



ZIMBABWE

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

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL DIPLOMA

IN

APPLIED BIOTECHNOLOGICAL TECHNOLOGY

**MODULE: Safety Health and Environmental
Management**

PAPER NO: 503/23/M02

DURATION: 3 Hours

REQUIREMENTS

INSTRUCTIONS TO CANDIDATES

1. Answer any five (5) questions.
2. Do not write anything on the question paper.

This paper consists of 2 printed pages.

QUESTION 1

Explain the following principles of risk assessment:

- | | | |
|----|----------------------|-----------|
| a) | Identify hazards | (4 marks) |
| b) | Assess the risks | (4 marks) |
| c) | Control the risks | (4 marks) |
| d) | Record your findings | (4 marks) |
| e) | Review the controls | (4 marks) |

QUESTION 2

Explain the importance of industrial wastewater treatment. (20 marks)

QUESTION 3

Evaluate the effectiveness of Personal Protective Equipment (PPE) in preventing occupational accidents. Support your answer with examples. (20 marks)

QUESTION 4

Discuss the categories of Threshold Limit Values (TLVs) and their significance in managing exposure to hazardous substances. (20 marks)

QUESTION 5

Outline the Standard Operating procedures for disposing of toxic waste and their role in safeguarding public health. (20 marks)

QUESTION 6

Discuss the causes of occupational hazards. (20 marks)

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NATIONAL DIPLOMA

IN

ABT, WATER AND SANITATION MANAGEMENT, EHT

MODULE: Research Methods and Statistics PAPER NO: 503/23/M09

DURATION: 3 Hours

JUNE 2026 EXAMINATION

REQUIREMENTS

- 1) Scientific calculator
- 2) Chi-square table

INSTRUCTIONS TO CANDIDATE

- 1) There are six (6) questions.
- 2) Choose any five (5) for the examination.
- 3) Each question carries 20 marks.
- 4) The exam is 3 hours.

This paper consists of 3 printed pages.

PAPER NO: 503/23/M09-RESEARCH METHODS AND STATISTICS

QUESTION 1

- a) List the five (5) key characteristics of good research objectives. (5 marks)
- b) State and explain any three (3) purposes of conducting a research. (6 marks)
- c) Discuss key aspects that characterise a research process. (9 marks)

QUESTION 2

- a) Explain the following probability sampling designs:
 - i) Simple random sampling (4 marks)
 - ii) Systematic sampling (4 marks)
 - iii) Stratified sampling (4 marks)
- b) Discuss any four (4) reasons why researchers work with samples rather than the entire population. (8 marks)

QUESTION 3

- a) Distinguish between a parameter and a static. (4 marks)
- b) Distinguish between descriptive and inferential statistics. (4 marks)
- c) Distinguish between a null hypothesis and an alternative hypothesis. (4 marks)
- d) State the disadvantage of using observation schedules during data collection. (8 marks)

QUESTION 4

Outline every stage involved in compiling a research proposal. (20 marks)

QUESTION 5

A new coagulant has been donated by a well wisher and your supervisor has tasked you to assess whether the coagulant is effective or not. Identify and describe the research design you will choose for this task. (20 marks)

QUESTION 6

Given the table below

		Treatment (floculator)		
		Mechanical	Hydraulic	Total
Was the flocculation good	Yes	28	48	76
	No	10	114	124
Total		38	162	200

The table is showing two categorical variables here

- Treatment – with either use of mechanical or hydraulic flocculator
- Flocculation outcome-either well flocculated or poorly flocculated
- 200 treatment units were observed

Using the chisquare test to investigate whether there is a relationship between The two categorical variables i.e does the outcome of flocculation process relate to type of floccutor used.

Use the value 0.05 for P

(20 marks)

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NATIONAL DIPLOMA

IN

APPLIED BIOLOGY TECHNOLOGY

**MODULE: Microscopy and Microbial
Cultivation**

PAPER NO: 503/23/M03

DURATION: 3 Hours

JUNE 2026 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Answer any five (5) questions.
2. Each question contains twenty (20) marks.
3. Do not write anything on the question paper.

PAPER NO: 503/23/M03 – MICROSCOPY AND MICROBIAL CULTIVATION

QUESTION 1

Discuss factors affecting microbial growth. (20 marks)

QUESTION 2

- a) Describe the different types of media under the following heading
- i) Non-selective media (3 marks)
 - ii) Differential media (4 marks)
 - iii) Selective media (4 marks)
- b) Describe the characteristic of suitable culture media. (7 marks)
- c) Explain the concept of cryopreservation. (2 marks)

QUESTION 3

- a) Identify the various uses of pure cultures in industry. (5 marks)
- b) Describe gram staining and how it is used to classify bacteria. (12 marks)
- c) Explain phage typing. (3 marks)

QUESTION 4

Highlight the difference between prokaryotic and eukaryotic cells. (20 marks)

QUESTION 5

Explain the functions of the parts of a microscope (20 marks)

QUESTION 6

- a) Describe the preparation of a sample of tissue for examination with a light microscope. (10 marks)
- b) Illustrate a microbial growth curve and explain the various stages. (10 marks)



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NATIONAL DIPLOMA

IN

APPLIED BIOLOGICAL TECHNOLOGY, MEAT HYGIENE

MODULE: Industrial Management

PAPER NO: 503/23/M08

DURATION: 3 Hours

JUNE 2026 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

- 1. Answer any five (5) questions.**
- 2. Do not write your name on the answer booklet.**
- 3. Do not write anything on the question paper.**

PAPER NO: 503/23/M08 - INDUSTRIAL MANAGEMENT

QUESTION 1

- a) Define the following terms:
- i) Manager (2 marks)
 - ii) Subordinate (2 marks)
 - iii) Organisational policy (2 marks)
 - iv) Resources (2 marks)
 - v) Target (2 marks)
- b) Discuss the importance of setting timelines. (10 marks)

QUESTION 2

Explain the functions of a manager. (20 marks)

QUESTION 3

- a) Discuss the importance of solving disputes at work. (12 marks)
- b) Outline the importance of task allocation in an organisation. (8 marks)

QUESTION 4

- a) With reference to relevant examples, discuss five (5) attributes of a good management team. (15 marks)
- b) State any five conflict resolution strategies. (5 marks)

QUESTION 5

Discuss the following theories of management:

- a) Scientific theory (6 marks)
- b) Human relations theory (6 marks)
- c) Theory X and Y (8 marks)

PAPER NO: 503/23/M08 - INDUSTRIAL MANAGEMENT

QUESTION 6

- a) Discuss the importance of setting targets. (6 marks)
- b) State the advantages and disadvantages of appraisals. (14 marks)

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NATIONAL DIPLOMA

IN

APPLIED BIOLOGICAL TECHNOLOGY

MODULE: Instrumental Analysis

PAPER NO: 503/23/M06

DURATION: 3 hours

JUNE 2026 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

- 1. Answer any five (5) questions.**
- 2. Each question carries 20 marks.**
- 3. Do not write your name on the answer sheet.**

This paper consists of 3 printed page.

QUESTION 1

Examine chromatography under the following headings:

- a) Liquid – solid (10 marks)
- b) Liquid – liquid (10 marks)

QUESTION 2

Discuss the following:

- a) Factors that affect electrophoresis techniques in preparation and analysis of samples. (10 marks)
- b) Limitations of the applicability of Beer-Lambert's law in spectroscopy analysis. (10 marks)

QUESTION 3

- a) With the aid of a diagram describe the principle of operation of a Geiger Muller Counter. (10 marks)
- b) Draw the count rate voltage curve of a Geiger Muller Counter. (5 marks)
- c) State any five (5) factors that affect the rate of sedimentation in a centrifuge. (5 marks)

QUESTION 4

With aid of relevant examples explain factors that affect enzymatic assays in sample analysis. (20 marks)

QUESTION 5

Outline the principle, instrumentation and application of high-performance liquid chromatography. (20 marks)

QUESTION 6

- a) Describe radio-immunoassay technique as applied in biotechnology. (10 marks)
- b) Sketch and label the instrumentation of the following:
- i) UV/visible spectrophotometer (5 marks)
 - ii) Gas chromatography (5 marks)

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NATIONAL DIPLOMA

IN

APPLIED BIOLOGICAL TECHNOLOGY

MODULE: Genetic Engineering

PAPER NO: 503/23/M04

DURATION: 3 Hours

JUNE 2026 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATES

1. Answer any five (5) questions.
2. Each question carries 20 marks.
3. Do not write your name on the answer booklet.
4. Do not write anything on the question paper.

This paper consists of 3 printed pages.

QUESTION 1

- a) Define the following terms:
- i) Gene (2 marks)
 - ii) Nucleotide (2 marks)
 - iii) DNA sequencing (2 marks)
- b) Distinguish between DNA and RNA according to Watson and crick model. (7 marks)
- c) State the enzymes involved and their functions during DNA replication. (7 marks)

QUESTION 2

- a) Describe in detail the following types of gene therapy:
- i) Somatic gene therapy (3 marks)
 - ii) Germ line gene therapy (3 marks)
- b) Outline any four applications of gene therapy (4 marks)
- c) i) Describe in detail the new generation method in DNA sequencing (6 marks)
- ii) Outline Importance of DNA sequencing (4 marks)

QUESTION 3

- a) Define the term genetic engineering (2 marks)
- b) Describe the use of the following tools in genetic engineering
- i) Restriction enzymes (2 marks)
 - ii) Vectors (2 marks)
 - iii) Genetic markers (2 marks)
 - iv) Host organisms (2 marks)
 - v) DNA ligase (2 marks)
- c) Discuss in detail any two (2) methods of inserting recombinant DNA into host cells. (8 marks)

QUESTION 4

- a) Describe how the process of genetic finger printing is carried out. (8 marks)
- b) State the names of enzymes used in PCR reactions. (8 marks)
- c) Explain how DNA replicates semi-conservatively. (4 marks)

QUESTION 5

- a) Using three nucleotides show the formation of a phosphodiester bond. (8 marks)
- b) Outline the steps involved in the production of human insulin using bacteria. (8 marks)
- c) Explain the advantages of treating diabetes with human insulin produced by gene technology. (4 marks)

QUESTION 6

Outline the types of gene mutations, chromosomal mutation and give examples of diseases that result from gene mutation. (20 marks)

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NATIONAL DIPLOMA

IN

APPLIED BIOLOGICAL TECHNOLOGY

MODULE: Plant Biotechnology

PAPER NO: 503/23/M07

DURATION: 3 hours

JUNE 2026 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. This paper contains six (6) questions.
2. Answer any five (5) questions.
3. Do not write anything on the question paper.

This paper consists of 3 printed pages.

QUESTION 1

With the aid of well-labelled diagrams describe the following methods of water transport across root cells:

- a) Symplast (7 marks)
- b) Apoplast (7 marks)
- c) Vacuolar pathway (6 marks)

QUESTION 2

- a) Describe the factors affecting the rate of transpiration. (10 marks)
- b) Outline aseptic techniques employed in tissue culture to produce disease free meristems. (5 marks)
- c) Describe the role of the following in tissue culture:
 - i) Growth media (1 mark)
 - ii) Sterilisation equipment (1 mark)
 - iii) Culture vessels (1 mark)
 - iv) Chemicals (1 mark)
 - v) Growth regulators (1 mark)

QUESTION 3

- a) Define recombinant DNA techniques. (2 marks)
- b) Outline the steps involved in recombinant DNA technology. (8 marks)
- c) Describe how *Bacillus thuringiensis* (Bt) is used in the production of pest resistance crops. (10 marks)

QUESTION 4

- a) Define the term phytochemical. (2 marks)
- b) Describe how phytochemicals are extracted and preserved for medicinal formulation. (18 marks)

QUESTION 5

Describe the design and layout of a mushroom farm structure.

(20 marks)

QUESTION 6

a) Explain the following physiological characteristics of plants.

- i) Seed germination
- ii) Dormancy
- iii) Tropisms
- iv) Photoperiodism
- v) Photomorphogenesis

(2 marks)

(3 marks)

(4 marks)

(4 marks)

(3 marks)

b) State the signs and symptoms for the following plant diseases:

- i) Powdery mildew
- ii) Black spot

(2 marks)

(2 marks)

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NATIONAL DIPLOMA

IN

APPLIED BIOLOGICAL TECHNOLOGY

MODULE: Quality Assurance

PAPER NO: 503/23/M05

DURATION: 3 Hours

JUNE 2026 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

- 1. Answer any five questions**
- 2. Each question carries 20 marks**
- 3. Do not write your name on the answer sheet.**

This paper consists of 3 printed pages.

QUESTION 1

Define the following terms.

- a) Quality control (QC) (5marks)
- b) Quality assurance (QA) (5marks)
- c) Quality systems (QS) (5marks)
- d) Total quality control (TQC) (5marks)

QUESTION 2

Highlight the importance of hazard analysis in HACCP. (20marks)

QUESTION 3

Organisations should adhere to the principle of ISO 9001 for their quality management systems. Outline the principles and benefits of ISO 9001 (20marks)

QUESTION 4

Describe the failure model effect analysis. (FMEA) (20marks)

QUESTION 5

- a) Discuss the probability techniques used in raw material sampling
 - i) Random sampling
 - ii) Stratified sampling
 - iii) Systematic sampling (10 marks)
- b) Write short notes on the following
 - i) Quality manual (2marks)
 - ii) Certificate of analysis (3marks)
 - iii) Corrective action and preventive action (3marks)
 - iv) Equipment maintenance records (2marks)

PAPER NO: 503/23/M05 QUALITY ASSURANCE

QUESTION 6

Describe the consequences of failing to implement good quality control measures in biological sample handling. (20 marks)

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NATIONAL DIPLOMA

IN

APPLIED BIOLOGICAL TECHNOLOGY

MODULE: Quality Assurance

PAPER NO: 503/23/M05

DURATION: 3 Hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Answer any five (5) questions.
2. Do not write anything on the question paper.

This paper consists of 2 printed pages.

QUESTION 1

- (a) Define the term standard Operating Procedures. (2 marks)
- (b) Give an account of the standard operating procedures for;
 - (i) Receiving and registration of samples (9 marks)
 - (ii) Analysing biological samples (9 marks)

QUESTION 2

- (a) Distinguish between random and systematic sampling techniques. (10 marks)
- (b) State the advantages and disadvantages of the ISO 9001 standard to an organisation. (10 marks)

QUESTION 3

Explain the seven steps of setting up a HACCP system in an organisation. (20 marks)

QUESTION 4

- (a) Discuss the stages involved in collecting in-process data. (10 marks)
- (b) Describe the quality standards that must be met when collecting biological samples. (10 marks)

QUESTION 5

Explain the importance of calibrating and servicing laboratory equipment. (20 marks)

QUESTION 6

Describe the following quality management tools: -

- (a) Quality control (5 marks)
- (b) Quality assurance (5 marks)
- (c) Total Quality Control (5 marks)
- (d) Total Quality Management (5 marks)

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**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL DIPLOMA

IN

APPLIED BIOTECH

SUBJECT: Genetic Engineering

PAPER NO: 503/23/M04

DURATION: 3 hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

- 1) This question paper contains six (6) questions.
- 2) Answer any five (5) questions.
- 3) Do not write your name on the answer script.

This paper consists of 3 printed pages.

PAPER NO: 503/23/M04-GENETIC ENGINEERING

QUESTION 1

- a) Outline the components making up the following:
 - i) Nucleoside (2 marks)
 - ii) Nucleotide (3 marks)
- b) Draw a simplified structure of or chromosome. (3 marks)
- c) With the aid of a diagram, describe the detailed structure of DNA. (12 marks)

QUESTION 2

- a) Define the following terms:
 - i) Gene isolation (2 marks)
 - ii) DNA sequencing (2 marks)
- b)
 - i) Outline any five (5) types of PCR. (5 marks)
 - ii) State any four (4) application of PCR testing. (4 marks)
- c) Discuss in detail the steps involved in PCR testing. (7 marks)

QUESTION 3

- a) Define the term "genetic engineering". (2 marks)
- b) With the aid of well labelled diagrams, describe in detail the use of bacteria in the synthesis of insulin. (18 marks)

QUESTION 4

- a) Discuss in detail how the following methods are you used to insert recombinant DNA into host cells:
 - i) Electroporation (4 marks)
 - ii) Microinjection (4 marks)
- b) Discuss the benefits and hazards of genetic engineering. (12 marks)

QUESTION 6

- a) Describe in detail the following methods of DNA sequencing:
- i) New generation sequencing (NGS). (8 marks)
 - ii) Sanger method (8 marks)
- b) Discuss the importance of gene isolation in genetic engineering. (4 marks)

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NATIONAL EXAMINATIONS COUNCIL
(NEXCO)

NATIONAL DIPLOMA

IN

APPLIED BIOLOGICAL TECHNOLOGY

MODULE: Plant Biotechnology

PAPER NO: 603/23/M07

DURATION: 3 Hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Answer any five questions.
2. Do not write your name on the answer script.



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NATIONAL DIPLOMA

IN

APPLIED BIOLOGICAL TECHNOLOGY

MODULE: Plant Biotechnology

PAPER NO: 503/23/M07

DURATION: 3 Hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Answer any five questions.
2. Do not write your name on the answer script.

This paper consists of 3 printed pages.

QUESTION 1

- (a) Describe how the following methods are used for transport across root cells:-
- (i) symplast (4 marks)
 - (ii) apoplast (4 marks)
 - (iii) vacuolar pathways (4 marks)
- (b) Discuss in detail with the aid of a well labelled diagram how the xylem vessels are adapted to perform their function. (8 marks)

QUESTION 2

- (a) Outline any three limiting factors affecting the rate of photosynthesis. (3 marks)
- (b) Describe the mode of action of the following plant growth regulators.:
- (i) Auxins (3 marks)
 - (ii) Gibberellins (3 marks)
 - (iii) Ethene (3 marks)
 - (iv) Absciscic acid (3 marks)
- (c) State any five causes of soil erosion. (5 marks)

QUESTION 3

- (a) Define soil conservation. (2 marks)
- (b) Explain in detail the following methods of soil conservation:-
- (i) Crop rotation (5 marks)
 - (ii) Reforestation (5 marks)
 - (iii) Contour planting (4 marks)
 - (iv) Terracing (4 marks)

QUESTION 4

- (a) Define the term :-
- (i) Tissue culturing (2 marks)
 - (ii) Aseptic techniques (2 marks)

- (b) Outline the different aseptic techniques employed in tissue culturing to produce disease free meristems. (6 marks)
- (c) Explain the following culturing techniques:
- (i) Seed culture (3 marks)
 - (ii) Callus culture (4 marks)
 - (iii) Protoplast culture (3 marks)

QUESTION 5

- (a) Define the terms:
- (i) Recombinant DNA technology (2 marks)
 - (ii) Transgenic plants (2 marks)
 - (iii) DNA extraction (2 marks)
- (b) State any four transgenic plants. (4 marks)
- (c) Discuss the benefits and hazards of transgenic crops. (10 marks)

QUESTION 6

- (a) Define the following terms:-
- (i) Photochemical (2 marks)
 - (ii) Organic fertiliser (2 marks)
- (b) Outline any three benefits and any three challenges of organic fertilisers. (6 marks)
- (c) Discuss in detail the following principles:-
- (i) Composting (5 marks)
 - (ii) Bioremediation (5 marks)

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NATIONAL DIPLOMA

IN

APPLIED BIOLOGICAL TECHNOLOGY

MODULE: Research Methods

PAPER NO: 503/23/M09

DURATION: 3 Hours

OCTOBER / NOVEMBER 2024 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Answer any five (5) questions.
2. Do not write your name on the answer booklet.

This paper consists of 2 printed pages.

QUESTION 1

a) Define the following terms:

- i) Research (2 marks)
- ii) Research gap (2 marks)
- iii) Research problem (2 marks)
- iv) Research scope (2 marks)
- v) Research limitations (2 marks)

- b) i) Distinguish between qualitative and quantitative data collection methods. (6 marks)
- ii) Explain two (2) reasons why it is important to validate data collection tools. (4 marks)

QUESTION 2

- a) Explain the significance of developing a research hypothesis at the beginning of a study. (8 marks)
- b) Discuss the importance of conducting a literature review in research. (12 marks)

QUESTION 3

- a) Distinguish between probability and non-probability sampling techniques. (8 marks)
- b) Describe four commonly used tools for primary data collection in qualitative research. (12 marks)

QUESTION 4

Describe the structure of a research report. (20 marks)

QUESTION 5

Examine any four (4) types of research methodologies. (20 marks)

QUESTION 6

Discuss the ethical issues involved in direct observation as a tool for primary data collection. (20 marks)

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Discuss the ethical issues involved in direct observation as a tool for primary data collection. (20 marks)

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