



Higher National Unit specification

General information for centres

Unit title: Human Metabolism

Unit code: DN39 35

Unit purpose: This Unit is designed to give candidates the opportunity to develop their knowledge and understanding of human metabolism and its control and regulation.

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

1. Describe the role of enzymes in human metabolism.
2. Outline the main concepts in human metabolism.
3. Describe carbohydrate metabolism.
4. Describe lipid metabolism.
5. Describe protein metabolism.
6. Perform a range of experiments on metabolism.

Credit points and level: 2 HN credit at SCQF level 8: (16 SCQF credit points at SCQF level 8*)

**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 studied the HN Units Human Body Structure and Function, (DG71 35) and Fundamental Chemistry: Theory and Practice, (DH2K 34).

Core Skills: There may be opportunities to gather evidence towards the Core Skills of Communication, Problem Solving and Working with Others at 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, HND Biomedical Science. It is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: Assessment of Outcomes 1-5 of this Unit will consist of a closed-book supervised holistic assessment with a cut off score of 60%. Outcome 6 will be assessed by completion of a laboratory log book and checklists.

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.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Describe the role of enzymes in human metabolism.

Knowledge and/or Skills

- ◆ Biomedical importance of enzymes
- ◆ Enzymes structure, factors affect enzyme activity
- ◆ Enzyme specificity, lock and key and induced fit models
- ◆ Importance of vitamins and minerals in metabolism (coenzymes)
- ◆ Enzyme kinetics (activation energy and transition state, Michaelis-Menton equation, K_m and V_{max} based on Michaelis-Menten and Lineweaver Burke graphs, inhibitors)

Outcome 2

Outline the main concepts in human metabolism.

Knowledge and/or Skills

- ◆ Catabolism, anabolism, amphibolic pathways
- ◆ Role, structure and production of ATP, (oxidative and substrate phosphorylation in brief)
- ◆ Metabolic control and its importance (covalent modification, enzyme induction, allosteric interactions, negative feedback and hormones)
- ◆ Integration of metabolic pathways

Outcome 3

Describe carbohydrate metabolism.

Knowledge and/or Skills

- ◆ Role of cells
- ◆ Pathways (glycolysis, TCA cycle, glycogen metabolism, gluconeogenesis)

Higher National Unit specification: statement of standards (cont)

Unit title: Human Metabolism

- ◆ Regulation
- ◆ Regulation of blood sugar levels

Outcome 4

Describe lipid metabolism.

Knowledge and/or Skills

- ◆ Role of cells and links to other pathways
- ◆ Pathways (TAG synthesis, fatty acid synthesis, beta oxidation, ketone metabolism)
- ◆ Regulation

Outcome 5

Describe protein metabolism

Knowledge and/or Skills

- ◆ Protein anabolism
- ◆ Protein catabolism
- ◆ Pathways of urea cycle
- ◆ Process of deamination

Evidence Requirements

It is recommended that a holistic assessment at the end of the Unit is given to the candidates for Outcomes 1-5. The assessment should be a closed-book assessment carried out under supervised conditions of two hours duration. This closed-book assessment should take the form of a set of structured questions and restricted responses to test the candidate's knowledge and understanding. Evidence for the knowledge and/or skills for these Outcomes will be provided on a sample basis and should include a representative range of questions to reflect the knowledge and/or skills items listed under the Evidence Requirements. The sampling is as follows:

Four of the five knowledge and/or skills items from Outcome 1
Three of the four knowledge and/or skills items from Outcome 2
Three of the four knowledge and/or skills items from Outcome 3
Two of the three knowledge and/or skill items from Outcome 4
Three of the four knowledge and/or skills items from Outcome 5

Each candidate will need evidence to show that s/he has achieved the threshold score set for this Unit. An overall threshold of 60% is recommended, however it is recommended that candidates should be able to demonstrate understanding in each of the Outcomes.

Higher National Unit specification: statement of standards (cont)

Unit title: Human Metabolism

Assessment Guidelines

Assessment of Outcomes 1-5 of this Unit will consist of a closed-book, supervised, holistic assessment with a cut off score of 60%. This assessment would take the form of set of structured and restricted response questions to test the candidate's knowledge and understanding.

Outcome 6

Perform a range of experiments on metabolism.

Knowledge and/or Skills

- ◆ Experiments are performed using established techniques
- ◆ Maintain a lab book of experiments an to appropriate standard
- ◆ Determination of V_{max} and K_m for a named enzyme
- ◆ Determination of the effect of inhibitors on enzyme activity
- ◆ Heath and Safety regulations

Evidence Requirements

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

- ◆ Perform metabolic experiments using appropriate techniques
- ◆ Prepare calibration graph
- ◆ Use qualitative methods to identify carbohydrates, proteins and lipids
- ◆ Maintain a laboratory log book to an agreed format
- ◆ Follow current Health and Safety practices

This Outcome should be assessed by a range of laboratory based practical experiments. Candidates should maintain a laboratory logbook to an agreed format. The experiments should between them, cover all the areas listed in knowledge and/or skills for Outcome 6. Checklists should be used to generate evidence that practical techniques have been performed to a satisfactory standard

Assessment Guidelines

A range of experiments will be given to students to ensure that all knowledge and skills items are assessed. This Outcome also provides an opportunity to include the concept of GLP and use of IT to produce graphs.

Administrative Information

Unit code: DN39 35

Unit title: Human Metabolism

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

Source: SQA

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Higher National Unit specification: support notes

Unit title: Human Metabolism

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 80 hours.

Guidance on the content and context for this Unit

Outcome 1 provides an overview of the role of enzymes, their structure, function and methods for determining enzyme activity. Candidates should become aware of the central role of enzymes in metabolism and their specificity.

Enzymes in human metabolism:

Enzymes:	Reaction rates, biological catalysts, integrate with Outcomes 3-5.
Structure:	Primary, secondary, tertiary and quaternary, enzyme concentration, pH, temperature, inhibitors.
Enzyme specificity:	Lock and key and induced fit models
Coenzymes:	Vitamin B ₁₂ and minerals, calcium, zinc
Enzyme kinetics:	Determination of V_{max} and K_m from graphs, Michaelis-Menton and Lineweaver Burke; affect of competitive and non-competitive inhibitors, and their determination from the graphs.

Outcome 2 provides an overview of the main concepts in human metabolism

Concepts in metabolism

Catabolism:	Degradation reaction (glycolysis, beta oxidation)
Anabolic:	Synthesis reactions (protein formation, glycogen formation)
Amphibolic:	Working both ways (glycolysis, gluconeogenesis)
ATP:	Structure, function and production
Control:	Negative feed back inhibition (insulin-glucagon)
Integration:	Oxidation of carbohydrates, proteins and lipids, central role of TCA cycle

Outcome 3 provides an outline of carbohydrate metabolism

Glycolysis:	Stages of glycolysis, integrate with amphibolic pathways (glycolysis/gluconeogenesis)
TCA:	Precursors to cycle, integrate with protein and lipid metabolism, NADH, FADH, cytochrome chain, integrate with ATP synthesis
Hormonal control:	Insulin, glucagons

Outcome 4 provides an outline of lipid metabolism

TAG synthesis:	Acetyl coA, activation of fatty acid
Fatty acid anabolism and catabolism	beta oxidation, and the central role of acetyl coA ketone bodies

Higher National Unit specification: support notes (cont)

Unit title: Human Metabolism

Outcome 5 provides an outline of protein metabolism

Protein anabolism: Transcription, translation, amino acid precursors

Protein catabolism: Link with energy generation

Urea cycle: Deamination, removal of nitrogenous waste, role of liver

Outcome 6 Perform a range of experiments on metabolism

Calibration graph

Rate of reaction graph

Enzyme inhibition

Lipid digestion

This Outcome provides an opportunity to include the concept of GLP and use of IT to produce graphs. In this Outcome, the experiments could be done as a group activity although a logbook must be kept by each candidate.

Guidance on the delivery and assessment of this Unit

Opportunities for developing Core Skills

This Unit is included in the framework of the Group Award HND Biomedical Sciences.

Laboratory experiments should be carried out at appropriate times during each Outcome.

The closed-book assessment should be given on completion of Outcomes 1-5.

Open learning

If this Unit is delivered by open learning methods, additional planning resources may be required for candidate support, assessment and quality assurance. Provision for supervised laboratory work should be made.

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: Human Metabolism

This is a 2 credit HN Unit at SCQF level 8. This Unit consists of six learning Outcomes and is assessed by means of a holistic assessment under closed-book condition and the participation in a range laboratory practicals for which a laboratory logbook must be maintained.

Outcome 1

Candidate will demonstrate knowledge of the role of enzymes. You will study an overview of the role of enzymes, their structure and function and methods for determining enzyme activity. You will become aware of the central role of enzymes in metabolism and their specificity.

Outcome 2

Candidate will demonstrate knowledge of basic concepts of metabolism. You will study main concepts including catabolism, anabolic, amphibolic, ATP, control and integration.

Outcome 3

Candidate will demonstrate knowledge of carbohydrate metabolism. You will study glycolysis, TCA cycle and hormonal control.

Outcome 4

Candidate will demonstrate knowledge of lipid metabolism. You will study TAG synthesis and fatty acid anabolism and catabolism.

Outcome 5

Candidate will demonstrate knowledge of protein metabolism. You will study protein anabolism and catabolism and the urea cycle.

Outcome 6

Candidate will perform a range of laboratory practicals and maintain a laboratory logbook. You will include calibration graphs, rate of reaction graphs and cover practicals which include enzyme inhibition and lipid digestion.

Assessment of Outcomes 1 – 5 of this Unit will consist of a closed-book end of Unit holistic assessment with a cut off score of 60%. In Outcome 6 where practical skills are assessed, a laboratory logbook must be maintained and evidence of good laboratory techniques should be recorded in the form of a checklist.