SCQF level 5
Unit Specification

Biology: Multicellular Organisms

SCQF: level 5 (6 SCQF credit points)

Unit code: J4AA 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 producing new cells; control and communication; reproduction; variation and inheritance; transport systems — plants; transport systems — animals; and absorption of materials. 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 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 producing new cells; control and communication; reproduction; variation and inheritance; transport systems — plants; transport systems — animals; and absorption of materials.

The following table describes the evidence for the Assessment Standards. Exemplification of assessment is provided in *Unit Assessment Support*.

Assessment Standard	Evidence required
Planning an experiment/practical investigation	The plan must include: ♦ 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
Following procedures safely	The learner must be seen to follow procedures safely.
Making and recording observations/measurements correctly	The raw data must be collated in a relevant format, for example a table.
Presenting results in an appropriate format	One format from: bar graph or line graph.
Drawing a valid conclusion	This must include reference to the aim and be supported by the results.
Evaluating experimental procedures	Provide one evaluative statement about the procedures used. **or** Suggest an improvement for the experiment. Appropriate justification must also be provided, whichever option is chosen.
Making accurate statements and solving problems	Achieve at least 50% of the total marks available in a holistic assessment. A holistic assessment must include: ♦ an appropriate number of opportunities to make accurate statements for each key area of the Unit ♦ at least one opportunity to demonstrate each of the following problem-solving skills: — make generalisations/predictions — select information — process information, including calculations, as appropriate — analyse information

Assessment Standard thresholds

Outcome 1

Learners 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. Learners must be given the opportunity to meet all Assessment Standards.

Outcome 2

Learners are assessed using a holistic assessment that assesses Assessment Standards 2.1 and 2.2. To gain a pass for Outcome 2, learners must achieve 50% or more of the total marks available in the assessment.

Transfer of evidence

Evidence for the achievement of Outcome 1 for this Unit can be used as evidence for the achievement of Outcome 1 in the SCQF level 5 Units: Cell Biology (J4A9 75) and Biology: Life on Earth (J4AC 75).

Evidence for the achievement of Outcome 2 for this Unit is **not** transferable between the SCQF level 5 Units: Cell Biology (J4A9 75) and Biology: Life on Earth (J4AC 75).

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 must be carried out under the same conditions as the original assessment.

Outcome 1

Learners can re-draft their original Outcome 1 report or carry out a new experiment/practical investigation.

Outcome 2

Learners must have a full re-assessment opportunity, ie a holistic assessment. To achieve Outcome 2, learners must achieve 50% of the total 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: 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:

- *Unit Assessment Support*

Developing skills, knowledge and understanding

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

Approaches to learning and teaching

Biology: multicellular organisms		
Key areas	**Depth of knowledge required**	**Suggested learning activities**
1 Producing new cells a Sequence of events of mitosis. Understanding of the terms chromatids, equator and spindle fibres.	Names of the phases are not required.	♦ Select and present information using mitosis stage cards. Create model chromosomes. ♦ Observe prepared root tip cell slides and/or bioviewer.
b Mitosis provides new cells for growth, repair of damaged tissues and replacement of dead or damaged cells. It also maintains the diploid chromosome complement.	Diploid cells have two matching sets of chromosomes, which are replicated during mitosis.	♦ Carry out numeracy activities based on cell growth graphs and/or curves.
c Stem cells in animals are unspecialised cells, which can divide in order to self-renew. They have the potential to become different types of cell. Stem cells are involved in growth and repair.	Stem cells can be obtained from the embryo at a very early stage. In addition, tissue stem cells can be found in the body throughout life. The terms pluripotent, totipotent and multipotent are not required.	♦ Use a variety of media to investigate the potential uses of stem cells and discuss ethical issues associated with their use.
d Specialisation of cells leads to the formation of a variety of cells, tissues and organs. Groups of organs that work together form systems. A hierarchy exists: cells → tissues → organs → systems	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 and work together to form systems. Details of organs that make up individual systems are not required.	♦ Examine a variety of cells from different tissues to relate their structure to function.

Biology: multicellular organisms		
Key areas	**Depth of knowledge required**	**Suggested learning activities**
2 Control and communication a Nervous control i Nervous system consists of central nervous system (CNS) and other nerves. CNS consists of brain and spinal cord. Structure and function of parts of the brain — cerebrum, cerebellum and medulla. Neurons are of three types: sensory, inter and motor. Receptors detect sensory input or stimuli. Electrical impulses carry messages along neurons. Chemicals transfer these messages between neurons, at synapses.	A response to a stimulus can be a rapid action from a muscle or a slower response from a gland. Sensory neurons pass the information to the CNS. Inter neurons operate within the CNS, which processes information from the senses that require a response. Motor neurons enable a response to occur at an effector (muscle or gland).	♦ Investigate reaction time in humans.
ii Structure and function of reflex arc.	Reflexes protect the body from harm.	♦ Research and/or investigate examples of human reflex activities, for example blinking, iris reflex, response to pain.
b Hormonal control i Endocrine glands release hormones into the bloodstream. Hormones are chemical messengers. A target tissue has cells with complementary receptor proteins for specific hormones, so only that tissue will be affected by these hormones.	Names and locations of individual endocrine glands, other than those mentioned in these notes (pancreas, testes, ovaries), are not required.	
ii Blood glucose regulation. The roles of insulin, glucagon, glycogen, pancreas and liver.	Detail of negative feedback is not required.	♦ Investigate the causes and treatment of type 1 and type 2 diabetes, with reference to trends in Scottish health statistics.

Biology: multicellular organisms		
Key areas	**Depth of knowledge required**	**Suggested learning activities**
3 Reproduction a Cells are diploid, except gametes, which are haploid.	Knowledge of polyploidy is not required.	
b The types of gametes, the organs that produce them, and where these are located in plants and animals. The basic structure of sperm and egg cells.	Recognition of cells and organs involved, from diagrams.	
c Fertilisation is the fusion of the nuclei of the two haploid gametes to produce a diploid zygote, which divides to form an embryo.		
4 Variation and inheritance a Comparison of discrete variation (single gene inheritance) and continuous variation (polygenic inheritance).	Combining genes from two parents contributes to variation within a species. Single gene inheritance of characteristics showing discrete variation where measurements fall into distinct groups. Polygenic inheritance of characteristics showing continuous variation where there is a range of values between a minimum and a maximum.	♦ Investigate a variety of discrete and continuous characteristics in organisms, for example long and short hair in cats, dry and wet earwax in humans, height in humans, leaf length in plants.

Biology: multicellular organisms		
Key areas	**Depth of knowledge required**	**Suggested learning activities**
4 Variation and inheritance (continued) b Understanding of genetic terms: gene; allele; phenotype; genotype; dominant; recessive; homozygous; heterozygous and P, F_1 and F_2.	Family trees and the identification of phenotypes and genotypes from them.	
c Monohybrid crosses from parental generation through to F_2 generation.	Carry out monohybrid crosses. Use Punnett squares to explain inheritance.	
d Reasons why predicted phenotype ratios among offspring are not always achieved.		
5 Transport systems — plants a Plant organs are roots, stems and leaves. Leaf structure diagram showing upper epidermis, palisade mesophyll, spongy mesophyll, vein (consisting of xylem and phloem), lower epidermis, guard cells and stomata.		♦ Stomatal models and use of leaf peels and microscopes to view stomata. ♦ Investigate number or distribution of stomata from different leaves and/or species. ♦ Microscope slides showing sections through leaf.
b Parts of the plant involved in water transport. Water and minerals enter the plant through the root hairs and are transported in dead xylem vessels.		♦ Germination of seeds to show root hairs.
Structure of xylem vessels.	Xylem cells are lignified to withstand the pressure changes as water moves through the plant.	♦ Stain xylem vessels in celery using food colouring. ♦ Examine slides showing xylem structure.

Biology: multicellular organisms		
Key areas	**Depth of knowledge required**	**Suggested learning activities**
5 Transport systems — plants (continued) c The process of transpiration and how the rate of transpiration is affected by wind speed, humidity, temperature and surface area.	Transpiration is the process of water moving through a plant and its evaporation through the stomata. The structures and processes involved as water moves through the plant from the soil to the air. Details of mechanism for opening and closing of stomata are not required. Details of transpiration pull and the forces involved are not required. External factors can increase or decrease the rate of transpiration. Details of how this takes place are not required.	♦ Transpiration experiments to show water loss using a weight or a bubble photometer. ♦ Investigate the effect of wind speed, humidity, temperature or surface area on transpiration.
d Sugar is transported up and down the plant in living phloem. Structure of phloem tissue.	Phloem cells have sieve plates and associated companion cells.	♦ Microscope slides showing phloem structure.

Biology: multicellular organisms		
Key areas	**Depth of knowledge required**	**Suggested learning activities**
6 Transport systems — animals a In mammals the blood contains plasma, red blood cells and white blood cells. It transports nutrients, oxygen and carbon dioxide.	Information about platelets is not required.	♦ Use of diagrams and/or models to illustrate the structure of blood cells.
b 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.	oxygen + haemoglobin → oxyhaemoglobin	
c White blood cells are part of the immune system and are involved in destroying pathogens. There are two main types of cells involved. Phagocytes carry out phagocytosis by engulfing pathogens. Some lymphocytes produce antibodies that destroy pathogens. Each antibody is specific to a particular pathogen.	Pathogens are disease-causing micro-organisms (bacteria, viruses, fungi). Process of phagocytosis — engulfing and digestion. Detail of lysis and lysosomes not required. Detail of antibody structure not required.	
d Pathway of oxygenated and deoxygenated blood through heart, lungs and body. Diagram of heart to show the right and left atria, ventricles, location of four valves, location of associated blood vessels (aorta, vena cava, pulmonary artery, pulmonary vein and coronary arteries). Function of each of these parts.	Names of individual valves are not required.	♦ Investigate heart structure through the use of dissection, models or films.

Biology: multicellular organisms		
Key areas	**Depth of knowledge required**	**Suggested learning activities**
6 Transport systems — animals (continued) e Arteries have thick, muscular walls, a narrow central channel and carry blood under high pressure away from the heart. Veins have thinner walls, a wider channel and carry blood under low pressure back towards the heart. Veins contain valves to prevent backflow of blood. Capillaries are thin-walled and have a large surface area, forming networks at tissues and organs to allow efficient exchange of materials. **7 Absorption of materials** a Oxygen and nutrients from food must be absorbed into the bloodstream to be delivered to cells for respiration. Waste materials, such as carbon dioxide, must be removed from cells into the bloodstream. b Tissues contain capillary networks to allow the exchange of materials at cellular level. c Surfaces involved in the absorption of materials have certain features in common: large surface area, thin walls, extensive blood supply. These increase the efficiency of absorption.		♦ Use of diagrams and/or models to illustrate the structure of arteries, veins and capillaries.

Biology: multicellular organisms		
Key areas	**Depth of knowledge required**	**Suggested learning activities**
7 Absorption of materials (continued) d Lungs are gas-exchange organs. They consist of a large number of alveoli, providing a large surface area. Oxygen and carbon dioxide are absorbed through the thin alveolar walls to or from the many blood capillaries. e Nutrients from food are absorbed into the villi in the small intestine. The large number of thin-walled villi provides a large surface area. Each villus contains a network of capillaries to absorb glucose and amino acids and a lacteal to absorb fatty acids and glycerol.		♦ Investigate lung structure through the use of dissection, models or films. ♦ Investigate villus structure through the use of models and films.

Administrative information

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Superclass: RH

History of changes to National Unit Specification

Version	Description of change	Authorised by	Date