-SQA-SCOTTISH QUALIFICATIONS AUTHORITY

Hanover House
24 Douglas Street
GLASGOW G2 7NQ

NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number-	**7311021**	**-Session-1991-92**
-Superclass-	**RH**	

-Title- **CELL BIOCHEMISTRY**

-DESCRIPTION-

Purpose

This module is designed to extend and develop the student's knowledge and skills required in cell biochemistry.

The module is suitable for inclusion in Biology or Human Biology programmes and offered in conjunction with other Stage 2 Biology modules it could be a preparation for Higher Education.

Preferred Entry Level

7310011 Introducing Cell Structure and Function,
7310021 Introducing Cell Processes or Standard Grade Biology at Grade 3

Outcomes

The student should:

1. apply the concept of molecular structure to cell components;
2. apply the concept of enzyme action to cell reactions;
3. apply the concept of chemical pathways to cell processes;
4. perform and report on experiments relating to cell processes.

Assessment Procedures

Acceptable performance in this module will be satisfactory achievement of all the Performance Criteria specified for each Outcome.

The following abbreviations are used below:

PC Performance Criteria

IA Instrument of Assessment

Note: The Outcomes and PCs are mandatory and cannot be altered. The IA may be altered by arrangement with SQA. (Where a range of performance is indicated, this should be regarded as an extension of the PCs and is therefore mandatory.)

OUTCOME 1 **APPLY THE CONCEPT OF MOLECULAR STRUCTURE TO CELL COMPONENTS**

PCs

(a) The description of the molecular structure of cell chemicals is correct with respect to:

(i) constituent molecules;
(ii) arrangement of constituent molecules;
(iii) bonding.

(b) The application of the concept of molecular structure to given cell components is correct in relation to:

(i) reactive sites;
(ii) structural properties.

IA Structured Questions

3 structured questions to assess the student's ability to apply the concept of molecular structure to cell components.

There should be 1 question on each of the following:

(i) proteins;
(ii) carbohydrates;
(iii) lipids.

The questions should be structured so that Performance Criterion (a) and the appropriate part(s) of (b) are covered in each question. Both parts of Performance Criterion (b) must be assessed at least once.

Satisfactory achievement of the Outcome will be demonstrated by the student achieving all the Performance Criteria specified for each question.

OUTCOME 2 **APPLY THE CONCEPT OF ENZYME ACTION TO CELL REACTIONS**

PCs

(a) The description of enzyme action is correct in terms of:

(i) effect on rate of reaction;
(ii) the lock and key hypothesis.

(b) The application of the concept to cell reactions is correct with respect to:

(i) the effect of pH;
(ii) the effect of temperature;
(iii) the effect of inhibitors;
(iv) the effect of enzyme and substrate concentrations.

IA Structured Questions

5 structured questions to assess the student's ability to apply the concept of enzyme action to cell reactions.

The questions should be allocated as follows:

PC (a) 1 question
(b) 4 questions (one on each of the four parts).

Satisfactory achievement of the Outcome will be demonstrated by the student achieving all the Performance Criteria.

OUTCOME 3 **APPLY THE CONCEPT OF CHEMICAL PATHWAYS TO CELL PROCESSES**

PCs

(a) The outline of the chemical pathway is correct.
(b) The identification of the locations of the chemical pathways is correct.
(c) The description of energy involvement is correct.

IA Structured Questions

2 structured questions to assess the student's ability to apply the concept of chemical pathways to cell processes.

The questions should be allocated as follows:

1 question on respiration
1 question on photosynthesis

Satisfactory achievement of the Outcome will be demonstrated by the student achieving all the Performance Criteria for each of the questions.

OUTCOME 4 **PERFORM AND REPORT ON EXPERIMENTS RELATING TO CELL PROCESSES**

PCs

(a) The preparation for an experimental procedure is:

(i) in accordance with given specifications;
(ii) correct with respect to setting up equipment.

(b) The experimental procedures carried out are correct and safe.
(c) The recorded results are in an appropriate format.
(d) The interpretation of data is correct with respect to:

(i) experimental errors and appropriate means of reduction;
(ii) reliability of results.

(e) The conclusions drawn are valid.

IA Assignments

2 assignments to assess the student's ability to perform and report on experiments relating to cell processes.

A checklist should be devised to ensure a reliable interpretation of the student's practical performance for Performance Criteria (a) and (b).

The student will be required to produce a scientific report for Performance Criteria (c)-(e). The report must be structured and contain the following sections: aims, procedures, results, conclusions.

Satisfactory achievement of the Outcome will be demonstrated by the student achieving all the Performance Criteria for each assignment.

The following sections of the descriptor are offered as guidance.
They are not mandatory.

CONTENT/CONTEXT

Corresponding to Outcomes 1-4:

1. Proteins — carbon, hydrogen, nitrogen, oxygen, amino acids, polypeptide chains. Consist of one or more polypeptide chains, peptide bonds, disulphide bonds, non-covalent forces.

   Reactive sites: enzymes - active site
   haemoglobin - O_2 transport.
   insulin - hormone action.
   Structural: membrane proteins
   connective tissue - collagen, elastin, keratin,
   muscle proteins.

   Carbohydrates — carbon, hydrogen, oxygen, monosaccharides, disaccharides, polysaccharides, covalent bonding, glycosidic bonds.

   Structural: starch granules, glycogen granules.
   cellulose - cell wall.

   Lipids — carbon, hydrogen, oxygen, fatty acid, glycerol, phosphate, phospholipids, glycolipids, covalent, non covalent forces.

   Structural: membrane - lipid bilayer.

2. Enzyme — specificity, complementary shape of substrate and active site of enzyme, cofactors, ATP, enzyme-substrate-complex, the enzyme remains unaltered, product formation. Optimum temperature, optimum pHs, denaturation. Inhibitors - reversible/irreversible, competition with substrate.

3. Respiration (Aerobic and Anaerobic).

   Glycolysis — 6C glucose broken down to 3C pyruvic acid takes place in cytoplasm.
   Net production of energy - ATP.

   Krebs Cycle — Acetyl CoA (2C) + Oxaloacetic acid (4C) produces citric acid (6C) which is converted to 5C then 4C.
   Reduced coenzyme produced eg. NADH. Energy is produced (substrate level phosphorylation).
   Takes place in matrix of mitochondrion.

Cytochrome System (Electron Transport Chain)	Series of hydrogen carriers. Production of ATP, carbon dioxide, water. Takes place on cristae of mitochondrion.
Anaerobic	Glycolysis plus conversion of pyruvic acid into lactic acid or ethanol. Takes place in cytoplasm.

Photosynthesis

Light dependent stage	photolysis - production of ATP, hydrogen (hydrogen carriers - NADP) Chlorophyll molecules in thylakoid membranes of chloroplasts.
Carbon fixation (Calvin cycle)	ribulose biphosphate, phosphoglyceric acid, glyceraldehyde phosphate. Requires ATP. Input stroma of chloroplasts.

Active Transport

eg. sodium/potassium pump.

Membrane transport proteins, ATPase, energy requirement. Binding to carrier proteins, phosphorylation/dephosphorylation, translocation, release.

4. Suggested assignments - investigate effects of pH, temperature, inhibitors on enzymes, Hill reaction.

SUGGESTED LEARNING AND TEACHING APPROACHES

During the work of the module students should have several opportunities to practise their skills. Each student should be assessed at appropriate points throughout the module. Where a student is unsuccessful in achieving an Outcome, provision should be made for remediation and reassessment.

A student-centred, resource-based approach is likely to be the most flexible for this module. The Outcomes can be integrated so that concepts can be developed.

Laboratory practical work is likely to play a significant part in this module. Due consideration should be given to safety at all times.

Selection of data, tabulating and drawing conclusions are examples of a problem-solving approach appropriate for establishing concepts.

The module could be integrated with other Stage 2 Biology modules.