

Biology: Multicellular Organisms

SCQF: level 5 (6 SCQF credit points)

Unit code: H208 75

Unit outline

The general aim of this Unit is to develop skills of scientific inquiry, investigation and analytical thinking, along with knowledge and understanding of multicellular organisms. Learners will apply these skills when considering the applications of multicellular organisms on our lives, as well as the implications on society/the environment. This can be done by using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of: cells, tissues and organs; stem cells and meristems; control and communication; reproduction; variation and inheritance; the need for transport; and effects of lifestyle choices on human transport and exchange systems. Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Learners who complete this Unit will be able to:

- 1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment/practical investigation
- 2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills

This Unit is available as a free-standing Unit. The *Unit Support Notes* in the Appendix provide advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in *Unit Assessment Support*.

Recommended entry

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- ◆ National 4 Biology Course or relevant component Units

Equality and inclusion

This Unit Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. For further information, please refer to the Appendix: *Unit Support Notes*.

Standards

Outcomes and Assessment Standards

Outcome 1

The learner will:

- 1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment/practical investigation by:**
 - 1.1 Planning an experiment/practical investigation
 - 1.2 Following procedures safely
 - 1.3 Making and recording observations/measurements correctly
 - 1.4 Presenting results in an appropriate format
 - 1.5 Drawing valid conclusions
 - 1.6 Evaluating experimental procedures

Outcome 2

The learner will:

- 2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills by:**
 - 2.1 Making accurate statements
 - 2.2 Solving problems

Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used.

The key areas covered in this Unit are: cells, tissues and organs; stem cells and meristems; control and communication; reproduction; variation and inheritance; the need for transport; and effects of lifestyle choices on human transport and exchange systems.

Evidence can be drawn from a variety of sources and presented in a variety of formats.

The following table describes the evidence for the assessment standards which require exemplification. Evidence may be presented for individual outcomes, or gathered for the unit. If the latter approach is used, it must be clear how the evidence covers each outcome.

Assessment Standard	Evidence required
Planning an experiment/practical investigation	The plan should include: <ul style="list-style-type: none">◆ an aim◆ a dependent and independent variable◆ key variables to be kept constant◆ measurements/observations to be made◆ the resources◆ the method including safety considerations
Presenting results in an appropriate format	One format from: table, line graph, chart, key, diagram, flow chart, summary or other appropriate format
Drawing a valid conclusion	Include reference to the aim
Evaluating experimental procedures	Suggest an improvement with justification
Making accurate statements	At least half of the statements should be correct across the key areas of this Unit.
Solving problems	One of each: <ul style="list-style-type: none">◆ make generalisations/predictions◆ select information◆ process information, including calculations, as appropriate◆ analyse information

Exemplification of assessment is provided in *Unit Assessment Support*. Advice and guidance on possible approaches to assessment is provided in the Appendix: *Unit Support Notes*.

Assessment Standard Thresholds

Outcome 1

Candidates are not required to show full mastery of the assessment standards to achieve outcome 1. Instead, five out of the six assessment standards for outcome 1 must be met to achieve a pass. Candidates must be given the opportunity to meet all assessment standards. The threshold has been put in place to reduce the volume of re-assessment where that is required.

Transfer of evidence

Evidence of outcome 1 in a unit is transferrable between the other units at SCQF level 5.

Re-assessment

Candidates can be given the opportunity to re-draft their original outcome 1 report or to carry out a new experiment/practical investigation.

Outcome 2

There is no requirement to pass assessment standard 2.1 (making accurate statements) and assessment standard 2.2 (solving problems) independently. Candidates can be assessed using a single test that contains marks and a cut-off score.

A suitable unit assessment will cover all of the key areas (assessment standard 2.1) **and** assess each of the problem-solving skills (assessment standard 2.2).

Where a candidate achieves 50% or more of the total marks available in a single unit assessment, they will pass outcome 2 for that unit. Existing unit assessment support packs (UASPs) can be used, or centres can replace the questions with suitable alternatives of a similar standard.

Unit assessment support pack 1 (unit-by-unit approach) contains questions on all of the key areas (AS 2.1) and questions covering each of the problem solving skills (AS 2.2), and may be adapted for use as a single assessment. The number of marks available for each question should be combined to give the total number of marks available. A cut-off score of 50% should be applied to the unit assessment.

Outcome 2 assessment activity 2 tests contain questions covering assessment standards 2.1 and 2.2 in a single assessment.

Unit assessment support pack 2 (combined approach) contains questions covering only assessment standard 2.1. They are not suitable for use as a single assessment. If a centre chooses to use UASP 2 as a single unit assessment, questions covering each of the four problem solving skills would need to be added. The marks available for the key areas (AS 2.1) should be combined with the marks added to assess the problem solving skills (AS 2.2) before the 50% cut-off score is applied. Where centres are adding additional questions, care should be taken that these questions are of an appropriate standard for unit assessment and are not 'A grade' type questions.

Important note: Centres can continue to assess AS 2.1 and 2.2 separately using the existing UASPs. If this option is chosen, 50% or more of the KU statements (AS 2.1) made by candidates must be correct in the unit assessment and at least one correct response for each problem solving skill (AS 2.2) is required to pass outcome 2. However, if a candidate is given more than one opportunity in a unit assessment to provide a response for a problem solving skill, then they must answer 50% or more correctly.

Re-assessment

SQA's guidance on re-assessment is that there should only be one or, in exceptional circumstances, two re-assessment opportunities. Re-assessment should be carried out under the same conditions as the original assessment. It is at the teacher or lecturer's discretion how they re-assess their candidates. Candidates may be given a full re-assessment opportunity, or be re-assessed on individual key areas and/or problem-solving skills. As there is no requirement to pass assessment standard 2.1 (making accurate statements) and assessment standard 2.2 (solving problems) independently, candidates must achieve 50% of the marks available in the re-assessment.

Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the Unit where there are appropriate opportunities.

2 Numeracy

- 2.1 Number processes
- 2.2 Money, time and measurement
- 2.3 Information handling

5 Thinking skills

- 5.3 Applying
- 5.4 Analysing and evaluating

Amplification of these is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work*. The level of these skills should be at the same SCQF level of the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the Appendix: *Unit Support Notes*.

Appendix 1: Unit support notes

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing this Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- ◆ the *Unit Assessment Support packs*

Developing skills, knowledge and understanding

Teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Approaches to learning and teaching

Multicellular Organisms		
key areas	Suggested learning activities	Exemplification of key areas
<p>1 Cells, tissues and organs Specialisation of cells, in animals and plants, leads to the formation of a variety of tissues and organs. Groups of organs which work together form systems.</p>	<p>Examine a variety of cells from different tissues to relate their structure to function.</p>	<p>Multicellular organisms have more than one cell type and are made up of tissues and organs. Organs perform different functions. The cells in organs are specialised for their function. Specialisation can be applied to all named tissues in this Unit.</p>
<p>2 Stem cells and meristems a. Stem cells in animals can divide and have the potential to become different types of cell. Stem cells are involved in growth and repair. b. Meristems are the sites of production of non-specialised cells in plants and are the sites for mitosis in a plant. These cells have the potential to become other types of plant cell and they contribute to plant growth.</p>	<p>Use a variety of media to investigate the potential uses of stem cells and discuss ethical issues associated with their use. Carry out practicals on root tip/shoot tip stain.</p>	

Multicellular Organisms		
key areas	Suggested learning activities	Exemplification of key areas
<p>3 Control and Communication</p> <p>a. Nervous control</p> <p>(i) Nervous system consists of central nervous system (CNS) and nerves. CNS consists of brain and spinal cord. Structure and function of brain to include cerebrum, cerebellum and medulla. Neurons are of three types, sensory, relay and motor. Receptors detect sensory input/stimuli. Electrical impulses carry messages along neurons. A synapse occurs between neurons. Chemicals transfer these messages across synapses.</p> <p>(ii) Structure and function of reflex arc.</p>	<p>Investigate examples of where communication pathways are used, eg pain receptors.</p> <p>Investigate examples of human reflex activities, eg blinking, iris reflex, response to pain.</p>	<p>Internal communication is required for survival of a multicellular organism. Cells in multicellular organisms do not work independently.</p> <p>Sensory neurons pass the information to the central nervous system. The CNS processes the information from our senses which needs a response. Motor neurons enable a response to occur, which can be a rapid action from a muscle or a slower response from a gland.</p>

Multicellular Organisms		
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<p>b. Hormonal control</p> <p>(i) Endocrine glands release hormones into the blood stream. Hormones are chemical messengers. Target tissues have cells with receptor proteins for hormones, so only some tissues are affected by specific hormones.</p> <p>ii) Blood glucose regulation including the role of insulin, glucagon, glycogen, pancreas and liver.</p>	<p>Research the role of hormones in the body.</p> <p>Diabetes as a communication pathway that has failed due to a fault in release or a failure to respond to insulin and consequences and treatment.</p> <p>Investigate the causes and treatment of both type 1 and type 2 diabetes with reference to trends in Scottish health statistics.</p>	<p>Insulin production when blood glucose levels are higher than normal and production of glucagon when levels are below normal.</p> <p>Detail of negative feedback is not required.</p>
<p>4 Reproduction</p> <p>a. The structure of gametes and the sites of their production in plants and animals. Cells are diploid, except gametes, which are haploid.</p> <p>b. Fertilisation is the fusion of the nuclei of the two haploid gametes to produce a diploid zygote.</p>	<p>Compare and contrast male and female animal and plant gametes, gonads and organs from micrographs, models, reference materials, photographs and dissection of flowers.</p>	<p>Knowledge of polyploidy organisms is not required.</p>
<p>5 Variation and Inheritance</p> <p>a. Comparison of discrete and continuous variation.</p>	<p>Investigate a variety of discrete and continuous characteristics in organisms, eg ear lobes, tongue-rolling and height.</p>	<p>Combining genes from two parents contributes to variation within a species.</p>

Multicellular Organisms		
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<p>b. Most features of an individual phenotype are polygenic and show continuous variation.</p> <p>c. Genetic terms including gene, allele, phenotype, genotype, dominant, recessive, homozygous, heterozygous and P₁, F₁ and F₂. Carry out monohybrid crosses from parents through to F₂. Reasons why predicted ratios are not always achieved.</p>	<p>Research polygenic inheritance.</p> <p>Research Mendel's work on peas.</p> <p>Use Punnett squares to explain inheritance.</p>	<p>Single gene inheritance of characters showing discrete variation where measurements fall into distinct groups.</p> <p>Continuous variation shows a range of values between a minimum and a maximum.</p> <p>Family trees can be used to identify the phenotype and genotype of individuals.</p>
<p>6 The need for transport</p> <p>a. Plant transport systems</p> <p>(i) Leaf structure to include upper epidermis, palisade mesophyll, spongy mesophyll, vein, lower epidermis, guard cells and stomata.</p> <p>(ii) Other parts of the plant involved in water transport including root hairs and xylem vessels. Water and minerals are transported in xylem vessels. Xylem vessels are dead and contain lignin for support. Water is required for transporting materials and for photosynthesis.</p> <p>(iii) The process of transpiration.</p>	<p>Set up stomatal models, use leaf peels and microscopes to view stomata.</p> <p>Investigate the germination of seeds to show root hairs.</p> <p>Stain xylem vessels using dye and celery. Examine slides showing xylem structure.</p> <p>Transpiration experiments to show water loss.</p>	<p>Xylem cells are lignified to withstand the pressure changes as water moves through the plant.</p> <p>Transpiration is the loss of water through leaves. Water is lost by evaporation</p>

Multicellular Organisms		
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<p>(iv) Sugar is transported up and down the plant in living phloem. Structure of phloem tissue.</p>	<p>Examine slides showing phloem structure.</p>	<p>through stomata, whose opening and closing is controlled by guard cells, which are mainly found in the lower leaf epidermis. Mesophyll cells of the leaf require water for photosynthesis.</p> <p>Details of transpiration pull and the forces involved are not required.</p>
<p>b. Animal transport and exchange systems</p> <p>i. In mammals, nutrients, oxygen and carbon dioxide are transported in the blood.</p> <p>ii. Pathway of oxygenated and deoxygenated blood through heart, lungs and body. Heart structure to include right and left atria and ventricles and location and function of valves. Blood vessels to include: aorta, vena cava, pulmonary arteries and veins. Coronary arteries and their function.</p> <p>iii. Arteries have thick, muscular walls, a narrow central channel and carry blood under high pressure away from the heart. Veins carry blood under low pressure; have thinner walls and a wide channel. Veins contain valves to prevent backflow of blood and carry blood towards the heart. Capillaries form networks at organs and tissues, are thin</p>	<p>Investigate heart structure, eg dissection, models, films.</p> <p>Use of diagrams/models to illustrate the structure of arteries, veins, capillaries and blood cells.</p>	<p>Names of valves not required.</p>

Multicellular Organisms		
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<p>walled and have a large surface area, allowing exchange of materials.</p> <p>iv. Red blood cells are specialised by being biconcave in shape, having no nucleus and containing haemoglobin. This allows them to transport oxygen efficiently in the form of oxyhaemoglobin.</p> <p>v. Rings of cartilage keep main airways open. Oxygen and carbon dioxide are exchanged through the alveolar walls. Alveoli have a large surface area, thin walls and a good blood supply for more efficient diffusion of gases. Mucus traps dirt and microorganisms and cilia moves this up and away from the lungs.</p> <p>vi. Food is moved through the digestive system by peristalsis. Villi in the small intestine have a large surface area, thin walls and a good blood supply to aid absorption of glucose and amino acids. The lacteals absorb fatty acids and glycerol (the products of fat digestion).</p>	<p>Investigate lungs, eg dissection, model, films.</p> <p>Comparisons can be made between cartilage in airways and lignin in xylem.</p> <p>Peristalsis model. Model gut.</p>	
<p>7 Effects of lifestyle choices on human transport and exchange systems</p>	<p>Use health promotion and reference materials to identify how healthier lifestyle choices can directly and indirectly improve the physical and mental health of an individual.</p>	<p>Possible examples of lifestyle choices could be high-fat or high-salt diet, lack of exercise, use of tobacco or alcohol, or high-stress experiences.</p> <p>These directly and indirectly increase the chances of fatty deposits in blood vessels,</p>

Multicellular Organisms		
key areas	Suggested learning activities	Exemplification of key areas
	Take physiological measurements. Investigate the effect of moderate exercise on these measurements.	blood clots, heart attacks, strokes, diabetes and stress.

Appendix 2: Unit assessment of Outcome 2: Revised content

The following guidance applies where a centre is delivering the revised course content from the National 5 Biology Course Specification version 2.0 (June 2017). Centres can adapt the existing unit assessment support packs (UASPs) for Outcome 2 where candidates are being assessed for free-standing units.

Important note: This guidance is provided for the mechanism of Recognising Positive Achievement (RPA).

(a) Unit Assessment Support Pack 1 (Unit-by-Unit Approach)

Where a centre is using the assessments in UASP 1 these can be adapted as follows.

Multicellular Organisms

- ◆ Remove Questions 2(c) and 9.
- ◆ Insert question 3 from Cell Biology UASP 1.
- ◆ Change 'relay neuron' to 'inter neuron' in Question 3(b).
- ◆ Insert a question that will assess some aspect of the 'absorption of materials' key area.

For example: Intermediate 2 Biology 2007, Section B, Question 1(b) [2].

Two marks added to the total number of marks available to account for this question being used.

(b) Outcome 2, Assessment activity 2 - tests

Where a centre is using the Outcome 2, Assessment activity 2 tests, these can be adapted as follows.

Multicellular Organisms

- ◆ Remove Questions 2(a), 7(a) and (b) and 10.
- ◆ Insert Questions 3(a) and (b) from *Cell Biology* Outcome 2 test 2.

Administrative information

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Superclass: RH

History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
1.1	Assessment standard threshold information added. Unit support notes added as Appendix 1. Guidance on assessment of Outcome 2 for RPA added as Appendix 2.	Qualifications Manager	September 2018

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