) Volumetric flask (1 mark)
 - ii) Thermometers (1 mark)
 - iii) Moisture meter (1 mark)
 - iv) Tongs (1 mark)
- b) Summarise the transport mechanisms across the cell membrane. (8 marks)
- c) Discuss the importance of keeping a factory clean. (8 marks)

QUESTION 6

- a) i) Define hypotheses (2 marks)
- ii) Describe any four (4) methods of decomposing samples. (8 marks)
- iii) Differentiate between basic and derived SI units and give an example of each. (4 marks)

PAPER NO: 360/22/M01 – QUALITY CONTROLLING

b) Convert the following to SI units:

i) 20mg/mm^2 (2 marks)

ii) 27mm/msec (2 marks)

.../fem



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

**MODULE: Safety Health Environmental
Quality Management**

PAPER NO: 360/22/M03

DURATION: 3 Hours

OCTOBER/ NOVEMBER 2024 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

- 1. Answer all questions in Section A (40 marks).**
- 2. Answer any three (3) questions from Section B (60 marks).**

This paper consists of 3 printed pages.

PAPER NO: 360/22/M03 - SAFETY HEALTH AND ENVIRONMENTAL QUALITY
MANAGEMENT

Section A

Answer all questions.

QUESTION 1

- a) Define the following terms:
- | | | |
|------|-----------------|-----------|
| i) | Accident | (2 marks) |
| ii) | Risk | (2 marks) |
| iii) | Hazard | (2 marks) |
| iv) | Disinfection | (2 marks) |
| v) | Risk Assessment | (2 marks) |
- b) Explain what is meant by Risk Mitigation. (2 marks)
- c) Explain in detail any four fire fighting methods or precautions to ensure fire safety. (8 marks)

QUESTION 2

- a) Differentiate between an ACCIDENT and INCIDENT with aid of examples. (5 marks)
- b) Explain "safety colours" in a workplace. (5 marks)
- c) Explain briefly how the following materials should be stored in the laboratory:
- | | | |
|------|----------------------|------------|
| i) | Biological specimens | |
| ii) | Weighing balance | |
| iii) | Volumetric Glassware | (10 marks) |

PAPER NO: 360/22/M03 – SAFETY HEALTH AND ENVIRONMENTAL QUALITY
MANAGEMENT

Section B

Answer any three (3) questions.

QUESTION 3

- a)
 - i) Define Good Laboratory Practice (G.L.P). (2 marks)
 - ii) Explain fully the basic laboratory safety rules to consider when working in a lab. (8 marks)

- b) Give and explain any five factors that contribute to slips, trips and falls in the workplace. (10 marks)

QUESTION 4

- a) Discuss the importance of waste management in workplaces. (10 marks)
- b) Define effluent and give five (5) contaminants usually found in effluent. (10 marks)

QUESTION 5

- a) Explain how employers prevent manual handling and lifting injuries in a workplace. (10 marks)
- b) Explain the five (5) strategies which should be followed in risk analysis. (10 marks)

QUESTION 6

- a) Describe what good housekeeping promotes in the workplace. (4 marks)
- b) State the signs of poor housekeeping in the workplace. (6 marks)
- c) Outline the importance of workplace safety signs and symbols. (10 marks)

.../tez



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

LABORATORY TECHNOLOGY

MODULE: Laboratory Stock Management PAPER NO: 360/22/M05

DURATION: 3 Hours

OCTOBER/NOVEMBER 2024 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Answer all questions in Section A (40 marks).
2. Answer any three (3) questions from Section B (60 marks).
3. Each question in section B carries a total of (20 marks).
4. Do not write anything on the question paper.
5. Do not write your name on the answer booklet.

This paper consists of 3 printed pages.

SECTION A

Answer all questions.

QUESTION 1

- a) Define the following terms:
- i) Serial number (2 marks)
 - ii) FIFO (First- in- First- Out) (2 marks)
 - iii) FEFO (First- Expired- First – Out) (2 marks)
 - iv) Standard operating Procedure (SOP). (2 marks)
 - v) Stock card. (2 marks)
- b) i) List the five (5) basic elements that should be included on a stock card. (5 marks)
- ii) State the key steps involved in receiving incoming stock. (5 marks)

QUESTION 2

- a) i) Briefly explain the purpose of stock requisition. (4 marks)
- ii) Distinguish between “stock issue” and “stock receipt” (4 marks)
- iii) Explain the meaning of the term “inventory” (2 marks)
- b) i) Define the term “stock taking” and explain its purpose in stock management. (5 marks)
- ii) Describe the process of updating stock cards and explain why it is necessary. (5 marks)

SECTION B (60 marks)

Answer ant three (3) questions.

QUESTION 3

As part of the annual audit, you are required to conduct a physical count of laboratory supplies. Outline the steps you would take to ensure accurate counting in line with organisational regulations and standards. (20 marks)

QUESTION 4

During a routine inventory check you notice discrepancies in the expiry dates recorded on the stock cards. Explain the potential impact of inaccurate expiry dates on inventory management and how this issue can be rectified.

(20 marks)

QUESTION 5

During a waste management audit, a research and development laboratory has been reported to have some broken bottles of solutions at the back of its storage cabinets and within the backyard of the laboratory. Explain the documentation and disposal procedure to be followed.

(20 marks)

QUESTION 6

As a laboratory technician responsible for distributing quantities of stock using the FIFO method (First – In First- Out). Describe how you would select items for stock issuing and the importance of following standard operating procedures.

(20 marks)

.../fem