



Higher National Unit specification

General information for centres

Unit title: Biochemistry: Theory and Practice

Unit code: DH2J 34

Unit purpose: This Unit is designed to provide candidates with an introduction to, and understanding of, the relationship between structure and function of major types of biological molecules. It also covers processes of energy production involving these molecules as well as the role of enzymes in these processes.

On completion of the Unit the candidate should be able to:

1. Explain the relationship between structure and function in major groups of biological molecules.
2. Discuss the production of ATP.
3. Explain the role of enzymes in biological processes.
4. Demonstrate practical skills in biochemistry.

Credit value: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: Access to this Unit will be at the discretion of the centre, however it is recommended that candidates should have experience of studying biology at Intermediate 2 or Higher level.

Core Skills: There may be opportunities to gather evidence towards Core Skills in Communication at a higher level in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: This Unit is included in the framework of the Group Award, HNC Applied Sciences and HND Biotechnology. It is recommended that it should be taught and assessed within the subject area of the particular Group Award to which it contributes.

Assessment: This Unit could be assessed in several ways, eg either by three separate assessments (one per Outcome) for Outcomes 1 - 3, or by problem solving activities or by a holistic extended case study covering all 3 Outcomes.

General information for centres (cont)

Where separate assessments are used for each Outcome, candidates are required to produce short, restricted responses to written questions in order to demonstrate their understanding. These should be assessed by a supervised closed-book test.

It is not necessary that the students are assessed under closed-book conditions where problem-solving activities or case studies are used. It is recommended that candidates be provided with the case study very early on in order to familiarise themselves with the information.

Outcome 4 is an assessment of practical skills where evidence is recorded by either submission of a laboratory report or in the form of a checklist.

Candidates must meet the level of performance specified in the Evidence Requirements for all assessments to achieve the Unit.

Higher National Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and Evidence Requirements are mandatory.

Outcome 1

Explain the relationship between structure and function in major groups of biological molecules

Knowledge and/or Skills

- ◆ Nucleic acids
- ◆ Proteins
- ◆ Lipids
- ◆ Carbohydrates

Evidence Requirements

A candidate's response will be judged satisfactory where the evidence provided is sufficient to meet the requirements of each item by showing that the candidate is able to:

- ◆ describe building blocks
- ◆ describe the nature of bonds
- ◆ describe levels of structure
- ◆ describe properties
- ◆ explain functions

Evidence could be gathered using a closed-book assignment under supervised conditions which should be completed in one hour. Candidates must obtain 60% of the marks available in order to pass

Alternatively candidates may be assessed by a more holistic approach for Outcomes 1, 2 and 3 utilising either problem solving activities or a Unit assignment in the form of an extended case study. Further details of these approaches are given under Outcome 3.

Higher National Unit specification: statement of standards (cont)

Unit title: Biochemistry: Theory and Practice

Assessment Guidelines

This Outcome could be assessed by a closed-book assignment which may take the form of short answer responses to a series of questions which tests the candidates knowledge and understanding of the topics listed. Alternatively a single end of Unit holistic test could be used to generate evidence. In this case, this assessment should be taken under closed-book supervised conditions with an overall pass mark of 60%

Outcome 2

Discuss the production of ATP

Knowledge and/or Skills

- ◆ Choice of ATP as an energy currency
- ◆ Cellular Respiration
- ◆ Photosynthesis

Evidence Requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ choose ATP as an energy currency

The candidate must demonstrate an understanding of the properties of ATP which make it suitable as an immediate donor of free energy.

- ◆ explain cellular respiration

The candidate must demonstrate an understanding of the processes of aerobic and anaerobic cellular respiration.

- ◆ explain photosynthesis

The candidate must demonstrate an understanding of oxygenic photosynthesis in C3 plants.

The candidate will need evidence to demonstrate their knowledge and/or skills by showing that they can, in a piece of written work cover all of the points listed under knowledge and/or skills. This work should be the candidate's individual work and could be in the form of a short answer closed-book assignment. A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each item.

Assessment Guidelines

This Outcome could be assessed by a closed-book assignment which may take the form of short answer responses to a series of questions which tests the candidates knowledge and understanding of the topics listed. Alternatively a single end of Unit holistic test could be used to generate evidence. In this case, this assessment should be taken under closed-book supervised conditions with an overall pass mark of 60%

Higher National Unit specification: statement of standards (cont)

Unit title: Biochemistry: Theory and Practice

Outcome 3

Explain the role of enzymes in biological processes

Knowledge and/or Skills

- ◆ Molecular nature of enzymes
- ◆ Biological functions
- ◆ Mechanisms of action
- ◆ Effect of conditions on activity

Evidence Requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ explain the molecular nature of enzymes

The candidate must demonstrate an understanding of the protein or RNA nature of enzymes.

- ◆ explain biological functions

The candidate must demonstrate an understanding of the concept of catalysis in relation to enzyme activity.

- ◆ explain mechanism of action

The candidate must demonstrate an understanding of the concept of active sites.

- ◆ explain the effect of various conditions on enzyme activity.

The candidate must demonstrate an understanding of the concept of optimum conditions for enzyme activity.

The candidate will need evidence to demonstrate their knowledge and/or skills by showing that they can, in a piece of written work cover all of the points listed under knowledge and/or skills. This work should be the candidate's individual work and will be in the form of a short answer closed-book assignment. A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each item.

Assessment Guidelines

This Outcome could be assessed by a closed-book assignment which may take the form of short answer responses to a series of questions which tests the candidates knowledge and understanding of the topics listed. Alternatively a single end of Unit holistic test could be used to generate evidence. In this case, this assessment should be taken under closed-book supervised conditions with an overall pass mark of 60%

Higher National Unit specification: statement of standards (cont)

Unit title: Biochemistry: Theory and Practice

Outcome 4

Demonstrate practical skills in biochemistry

Knowledge and/or Skills

- ◆ Identification of biological molecules.
- ◆ Cellular respiration.
- ◆ Enzymes in biological processes.

Evidence Requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify an unknown biological molecule from its chemical and physical properties.
- ◆ perform an investigation of dehydrogenase activity in yeast.
- ◆ perform an investigation of the effect of changing environmental conditions, and/or inhibitor, on a named enzyme.

Evidence for this Outcome can be gathered by the use of practical activities. This will be assessed by either a checklist completed by the lecturer, or by submission of a laboratory report by the student.

Assessment Guidelines

This Outcome should be assessed by the use of practical experiments. This Outcome will be used to reinforce the theoretical knowledge gained in Outcomes 1-3 and will be assessed by either a checklist or by submission of a laboratory report.

Administrative Information

Unit code: DH2J 34

Unit title: Biochemistry: Theory and Practice

Superclass category: RH

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History of changes:

Version	Description of change	Date
02	Changes made to standardise assessment guidelines.	03/06/09

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Higher National Unit specification: support notes

Unit title: Biochemistry: Theory and Practice

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit is primarily intended to provide the candidate with an introduction to, and basic understanding of three main topics in biochemistry: namely, biological molecules, bioenergetics and the role of enzymes. The essential underpinning knowledge and skills gained here will be invaluable during further study of topics such as metabolism, fermentation and applied biochemistry.

Outcome 1 examines the relationship between structure and function of biological molecules. Candidates should become familiar with the following features:

- ◆ Nucleic Acids: DNA, mRNA, tRNA, rRNA; covalent structure; nucleotides; phosphodiester bonds; primary and secondary structures; functions.
- ◆ Proteins: amino acids; peptide bonds; primary, secondary, tertiary and quaternary structure; globular and fibrous proteins; functions.
- ◆ Lipids: simple lipids (TAGs); compound lipids (phosphoglycerides, sphingolipids, glycolipids); derived lipids (steroids); ester bonds; properties; functions (structural component of membranes, energy reserve).
- ◆ Carbohydrates: chemical composition; glycosidic linkages; properties of mono- and polysaccharides; functions (structural and storage).

Outcome 2 concentrates on providing candidates with an understanding of the role of ATP in cellular metabolism. The knowledge and/or skills which should be covered are:

- ◆ Energy currency: structure of ATP; phosphoanhydride bonds; free energy; biological half-life.
- ◆ Cellular respiration: aerobic vs anaerobic; glycolysis, TCA cycle, electrochemical gradient, ATP synthase (overview only); fermentation; energy yields.
- ◆ Photosynthesis: light dependent phase (photolysis); light harvesting pigments (primary and antenna complexes); reaction centres; carbon-fixation phase (Calvin cycle); limiting factors.

Higher National Unit specification: support notes (cont)

Unit title: Biochemistry: Theory and Practice

Outcome 3 concentrates on providing candidates with an understanding of how enzymes function in biological pathways. The knowledge and/or skills which should be covered are:

- Molecular nature: globular proteins; ribozymes.
- Biological functions: catalysts; lowering of activation energy.
- Mechanism of action: active sites (conformation and functional groups); coenzymes; prosthetic groups.
- Factors: temperature; pH; substrate concentration; competitive and non-competitive inhibitors.

Outcome 4 concentrates on allowing candidates to gain practical skills in biochemistry. These skills include identification of biological molecules using biochemical tests and investigation of factors effecting enzyme activity. It is important that this Outcome is used to reinforce the theoretical knowledge gained in all Outcomes. Students should adhere to Health and Safety requirements.

Guidance on the delivery and assessment of this Unit

This Unit is likely to form part of a Group Award which is primarily designed to provide candidates with knowledge and/or skills related to employment/further study in biological sciences. The Unit requires the candidate to be familiar with chemical terminology and concepts and hence it is expected to be delivered subsequent to units in chemistry in the first year of the HND Biotechnology. Where possible during the delivery, links should be drawn from situations which candidates will understand and/or be familiar with.

It is essential that emphasis is placed on candidates understanding of the key concepts (eg relationship between structure and function) rather than on the minutiae of details. Instruments of assessment should be constructed with this in mind.

The use of candidate-centred, resource-based methodologies should be as extensive as possible to promote independent study.

Assessment of Outcomes 1-3 is by production of appropriate written evidence. It is recommended that this evidence should be generated either by short answer/restricted response tests or by problem solving activities or by a more holistic extended case study. Where evidence is found to be unsatisfactory, candidates may be questioned in order to identify particular problems with specific area(s). Support tutorials may prove to be useful in providing a solution to these problems. During remediation only the inadequate section or sections require to be re-assessed.

Assessment of practical skills in Outcome 4 is by observation and checklist, and/or submission of a lab report, although the production of lab reports would be encouraged.

Higher National Unit specification: support notes (cont)

Unit title: Biochemistry: Theory and Practice

Open learning

If this Unit is delivered by open or distance learning methods, additional planning resources may be required for candidate support, assessment and quality assurance.

A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements

General information for candidates

Unit title: Biochemistry: Theory and Practice

This is a 1 credit HN Unit at SCQF level 7 intended for candidates undertaking the Group Award, HNC Applied Sciences and HND Biotechnology. It is designed to provide you with an introduction to some of the key topics in biochemistry: biological molecules, bioenergetics and enzymes.

On completion of this Unit you should be able to:

1. Explain the relationship between structure and function in major groups of biological molecules.
2. Discuss ATP production.
3. Explain the role of enzymes in biological processes.
4. Demonstrate practical skills in biochemistry

The four Outcomes which make up the Unit are described below;

Outcome 1

You will be introduced to the major groups of biological molecules. The lectures/tutorials for this Outcome will focus on particular aspects such as how these molecules are constructed in terms of building blocks, bonds and levels of structural organisation. You will also learn how their particular structure lends itself to their biological roles.

Outcome 2

This Outcome focuses on the use of ATP as an energy currency. The reasons why ATP is used will be discussed along with the processes of cellular respiration and photosynthesis.

Outcome 3

In this Outcome you will be introduced to the role played by enzymes in biological processes (such as respiration and photosynthesis covered in Outcome 2. Lectures/tutorials will focus on how these molecules perform their tasks and the conditions in which they need to operate effectively.

This Unit may be assessed by a project. Alternatively, it may be assessed by separate shorter assessments or problem solving activities under closed-book conditions.

To pass this Unit you must achieve at least 60% of the marks available in all assessments.

Outcome 4

This Outcome concentrates on the use of practical activities to reinforce the theoretical knowledge you will have gained from Outcomes 1 – 3. You will be required to produce evidence of having carried out practical activities for Outcome 4. Assessment of this Outcome will take the form of practical experiments and will be assessed either by a checklist, to be completed by the lecturer, or the form of a laboratory report. This will be at the discretion of your lecturer.