SCQF level 5
Unit Specification

Biology: Life on Earth

SCQF: level 5 (6 SCQF credit points)

Unit code: H209 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 life on Earth. Learners will apply these skills when considering the applications of life on Earth 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: biodiversity and the distribution of life; energy in ecosystems; sampling techniques and measurement of abiotic and biotic factors; adaptation, natural selection and the evolution of species; and human impact on the environment. 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: biodiversity and the distribution of life; energy in ecosystems; sampling techniques and measurement of abiotic and biotic factors; adaptation, natural selection and the evolution of species; and human impact on the environment. 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: ♦ 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: ♦ make generalisations/predictions ♦ select information ♦ process information, including calculations, as appropriate ♦ analyse information

Exemplification of assessment is provided in unit assessment support packs.
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 choses 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

Life on Earth		
key areas	**Suggested learning activities**	**Exemplification of key areas**
1 Biodiversity and the distribution of life a. Biotic and abiotic factors affect biodiversity in an ecosystem. Human activities can also have an impact on biodiversity.	Investigate a range of human influences that affect national and global environments such as: pollution of air and water, habitat destruction by, eg deforestation (tropical rain forest), desertification, endangered species, overfishing and lichen studies.	Various factors can increase or decrease the biodiversity of an ecosystem.
b Competition for resources, disease, food availability , grazing and predation are biotic factors. Light intensity, moisture, pH and temperature are abiotic factors.	Interpret predator prey interaction graphs. Analyse Barn Owl pellets from Barn Owl Trust website.	
c. Biomes are the various regions of our planet as distinguished by their climate, fauna and flora. Global distribution of biomes can be influenced by temperature and rainfall.	Research a range of biomes, eg marine, tundra, prairie, polar, temperate deciduous forest and tropical rain forest.	Names of individual biomes are not required.
d. An ecosystem consists of all the organisms (the community) living in a particular habitat and the non-living components with which the organisms interact.	Case studies/fieldwork on, eg Caledonian forests, sea lochs, heather moorland, tropical rainforests, arctic tundra, coral reefs and deserts.	
e. A niche is the role that an organism plays within a community. It includes the use it makes of the resources in its ecosystem, including light,	Investigate examples of niches of Scottish wildlife, eg wildcat, red squirrel, red grouse, Scottish crossbill, brown trout, and bracken.	

Life on Earth		
key areas	**Suggested learning activities**	**Exemplification of key areas**
temperature and nutrient availability and its interactions with other organisms in the community including competition, parasitism and predation.	Analyse data related to distribution of barnacles on rocky shores, native woodland and red deer numbers, distribution of ptarmigan.	
2 Energy in ecosystems a. Definitions of other ecological terms including: species, population, producer, consumer, herbivore, carnivore and omnivore.		
b. In transfers from one level to the next in a food chain, 90% of energy is lost as heat, movement or undigested materials. 10% is used for growth.		
c. Definitions and comparisons of pyramids of biomass, energy and numbers	Investigate examples of pyramid of energy (as measured in kJ/m^2/year), pyramid of biomass (g/m^2) and pyramid of numbers. Investigate irregular pyramids of number, eg a tree as a producer, presence of parasites.	Irregular shapes of pyramids of numbers based on different body sizes are represented as true pyramids of energy and of biomass.
d. Competition in ecosystems. Interspecific competition occurs when individuals of different species require similar resources in an ecosystem. Intraspecific competition occurs when individuals of the same species require the same resources. Intraspecific competition is therefore more intense than interspecific competition.	Investigate interspecific competition, eg red and grey squirrels, brown and rainbow trout. Investigate intraspecific competition, eg cress seedling density, trees of the same species growing close together, feeding in grasshoppers, territorial behaviour in birds, eg robins, red grouse.	Examples of competition can include the need for food, light and water.

Life on Earth		
key areas	**Suggested learning activities**	**Exemplification of key areas**
e. Nitrogen in ecosystems Plant proteins are produced using nitrogen from nitrates. The roles of nitrifying, denitrifying, root nodule and free-living nitrogen-fixing soil bacteria. Decomposers, such as fungi and bacteria, convert proteins and nitrogenous wastes to ammonium compounds These are converted to nitrites and then to nitrates. Animals obtain the nitrogen required to produce protein by consuming plants.	Construct simple flow diagrams that illustrate the cyclical activities in the Nitrogen cycle.	Fertilisers supply nitrates to increase yield.
3 Sampling techniques and measurement of abiotic and biotic factors a. Sampling of plants and animals using techniques including quadrats and pitfall traps. b. Evaluation of limitations and sources of error in the use of quadrats and pitfall traps. c. Using and constructing paired-statement keys to identify organisms. d. Measuring abiotic factors including light intensity, temperature, pH and soil moisture. Possible sources of error and how to minimise them.	Techniques for biotic factors, eg quadrats, transect, pitfall trap, Tullgren funnel, pooters, and tree beating/sweep net, pond netting. Techniques for abiotic factors; temperature using thermometer or temperature probes, light using light meters, moisture using moisture meters, pH using pH meters or chemical test. Use of probes linked to appropriate data logging software.	Representative sampling and adequate replication.

Life on Earth		
key areas	**Suggested learning activities**	**Exemplification of key areas**
e. The effect of abiotic factors on the distribution of organisms.		
4 Adaptation, natural selection and the evolution of species a. A mutation is a random change to genetic material. Mutations may be neutral, confer an advantage or a disadvantage. Mutations are spontaneous and are the only source of new alleles. Environmental factors, such as radiation, high temperatures and some chemicals, can increase rate of mutation.	Research different types of mutation — neutral, advantageous or disadvantageous. Research mutagenic agents.	
b. New alleles produced by mutation allow plants and animals to adapt to their environment. These adaptations can be structural or behavioural. Variation within a population makes it possible for a population to evolve over time in response to changing environmental conditions.	Investigate examples of adaptations such as desert mammals and plants and Galapagos finches.	An adaptation is an inherited characteristic that makes an organism well suited to survival in its environment/niche.
c. Species produce more offspring than the environment can sustain. Natural selection or survival of the fittest occurs when there are selection pressures. The best adapted individuals survive to reproduce, passing on the favourable alleles that confer the selective advantage.	Research consequences of over-prescription of antibiotics. Case Study on insect resistance to 'built-in' insecticides in GM crops, eg bollworm moth in cotton, European corn borer in maize.	

Life on Earth		
key areas	**Suggested learning activities**	**Exemplification of key areas**
d. Speciation occurs after part of a population becomes isolated by an isolation barrier. These can be geographical, ecological or reproductive. Mutations occur in each sub-population. Natural selection selects for different mutations in each group, due to different selection pressures. Each sub-population evolves until they become so genetically different they are two different species.	Research Scottish examples of isolation leading to speciation, eg Arran Whitebeam, St Kilda Wren, Arctic Char. Research examples of rapid natural selection, eg MRSA, insect resistance to GM crop toxins.	Examples of types of barriers are acceptable, eg river, mountain .
5 Human impact on the environment a. Increasing human population requires an increased food yield. b. Fertilisers can leach into fresh water, increasing algal blooms. This reduces light levels killing aquatic plants. These dead plants as well as dead algae become the food for bacteria which increase greatly in number. The bacteria use up large quantities of oxygen reducing the oxygen availability for other organisms. c. Indicator species are species that by their presence or absence indicate environmental quality/levels of pollution. d. Pesticides sprayed onto crops can accumulate in the bodies of organisms over time. As they are	Research GM crops, monoculture and intensive farming. Survey local area for different varieties of lichen and assess local air quality. Sample freshwater invertebrates from local water courses/ponds and assess water quality. Investigate bioaccumulation, eg DDT.	There are opportunities throughout this topic for learners to investigate and debate ethical issues.

Life on Earth		
key areas	**Suggested learning activities**	**Exemplification of key areas**
passed along food chains, toxicity increases and can reach lethal levels. e. Biological control may be an alternative to the use of pesticides. GM crops may be an alternative to the use of fertilisers.	Investigate biological control, eg using a virus (Myxomatosis) to kill rabbits; using ladybirds to kill aphids and scale insects; using caterpillar moth (Cactoblastis) to kill cacti (Opuntia). Investigate GM rice plants which take up nitrogen more efficiently.	

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.

Life on Earth

- Remove Question 1.
- Insert Question 7 from Cell Biology UASP 1.

Marking guidance

- Question 4(b) – remove high temperature.
- Question 4(d) – change reproductive to behavioural.

(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.

Life on Earth

- Remove Question 1(c)(i), 3(a)(i), 3(b) and(c) and 5.
- Insert Question 8 from *Cell Biology* Outcome 2 Test 2.

Marking guidance

- Question 7(a)(ii) – change reproductive to behavioural.
- Question 7(b) – remove high temperatures

Administrative information

Published: September 2018 (version 1.1)

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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