Course Support Notes

National 4 Biology Course Support Notes

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Contents

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the National 4 Biology Course. They are intended for teachers and lecturers who are delivering the Course and its Units. They should be read in conjunction with the *Course Specification*, the *Added Value Unit Specification*, and the *Unit Specification*s for the Units in the Course.

General guidance on the Course

Aims

As stated in the *Course Specification,* the aims of the Course are to enable learners to:

- develop and apply knowledge and understanding of biology
- develop an understanding of biology's role in scientific issues and relevant applications of biology in society and the environment
- develop scientific inquiry and investigative skills
- develop scientific analytical thinking skills in a biology context
- develop the use of technology, equipment and materials, safely, in practical scientific activities
- develop problem solving skills in a biology context
- use and understand scientific literacy, in everyday contexts, to communicate ideas and issues
- develop the knowledge and skills for more advanced learning in biology

Progression into this Course

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

- National 3 Biology Course

There may also be progression from National 3 Chemistry, National 3 Environmental Science, National 3 Physics or National 3 Science Courses.

Experiences and Outcomes
National Courses have been designed to draw on and build on the curriculum experiences and outcomes as appropriate. Qualifications developed for the senior phase of secondary education are benchmarked against SCQF levels. SCQF level 4 and the curriculum level 4 are broadly equivalent in terms of level of demand although qualifications at SCQF level 4 will be more specific to allow for more specialist study of subjects.

Learners who have completed Curriculum for Excellence experiences and outcomes will find these an appropriate basis for doing the Course. In this Course, learners would benefit from having experience of the following:

Organisers	**Lines of development**	
Planet Earth	Biodiversity and Interdependence	SCN 01, 02, 03
Biological Systems	Body Systems	SCN 12, 13
	Inheritance	SCN 14

More detail is contained in the Biology Progression Framework. The Biology Progression framework shows the development of the key areas throughout the suite of Courses.

Skills, knowledge and understanding covered in the Course

Note: teachers and lecturers should refer to the *Added Value Unit Specification* for mandatory information about the skills, knowledge and understanding to be covered in this Course.

Progression from this Course

This Course or its components may provide progression for the learner to:

- National 5 Biology Course
- National 4 or 5 Course in another science subject
- Skills for Work Courses (SCQF levels 4 or 5)
- National Certificate Group Awards
- National Progression Awards (SCQF levels 4 or 5)
- Employment and/or training

Hierarchies

Hierarchy is the term used to describe Courses and Units which form a structured sequence involving two or more SCQF levels.

It is important that any content in a Course and/or Unit at one particular SCQF level is not repeated if a learner progresses to the next level of the hierarchy. The skills and knowledge should be able to be applied to new content and contexts to enrich the learning experience. This is for centres to manage.

- Biology Courses from National 3 to Advanced Higher are hierarchical.
- Courses from National 3 to National 5 have Units with the same structure and titles.
- National 5 gives equal progression to both Higher Biology and Higher Human Biology. Higher Biology and Higher Human Biology give equal progression to Advanced Higher Biology.

Approaches to learning and teaching

The purpose of this section is to provide you with advice and guidance on learning and teaching. It is essential that you are familiar with the mandatory information within the Biology Added Value Unit.

Teaching should involve an appropriate range of approaches to develop knowledge and understanding and skills for learning, life and work. This can be integrated into a related sequence of activities, centred on an idea, theme or application of biology, based on appropriate contexts, and need not be restricted to the Unit structure. Learning should be experiential, active, challenging and enjoyable, and include appropriate practical experiments/activities and could be learner-led. The use of a variety of active learning approaches is encouraged, including peer teaching and assessment, individual and group presentations, role-playing and game-based learning, with learner-generated questions.

When developing your Biology Course there should be opportunities for learners to take responsibility for their learning. Learning and teaching should build on learners' prior knowledge, skills and experiences. The Units and the key areas identified within them may be approached in any appropriate sequence, at the centre's discretion. The distribution of time between the various Units is a matter for professional judgement and is entirely at the discretion the centre. Each Unit is likely to require an approximately equal time allocation, although this may depend on the learners' prior learning in the different key areas.

Learning and teaching, within a class, can be organised, in a flexible way, to allow a range of learners' needs to be met, including learners achieving at different levels. The hierarchical nature of the new Biology qualifications provides improved continuity between the levels. Centres can, therefore, organise learning and teaching strategies in ways appropriate for their learners.

Within a class, there may be learners capable of achieving at a higher level in some aspects of the Course. Where possible, they should be given the opportunity to do so. There may also be learners who are struggling to achieve in all aspects of the Course, and may only achieve at the lower level in some areas.

Teachers/lecturers need to consider the Course and Unit Specifications to identify the differences between Course levels. It may also be useful to refer to the Biology Progression Framework.

When delivering this Course to a group of learners, with some working towards different levels, it may be useful for teachers to identify activities covering common concepts and skills for all learners, and additional activities required for some learners. In some aspects of the Course, the difference between levels is defined in terms of a higher level of skill.

An investigatory approach is encouraged in Biology, with learners actively involved in developing their skills, knowledge and understanding by investigating a range of relevant Biology applications and issues. A holistic approach should be adopted to encourage simultaneous development of learners' conceptual understanding and skills.

Where appropriate, investigative work/experiments, in Biology, should allow learners the opportunity to select activities and/or carry out extended study. Investigative/ experimental work is part of the scientific method of working and can fulfil a number of educational purposes.

All learning and teaching should offer opportunities for learners to work collaboratively. Practical activities and investigative work can offer opportunities for group work, which should be encouraged.

Group work approaches can be used within Units and across Courses, where it is helpful to simulate real-life situations, share tasks and promote team working skills. However, there must be clear evidence for each learner to show that the learner has met the required assessment standards for the Unit or Course.

Laboratory work should include the use of technology and equipment that reflects current scientific use in Biology. Fieldwork provides an opportunity for practical work, using first-hand experience of an ecosystem to develop knowledge, understanding and problem solving. Appropriate risk assessment must be undertaken.

Learners would be expected to contribute their own time in addition to programmed learning time.

Effective partnership working can enhance the science experience. Where possible, locally relevant contexts should be studied, with visits where this is possible. Guest speakers from, for example, industry, further and higher education could be used to bring the world of biology into the classroom.

Information and Communications Technology (ICT) can make a significant contribution to practical work in Biology, in addition to the use of computers as a learning tool. Computer interfacing equipment can detect and record small changes in variables allowing experimental results to be recorded over short periods of time, completing experiments in class time. Results can also be displayed in real time helping to improve understanding. Data logging equipment and video cameras can be set up to record data and make observations over periods of time longer than a class lesson which can then be subsequently downloaded and viewed for analysis.

Learning about Scotland and Scottish culture will enrich the learners' learning experience and help them to develop the skills for learning, life and work they will need to prepare them for taking their place in a diverse, inclusive and participative Scotland and beyond. Where there are opportunities to contextualise approaches to learning and teaching to Scottish contexts, teachers and lecturers should consider this.

Assessment should be integral to and improve learning and teaching. The approach should involve learners and provide supportive feedback. Self- and peer-assessment techniques should be encouraged, wherever appropriate. Assessment information should be used to set learning targets and next steps.

As part of learning, teaching and preparation for assessment, it is recommended that learners carry out several investigations that meet the requirements of the Assignment, as stipulated in the Added Value Unit Specification. This should help learners develop the necessary skills and prepare them for subsequent assessment.

For exemplification, a resource pack for one investigation is contained in Appendix 2. This resource pack contains background information on one topic, as well as links and suggestions of other sources of information. It exemplifies one approach to Stage 1 (research stage) of the investigation.

Learners may practise producing their report/communication, using this resource pack as their source of information/data for Stage 1 (research stage) of the investigation. This will allow Stage 2 (communicating stage) to be carried out without learners having to access additional resources.

The *Course and Unit Support Notes* for National 5 Biology, National 4 Environmental Science and National 5 Environmental Science each contain a resource pack for a different topic. Some of these may also provide learners with suitable opportunities to practise their Assignment.

Teachers and lecturers may choose to develop other resource packs, on an ongoing basis, to provide sets of resources for learners.

Suggestions for possible contexts and learning activities to support and enrich learning and teaching are detailed in the table below.

The **key areas** are from the Added Value Unit Specification. **Suggested learning activities** are not mandatory. This offers examples of suggested activities, from which you could select a range. It is not expected that all will be covered. The contexts for key areas are open to personalisation and choice, so centres are likely to devise their own learning activities. **Exemplification of key areas** is not mandatory. It provides an outline of the level of demand and detail of the key areas.

Cell Biology		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
1 Cell division and its role in growth and repair.	♦ Grow colonies of microorganisms on agar. ♦ Investigate the use of cells in the context of tissue culture for therapeutic use. ♦ Investigate regeneration of damaged tissues in organisms such as salamanders and starfish.	Cell division is essential to allow organisms to grow and repair damaged parts, eg cuts, broken bones. During cell division, the parent cell divides to produce two identical cells, which contain the same number of chromosomes in their nuclei as the parent cell. Cancer cells result from uncontrolled cell division.
2 DNA, genes and chromosomes.	♦ Decoding activities to produce coloured 'paper-chain' proteins. ♦ Case studies of inherited diseases.	Genes are located on chromosomes in the nucleus. Genes are made of DNA which carries the instructions to make proteins. Genes are passed on from parents to offspring. Each individual's DNA is unique.
3 Therapeutic use of cells.	♦ Investigate uses of genetic engineering. ♦ Investigate, eg insulin/factor VIII/human growth hormone. ♦ Research projects or visit research labs to see uses which are relevant.	Insulin or other protein production via genetic engineering. Other examples may include stem cell technology or using cells to grow artificial organs.
4 Properties of enzymes and their use in industries.	♦ Carry out experiments with, eg phosphorylase, amylase, catalase to demonstrate specificity and to test for substrates and products using iodine, Benedict's and Clinistix. ♦ Make paper/plasticine models or	Enzymes are found in living cells. They are specific, speed up reactions in cells and remain unchanged by the reaction. Enzymes build-up and break-down molecules. The actual mechanism of how they do this is not required. Enzymes can be used in a range of biotechnology industries.

Cell Biology		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
	animations of enzyme action. ♦ Investigate the cleaning effect or energy efficiency of biological and non-biological detergents. ♦ Carry out experiments with rennet. Make cheese/visit cheese factory. Investigate the history and ethics of rennet production.	
5 Properties of microorganisms and their use in industries.	♦ Make, eg bread, beer, yoghurt. ♦ Visit a local industry. ♦ Investigate production and use of biofuels. ♦ Investigate the effect of temperature on rising dough. ♦ Investigate breakdown of sewage. ♦ Use, eg nigrosin stain to visualise bacteria in yoghurt. ♦ Investigate use of microorganisms in bioremediation	Properties of microorganisms include rapid growth, diverse use of food source and wide range of products. Examples of how some microorganisms work and are used in industrial processes, eg yeast in baking and brewing, bacteria for yoghurt, cheese and biofuel production.
6 The effect of limiting factors on photosynthesis.	♦ Carry out starch tests on plants in various conditions. ♦ Elodea/Cabomba investigations to find out about limiting factors. ♦ Investigate immobilised algae and hydrogen carbonate indicator to show the effect of light on the production of carbon dioxide. Use IT simulations and data logging.	If any of the requirements (light, water, carbon dioxide or a suitable temperature) are low or missing, the photosynthesis rate is limited. By overcoming these limitations, faster growth rates can be achieved.

Cell Biology		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
7 The process of respiration and the factors that can affect it.	♦ Carry out germinating peas experiments. ♦ Investigate the effect of mass of sugar/temperature on the rate of respiration in yeast. Use IT simulations and data logging.	Respiration is used to release energy for use in cells. Oxygen may or may not be used in yeast, plant and animal cells. When oxygen is available, yeast, plant and animal cells use glucose to produce carbon dioxide and water. Without oxygen, yeast and plant cells use glucose to produce alcohol and carbon dioxide. Without oxygen, animal cells use glucose to produce lactic acid. More energy is released per molecule of glucose when oxygen is present. The process is enzyme controlled in all cases and so is affected by temperature.
8 Controversial biological procedures.	♦ Investigate/debate any relevant interesting topic, eg gene therapy, pharming, transgenic animals and plants.	

Multicellular Organisms		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
1 Sexual and asexual reproduction and their importance for survival of species.	♦ Investigate reproduction in various organisms. ♦ Compare different methods, success rates and how these relate to species survival. ♦ Brine shrimp practicals. ♦ Investigate asexual reproduction in plants and animals using models, reference materials and videos.	Sexual reproduction involves two parents. All of the offspring produced are different from each other. Asexual reproduction involves only one parent and all the offspring produced are identical to that parent. Sexual reproduction is important for introducing variation in a population and enables species to adapt to changing environmental conditions. Asexual reproduction does not produce variation but it allows populations to grow quickly.
2 Propagating and growing plants.	♦ Carry out various propagation techniques with suitable plants.	Different methods to propagate plants, eg seeds, cuttings, bulbs, tubers and runners.
3 Commercial use of plants.	♦ Investigate increased yields of crops/fuel/medicines via pharming.	Plants are grown to provide food, fuel, raw materials and medicines. They are also used for aesthetic reasons. Pharming as a means of genetically modifying plants to produce medicinal products.
4 Genetic information.	♦ Investigate how genetics determines our features, ensures variation. ♦ Use *Reebops* or similar activities to model inheritance from two parents. Examine photographs of families to consider which features a child inherited from which parent.	Our genes determine our features. As we inherit half of our DNA from our father and the other half from our mother this ensures variation. Basic monohybrid crosses showing how dominant characteristics are passed on from parents to the F1 generation.

Multicellular Organisms		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
5 Growth and development of different organisms.	♦ Select a range of different organisms and compare their growth and development. ♦ Seed germination experiments to compare necessary/optimum conditions for growth. ♦ Investigate how chemicals or radiation can affect growth and development. ♦ Investigate commercial plant growing/visit a commercial plant nursery. ♦ Research/investigate the importance of suitable conditions eg diet and temperature to maintain growth and development. Debate the links between diet and growth and development disorders.	The growth and development of different organisms can be influenced by different factors. Water, oxygen and warmth are important for the growth and development of plants. Humans need a balanced diet, water, minerals, vitamins and suitable conditions.
6 Biological actions in response to internal and external changes to maintain stable body conditions.	♦ Investigate the effect of changing external temperature on core body temperature. Research causes of diabetes.	The basic principles of homeostasis through maintaining body temperature and regulating blood glucose. When body temperature decreases blood is diverted away from the skin, skin hairs become upright and shivering may occur. These actions bring the body temperature back to normal. When body temperature increases, blood is diverted to the skin and sweat is produced bringing the body temperature back to normal. If blood glucose levels are too high insulin (a hormone) is released. This tells the body to store the excess glucose in the liver. This brings the blood glucose levels back to normal. If blood levels are too low this excess glucose can be released again bringing them back to normal.

Life on Earth		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
1 Animal and plants species depend on each other.	♦ Investigate a variety of ecosystems/biomes, eg rainforest, tundra, desert, arctic, temperate, local ecosystems. ♦ Investigate various biotic factors, eg food availability, predators, disease and competition. Use sampling techniques, eg transect and quadrat analysis. ♦ Investigate/research how the addition/removal of a species will impact upon other species in an ecosystem.	Animals and plants depend upon each other for a number of things including food, shelter and pollination. The addition/removal of a species will impact upon other species within an ecosystem.
2 Impact of population growth and natural hazards on biodiversity.	♦ Investigate examples of human population growth and how these affect biodiversity. Investigate/research ecological footprints that measure human demands on earth's resources. ♦ Debate issues around conservation of endangered species to maintain biodiversity nationally and globally.	Human population growth has resulted in habitat destruction, deforestation, over-fishing, intensive agriculture, genetic pollution, climate change, acid rain, oil and chemical spills, sewage and litter. These environmental disruptions have had a negative impact on biodiversity. Natural hazards such as forest fires, earthquakes, tsunamis, floods and volcanic activity will also reduce biodiversity.
3 Nitrogen cycle.	♦ Investigate/research the nitrogen cycle including the role of microorganisms. ♦ Use card sorting to identify stages and processes of the cycle. ♦ Use compost columns/heaps/bins to investigate decay. ♦ Carry out water culture experiments with, eg lemna ♦ Investigate seedling development with/without nitrogen using sand or perlite.	Nitrogen is essential for organisms to make proteins. It is recycled through a set of processes known as the nitrogen cycle. Bacteria and fungi are vital to the nitrogen cycle. The basic nitrogen cycle showing the stages and processes involved.

Life on Earth		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
4 Fertiliser design and environmental impact of fertilisers.	♦ Explore the use of natural and artificial fertilisers and the advantages/disadvantages of each, eg cost, specificity, purity, NPK composition. ♦ Visit a farm. ♦ Investigate the effects of fertilisers, eg algal blooms. ♦ Investigate Blue Flag beaches nationally and internationally.	When crops are harvested, nitrogen is taken out of the cycle so needs to be replaced. Nitrogen can be added to the soil in the form of nitrate fertilisers, manure or compost. Nitrogen in fresh water increases algal growth, blocking out the light. This causes death of organisms, decrease of oxygen and means less life can be supported.
5 Adaptations for survival.	♦ Research examples of structural and physiological adaptations which lead to species survival eg cactus, camel, polar bear, fish.	Adaptations can be structural, physiological or behavioural and help organisms survive and reproduce in their environment.
6 Learned behaviour in response to stimuli linked to species survival.	♦ Research examples of innate and learned behavioural adaptations which lead to species survival such as swarming, huddling, imprinting, migration, communication, eg waggle dance in bees. ♦ Practical investigation using, eg choice chambers, mazes, mirror drawing, touch typing. ♦ Practical investigation on habituation, eg in snails. ♦ Research group/cultural/social/territorial behaviour, eg robins, Japanese macaques. Use data to produce a graph/chart of daily activities. ♦ Research how insects (eg bees) learn to associate flower scent and colour with nectar.	Changes in learned behaviour due to internal and external stimuli are of benefit to the survival of species.

Developing skills for learning, skills for life and skills for work

Learners are expected to develop broad generic skills as an integral part of their learning experience. The *Course Specification* lists the skills for learning, skills for life and skills for work that learners should develop through this Course. These are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and must be built into the Course where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Course.

For this Course, it is expected that the following skills for learning, skills for life and skills for work will be significantly developed:

Numeracy
This is the ability to use numbers in order to solve problems by counting, doing calculations, measuring, and understanding graphs and charts. This is also the ability to understand the results. Learners will have opportunities to extract, process and interpret information presented in numerous formats including tabular and graphical. Practical work will provide opportunities to develop time and measurement skills.

2.1 Number processes
Number processes means solving problems arising in everyday life through carrying out calculations, when dealing with data and results from experiments/investigations and everyday class work, making informed decisions based on the results of these calculations and understanding these results

2.2 Money, time and measurement
This means using and understanding time and measurement to solve problems and handle data in a variety of biology contexts, including practical and investigative

2.3 Information handling
Information handling means being able to interpret biological data in tables, charts and other graphical displays to draw sensible conclusions throughout the Course. It involves interpreting the data and considering its reliability in making reasoned deductions and informed decisions. It also involves an awareness and understanding of the chance of events happening.

Thinking skills
This is the ability to develop the cognitive skills of remembering and identifying, understanding and applying. The Course will allow learners to develop skills of applying, analysing and evaluating. Learners can analyse and evaluate practical work and data by reviewing the process, identifying issues and forming valid conclusions. They can demonstrate understanding and application of concepts and explain and interpret information and data.

5.3 Applying
Applying is the ability to use existing information to solve biological problems in different contexts, and to plan, organise and complete a task such as an investigation.

5.4 Analysing and evaluating
This covers the ability to identify and weigh-up the features of a situation or issue in biology and use judgement of them in coming to a conclusion. It includes reviewing and considering any potential solutions.

In addition, learners will also have opportunities to develop literacy skills, working with others, creating and citizenship.

Literacy
Learners develop the literacy skills to effectively communicate key biology concepts and describe, clearly, biology issues in various media forms. Learners will have opportunities to communicate knowledge and understanding, with an emphasis on applications and environmental, ethical and/or social impacts. Learners will have opportunities to develop listening and reading skills when gathering and processing information.

Working with Others
Learning activities provide many opportunities, in all areas of the Course, for learners to work with others. Practical activities and investigations, in particular, offer opportunities for group work, which is an important aspect of biology and should be encouraged.

Creating
Through learning in biology, learners can demonstrate their creativity. In particular, when planning and designing experiments/investigations, learners have the opportunity to be innovative in their approach. Learners also have the opportunities to make, write, say or do something new.

Citizenship
Learners will develop citizenship skills, when considering the applications of biology on our lives, as well as environmental and ethical implications.

Approaches to assessment

Assessment should cover the mandatory skills, knowledge and understanding of the Course. Assessment should be integral to and improve learning and teaching. The approach should involve learners and provide supportive feedback. Self and peer assessment techniques should be used, where appropriate.

See the *Unit Support Notes* for guidance on approaches to assessment of the Units of the Course.

Added Value

Courses from National 4 to Advanced Higher include assessment of added value. At National 4 the added value will be assessed in the Added Value Unit.

Information given in the *Course Specification* and the *Added Value Unit Specification* about the assessment of added value is mandatory.

The Biology Added Value Unit is assessed by an Assignment. Prior to doing this Unit, learners would benefit from having covered the key areas from at least one of:

- Cell Biology (National 4)
- Biology: Multicellular Organisms (National 4)
- Biology: Life On Earth (National 4)

It is intended that the majority of the time for the Added Value Unit should be spent in learning and teaching activities, which further develop the skills necessary to conduct investigative/practical work in Biology. In addition to ensuring that learners are suitably prepared to conduct simple background research using the internet.

If the Added Value Unit is delivered as part of a Course, centres can deliver this Unit at an appropriate point during the Course.

Learners will use the skills, knowledge and understanding necessary to undertake an investigation into a topical issue in biology. The teacher/lecturer may provide guidance to learners on topics for study, taking into account the needs of their learners and the relevance to everyday issues. While the learner should choose the topic to be investigated, it would be reasonable for the choice the learner makes to be one where the teacher/lecturer has some expertise and has resources available to enable the learner to successfully meet the Assessment Standards.

The Assignment offers opportunities for learners to work in partnership and in teams, though it must be clear, at each stage, that the learner has produced evidence of their contribution to any group work carried out.

Suggested investigations

Some suggested investigations are listed below which are likely to be familiar to assessors. Centres are free to select other appropriate investigations.

Investigations
Use of factor VIII or other genetically engineered product for human use
Production of beer, wine, cheese, etc
Gene therapy
Pharming
Commercial plant growing
Conservation of endangered species
Habitat loss

A resource pack has been developed for one of these investigations and can be found in Appendix 2. This is not mandatory. Centres are free to develop their own investigations.

Combining assessment across Units

If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units. If this approach is used, then it is necessary to be able to track evidence for individual Outcomes and Assessment Standards.

Transfer of evidence
Evidence for the achievement of Outcome 1 and Assessment Standards 2.2, 2.3 and 2.4 for one Unit can be used as evidence of the achievement of Outcome 1 and Assessment Standards 2.2, 2.3 and 2.4 in the other Units of this Course.

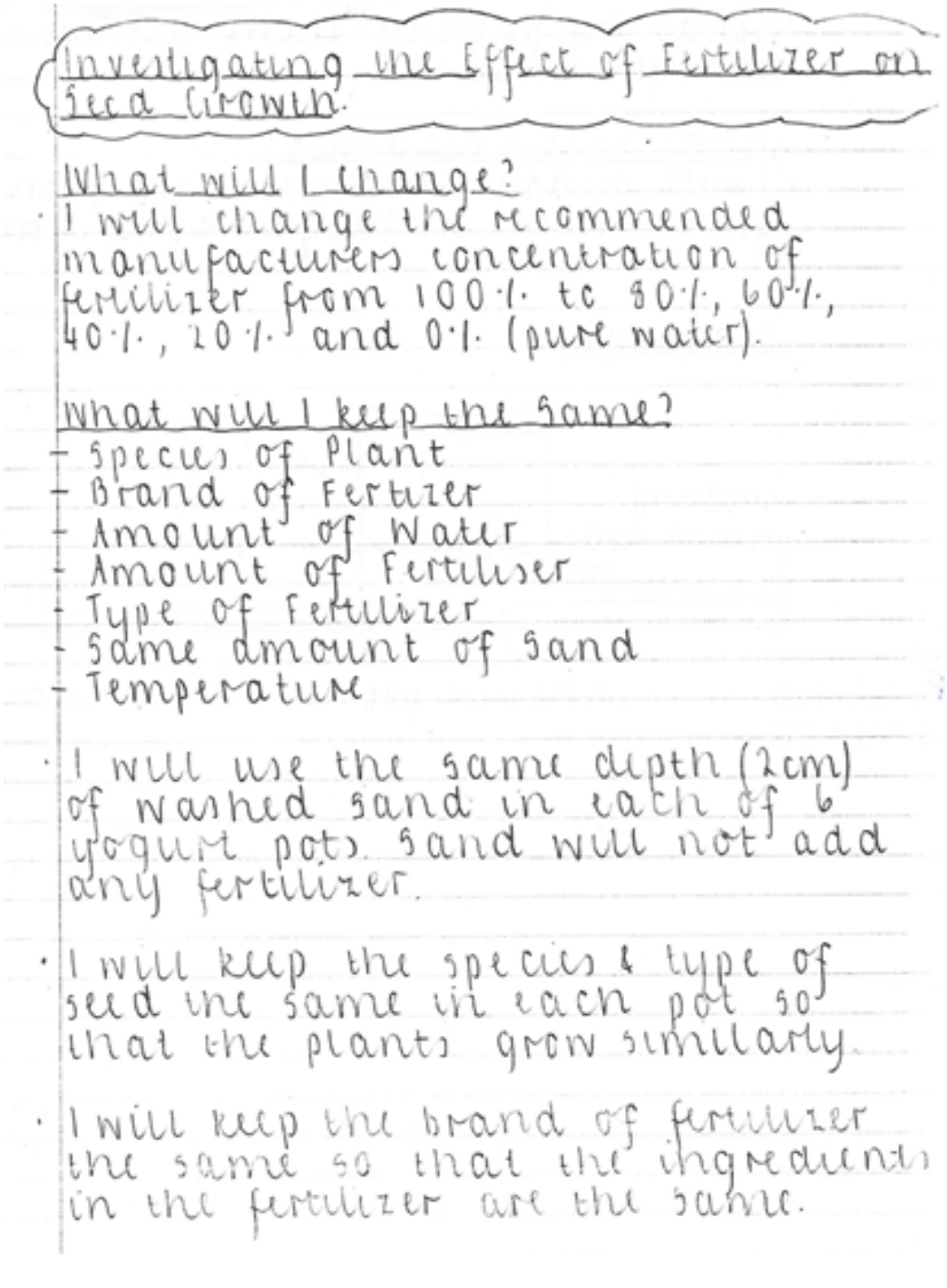
Exemplification of standards

Assessment Standards can be achieved via a number of pieces of evidence covering work done on different occasions.

Candidate 1's report provides evidence for Assessment Standards, 1.3 and 1.4 in a single report. The assessor's recording evidence table for candidate 2 provides an alternative example. It shows when the 'Variable to be kept constant' section of Assessment Standard 1.1 was overtaken. It also includes a record of the evidence to demonstrate success for this section.

Candidate 1

AIM
My aim is to find out what happened if changing the amount of fertiliser effects the growth of seedlings. (Transcribed from candidate evidence).



Investigating the Effect of Fertilizer on Seed Growth.

What will I change?

- I will change the recommended manufacturers concentration of fertilizer from 100% to 80%, 60%, 40%, 20% and 0% (pure water).

What will I keep the same?

- Species of Plant
- Brand of Fertizer
- Amount of Water
- Amount of Fertiliser
- Type of Fertilizer
- Same amount of Sand
- Temperature

- I will use the same depth (2cm) of washed sand in each of 6 yogurt pots. Sand will not add any fertilizer.

- I will keep the species & type of seed the same in each pot so that the plants grow similarly.

- I will keep the brand of fertilizer the same so that the ingredients in the fertilizer are the same.

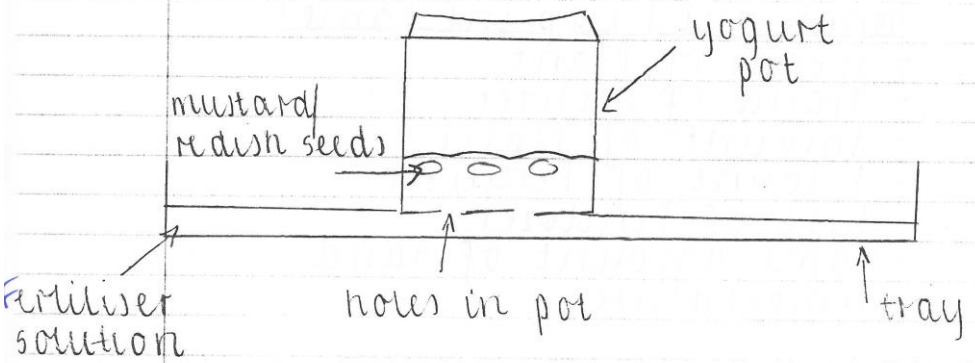
Candidate 1 (cont'd)

I will keep the light given to the seeds by putting them all in the greenhouse.

What will I measure?

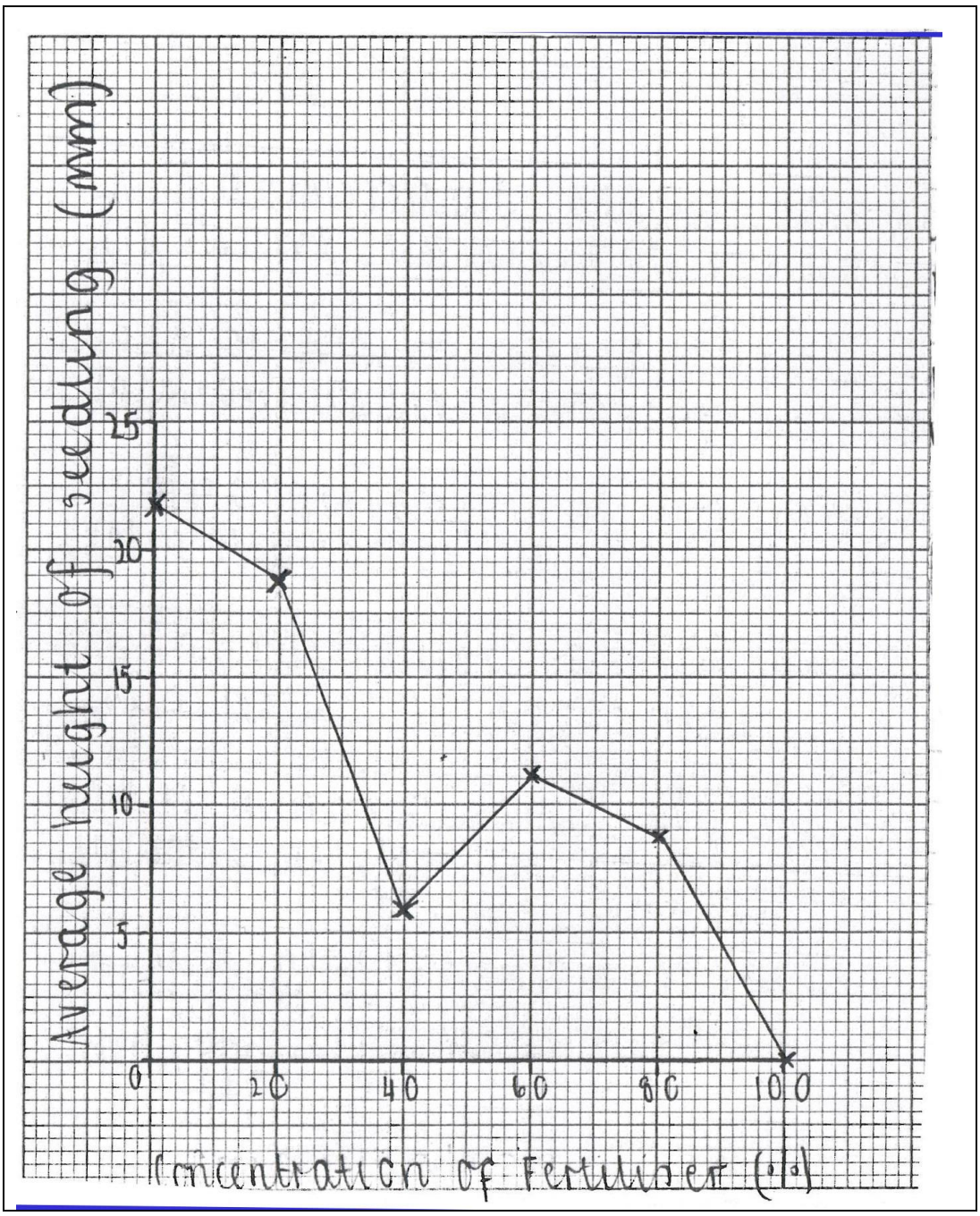
I will measure how much the plant has grown in cm in height after 2 weeks.

Diagram



fertiliser %	seed	length of seedling (mm) 1	2	3	4	5	6	average length of seedling (mm)
0	66	43	0	0	0	0		21·8
20	37	24	33	0	0			18·8
40	21	9	0	0	0			6
60	19	10	6	23	0			11·6
80	27	17	0	0	0			8·8
100	0	0	0	0	0			0

Candidate 1 (cont'd)



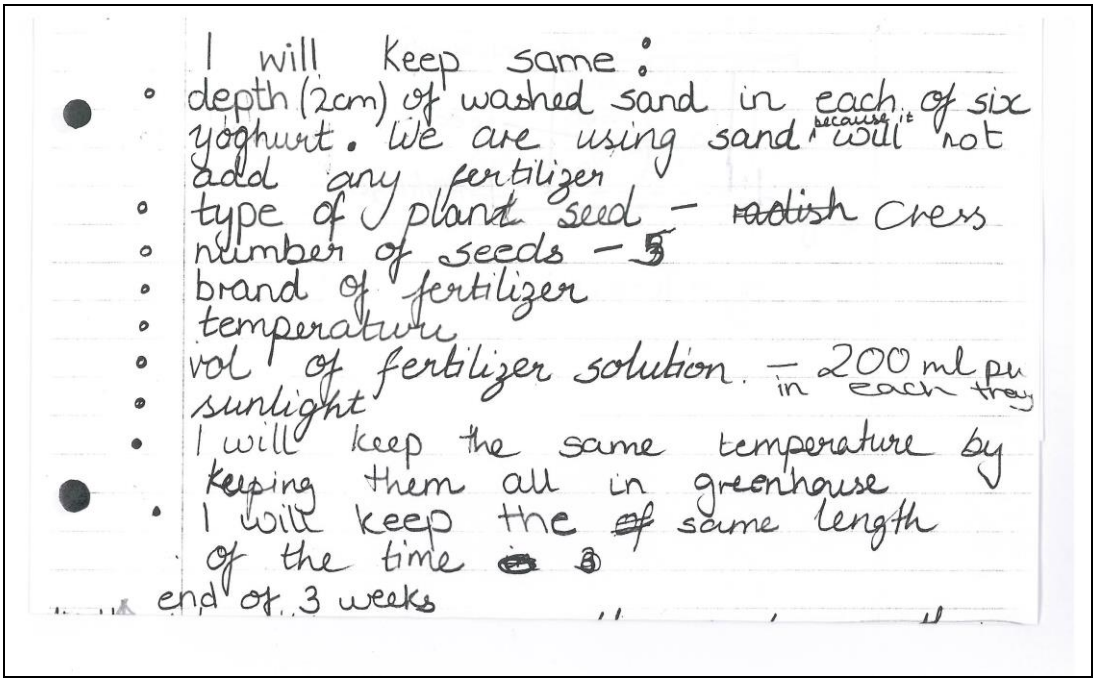
Experimental Investigation

Candidate 2

Candidate 2's report provides evidence for the 'Variable to be kept constant' section of Assessment Standard 1.1.

Assessment Standard	Evidence	Result
1.1 Planning an experiment/practical investigation	Aim of experiment	
	Variable to be kept constant	22/1/13
	Measurements/observations to be made	
	Resources	
	Method including health and safety	
1.2 Following procedures safely	Procedures have been followed safely	
1.3 Making and recording observations/ measurements correctly	Observations/measurements taken are correct	
1.4 Presenting results in an appropriate format	Results have been presented in an appropriate format	
1.5 Drawing valid conclusions	What the experiment/practical investigation shows, with reference to the aim	
1.6 Evaluating experimental procedures	The suggestion given will improve the experiment/practical investigation	

Candidate 2 (cont'd)
Candidate 2's report provides evidence for the 'Variable to be kept constant' section of Assessment Standard 1.1.



I will keep same:

- depth (2cm) of washed sand in each of six yoghurt. We are using sand because it will not add any fertilizer
- type of plant seed – ~~radish~~ Cress
- number of seeds – 5
- brand of fertilizer
- temperature
- vol of fertilizer solution. – 200 ml per in each tray
- sunlight
- I will keep the same temperature by keeping them all in greenhouse
- I will keep the ~~of~~ same length of the time
- end of 3 weeks

Candidate 3

Candidate 3's report provides evidence for Assessment Standards 1.5 to 1.6.

Investigating The Effect Of Fertilizer On Seed Growth

1.1a I will investigate the effect of changing the fertilizer concentration on the growth of seedlings.

What will I change?

I will change the concentration of the fertilizer from 100, 80, 50, 40, 20, and 0% (0% being pure water) by adding water.

What will I keep the same?

I will keep the same:

1.1b
- I will keep the same kind of seed, mustard seed.
- I will keep using six seeds.
- I will use the same amount of sand in every pot.
- I will keep the depth of the sand at 2 cm.
- I will use the same brand of fertilizer.
- I will leave them all to grow for two weeks, no more no less.
- I will keep them at the same temperature.

What will I measure?

1.1c I will measure the height of the plant that grows from the seeds in mm with a ruler.

Diagram:

1.2

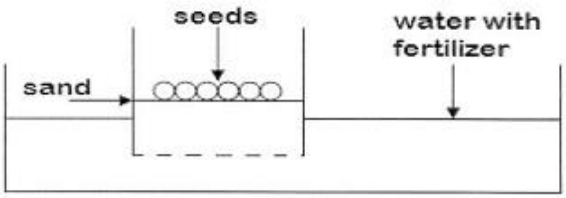


Table:

1.3
1.4

Concentration of Fertilizer (%)	Average Height of seedling (mm)
0	7.5
20	9.5
40	8.3
60	16.5
80	9.2
100	5.5

Conclusion:

1.5 As the concentration of the fertilizer solution goes from 0 to 60% the average height of the seedling increases. As the concentration of the fertilizer solutions goes from 60 to 100% the average height of the seedling decreases.

1.6 The next time I will use 0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100% fertilizer so there are more results to give a more reliable result. I will grow them in May when the weather is warmer and better for plant growth. I will leave them longer to grow, three weeks, so there can be a bigger difference between the results.

1.6

Candidates 4 and 5

The reports from candidates 4 and 5 show how research into the same application of biology produced individual evidence for Assessment Standard 2.2.

Assessment Standard	Evidence required	Evidence produced
2.2 Describing an application	The application is related to a key area of the Course	The assessor identified associated key areas of the Course — How animal and plants species depend on each other; Impact of population growth and natural hazards on biodiversity. It is only necessary to relate to one key area.
	Application stated	An application, 'environmental management', is stated
	Appropriate biology used to describe application	Each candidate has used appropriate National 4 Biology knowledge to describe the application. The word count is appropriate for National 4.

Candidate 4

I have investigated the application of environmental management. This is a process to control or reduce human impact on the environment in order to preserve natural resources. The natural environment contains habitats and species that are ecologically valuable. It must be protected from pollution and damage as it has evolved over hundreds of years and is not easily replaced, and it is important to preserve it for us and future.

2.1

Candidate 5

I have investigated the application of environmental management. The RSPB exists to secure a healthy environment for birds and wildlife, helping to create a better world for us all. To achieve this they protect, restore and manage habitats for birds and wildlife, and research the problems facing birds and the environment. An example of this is that the seas around the UK's coasts are increasingly overfished, over-trafficked and over-developed, but crucially under-protected. The RSPB fundraise for money to help support the work that they do to sort these and keep these problems under control.

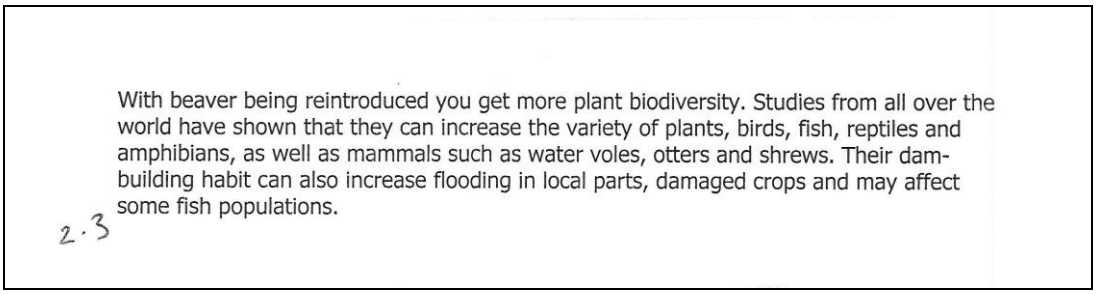
2.2

Candidate 6

The report from Candidate 6 provides evidence for Assessment Standard 2.3.

Assessment Standard	Evidence required	Evidence produced
2.3 Describing a biological issue in terms of its effect on the environment/ society	The issue is related to a key area of the Course	The Assessor identified the associated key area of the Course — Animal and plants species depend on each other; Impact of population growth and natural hazards on biodiversity. It is only necessary to relate to one key area.
	A biological issue is stated	The biological issue is identified — beaver reintroduction
	Appropriate biology knowledge is used to describe its effect	Effects on the environment are stated. The biology knowledge and the word count are appropriate for National 4.

Candidate 6



With beaver being reintroduced you get more plant biodiversity. Studies from all over the world have shown that they can increase the variety of plants, birds, fish, reptiles and amphibians, as well as mammals such as water voles, otters and shrews. Their dam-building habit can also increase flooding in local parts, damaged crops and may affect some fish populations.

2.3

Equality and inclusion

The following should be taken into consideration:

Situation	Reasonable Adjustment
Carrying out practical activities	Use could be made of practical helpers for learners with: ♦ physical disabilities, especially manual dexterity, when carrying out practical activities ♦ visual impairment who have difficulty distinguishing colour changes or other visual information
Reading, writing and presenting text, symbolic representation, tables, graphs and diagrams	Use could be made of ICT, enlarged text, alternative paper and/or print colour and/or practical helpers for learners with visual impairment, specific learning difficulties and physical disabilities
Process information using calculations	Use could be made of practical helpers for learners with specific cognitive difficulties (eg dyscalculia)
Draw a valid conclusion, giving explanations and making generalisation/predictions	Use could be made of practical helpers for learners with specific cognitive difficulties or autism

As far as possible, reasonable adjustments should be made for the Assignment, where necessary. This includes the use of 'practical helpers', readers, scribes, adapted equipment or assistive technologies.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Course Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Course.

It is important that centres are aware of and understand SQA's assessment arrangements for disabled learners, and those with additional support needs, when making requests for adjustments to published assessment arrangements. Centres will find more guidance on this in the series of publications on Assessment Arrangements on SQA's website: www.sqa.org.uk/sqa//14977.html.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications are available on SQA's website at: www.sqa.org.uk/sqa//14977.html.
- *Building the Curriculum 3: A framework for Learning and Teaching*
- *Building the Curriculum 4: Skills for learning, skills for life and skills for work*
- *Building the Curriculum 5: A framework for assessment*
- Course Specifications
- Design Principles for National Courses
- *Guide to Assessment* (June 2008)
- Science: A Portrait of current practice in Scottish schools (Nov 2008)
- *SCQF Handbook: User Guide* (published 2009) and SCQF level descriptors (to be reviewed during 2011 to 2012): www.sqa.org.uk/sqa/4595.html
- *SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*

Appendix 2: Resource pack

National 4 Biology: Added Value Unit

Resource pack: Commercial fishing in the North Sea

Relationship to Course
Biology: Life On Earth Unit
Key area: the impact of population growth and natural hazards on biodiversity.

Outcome 1 The learner will apply skills and knowledge to investigate a topical issue in biology and its impact on society/the environment by:

1.1 Choosing, with justification, a relevant issue in biology
1.2 Researching the issue
1.3 Presenting appropriate information/data
1.4 Explaining the impact, in terms of the biology involved
1.5 Communicating the findings of the investigation

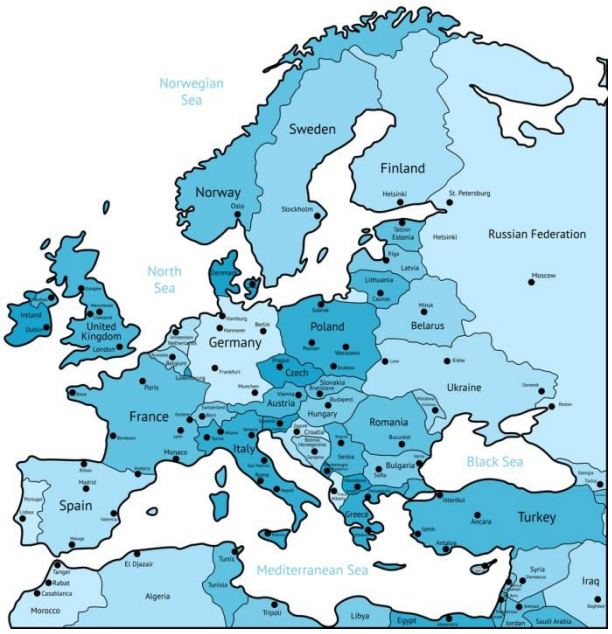
The sections in this pack provide background information on:

1. The North Sea and fishing
2. How are fish caught?
3. How are fish populations estimated?
4. Are fish stocks declining?
5. What could be causing fish stocks to decline?
6. Consequences
7. Possible solutions

Background information

1. The North Sea and fishing

The North Sea stretches between Great Britain and northern Europe, as shown on the map below. All of the countries which have coastlines on the North Sea have fishing rights for an area in which they are allowed to catch fish. The North Sea provides a habitat for over 230 species of fish. Examples of species which have been fished commercially include cod, haddock, plaice and mackerel.



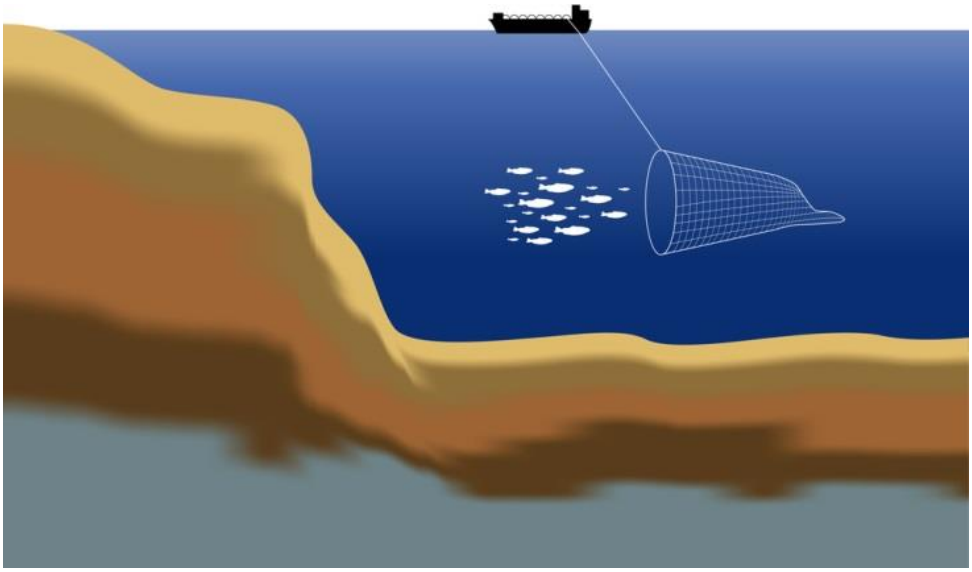
Commercial fishing in the North Sea is important to Scotland, as many towns and cities rely on income from fishing. Many people, especially in coastal areas, rely on the North Sea fishing industry for jobs. This includes being out at sea catching fish, preparing fish for sale, and building and repairing boats and other fishing equipment. Commercial fishing also brings income from the export of fish and fish products to other countries. In addition, fish are an important part of the Scottish diet.

You can find out more about the fishing industry in Scotland by looking at the following website: http://www.scotfishmuseum.org/the-developing-industry

2. How are fish caught?

The most common method for commercial fishing boats is trawling. In this process a big net is dragged along behind boats called trawlers. This can be carried out by one boat or two boats working together with a net dragged between them.

Trawling is efficient at capturing large numbers of fish. All the fish in the area are caught in the net and only the smallest fish can escape through the holes in the net.



Trawler image copyright shutterstock: 36284512

3. How are fish populations estimated?

It is difficult to estimate the number of fish in a large area like the North Sea. However, scientists analyse the information about the number, size and age of fish caught each year. Scientists also carry out their own sampling in less-fished parts of the North Sea, to estimate how many fish there are.

4. Are fish stocks declining

There is disagreement amongst different groups about how many fish are left in the North Sea. The Scottish and UK Governments recognise that there has been a decline in fish stocks over the past 30 years and recognise the need for conservation programmes. They also recognise that as a consequence of some current conservation programmes some fish stocks are recovering.

The European Union (EU) also agrees that there has been a reduction in fish stocks.

The Seafish organisation (www.seafish.org) represents the fishing industry. It also agrees that there has been a reduction in fish stocks over a number of years. It believes that the numbers of many fish species are recovering in the North Sea.

5. What could be causing fish stocks to decline?

There are various reasons that scientists have identified as contributing to the reduction in the number of fish in the North Sea.

This video gives a brief overview.
http://www.bbc.co.uk/learningzone/clips/why-have-fish-stocks-decreased-in-the-north-sea-pt-1-2/4687.html).

a. Over-fishing

This is caused by fishermen catching too many fish, so that there are not enough breeding adults left. This causes the population to decrease.

The following website is easy to read and gives a lot of good information about over-fishing and its effects.
http://www.ypte.org.uk/environmental/over-fishing/29

A documentary which gives an excellent introduction and explanation of the issues relating to global over-fishing is 'The end of the line', at the following website. You can enter your details and watch 25 minutes of this documentary for free.
http://www.bluemarinefoundation.com/en-GB/watch-eotl-video.aspx

There is a general explanation and more information about over-fishing around the world at:
http://ocean.nationalgeographic.com/ocean/critical-issues-overfishing

The table below gives data on the numbers of some fish species caught by Scottish fishermen, in the North Sea, over a period of 60 years.

Species of fish	**Number of fish caught (thousands)**					
	1950–59	**1960–69**	**1970–79**	**1980–89**	**1990–99**	**2000–09**
European plaice	56	68	50	61	100	66
Haddock	676	862	1066	1097	697	368
Atlantic cod	458	555	569	597	378	114
Atlantic halibut	25	14	4	1	2	2
Atlantic herring	1073	862	898	702	898	620
Atlantic mackerel	28	18	338	1615	1606	1335

There is a lot of other data available relating to fish catches which you could consider.

b. Pollution

It is suggested that pollution from the highly populated countries surrounding the North Sea has been partly responsible for reducing fish numbers. Pollution can come from sources polluting the sea directly or through issues with the rivers which run into the sea. Often chemicals used in agriculture can be washed from the fields into rivers and can cause problems for organisms living in those rivers and seas. In other instances, sewage and waste from factories are released into waterways. This can increase the number of microorganisms in the water. Microorganisms will use up oxygen and make water unsuitable for larger organisms to survive.

These low oxygen levels may cause fish to die or may affect organisms further down the food chain. This reduces the number of prey species and fish may die through lack of food.
http://www.northseawildlife.org.uk/from-inland-to-open-water/pollution/

c. Climate change

Climate change and rising sea temperature may also be a factor affecting fish numbers. Small rises in sea temperature by as little as 1°C can make the conditions more suitable for species which would not normally be able to live in the area. In the past few decades some scientists have described an increase in temperature of 1·5°C, which has allowed more warm weather fish (eg red mullet) to start appearing in the North Sea. These temperatures are not favoured by traditional species like cod so they have had to move north into different waters where their food chains and habitats might be different. Warmer waters change the complex feeding relationships in marine habitats.
http://www.awi.de/en/news/background/climate_change/how_is_the_north_sea_changing/

6. Consequences

The decline in fish stocks in the North Sea has had consequences for the food webs in the North Sea and the human populations that depend on them.

a. Food webs

Food webs involving the fish are affected by changes in fish numbers. Those fish which are caught are normally eaten by larger fish and they also feed on smaller plants and animals.

Therefore, all the organisms in the food chains of these fish may be affected. Animals which feed on specific fish have less food available to them. Some animals and plants which these fish feed on may increase in numbers. This is an example of a food chain involving haddock.

phytoplankton → copepod → capelin → haddock

Since the collapse of herring fishing in the North Sea, some fishing boats have started to fish capelin instead in larger numbers. As haddock feed on capelin, if capelin numbers decrease, there will be a reduction in the food available for haddock. Therefore, the ecosystem will not be able to support as many haddock as had previously been the case.

http://www.mcsuk.org/what_we_do/Fishing+for+our+future
http://www.fisheries.is/ecosystem/

b. Fishing communities

A reduction in fish numbers in the North Sea reduces the potential catches for fishermen. This reduces the earnings they make from their catch. This can have devastating consequences for their families, their communities and the income generated nationally.

As well as the fishermen, there is a whole industry dependent on the fish which are caught. This includes people who process the fish for sale, those who run the harbour and those who make and repair fishing equipment.

As a result, there would be less money available to spend on other things in the community. People would no longer be able to afford to spend money in shops and leisure activities, which could cause these to close down. The collapse of the fishing industry in these communities would affect every business in that community whether it was directly involved in fishing or not.

c. Extinction

Decreasing fish stocks are a global problem, which becomes a bigger issue with each passing year. This could lead to the extinction of some fish species.

d. Human diet

It can also have serious effects on the availability of food for humans. This has also led to people eating types of fish, and other seafood, which were not previously part of their diet.

The problem for some species of fish was highlighted in the UK in 2011, in a series called 'Hugh's Fish Fight'. It may be useful to view some of these programmes. http://www.channel4.com/programmes/hughs-fish-fight/4od.

7. Possible solutions

A variety of solutions to declining fish numbers have been proposed by different interested groups.

a. Marine reserves

Marine reserves are areas in the sea that are protected and not allowed to be fished. It is suggested that, by having 'no fishing zones', areas of the sea bed which are damaged by invasive fishing techniques will be allowed to recover. This will give protection to some species, allowing their numbers to recover and increase. At present, less than 1% of the sea surrounding the UK is protected. However, it has been suggested that making more areas protected would speed up the recovery of fish stocks.

b. Reducing the number of fishing days

Another suggestion is to set limits on the number of days that fishing is permitted. At present, in Alaskan waters this strategy has been very successful in allowing fish stocks to recover.

However, when the restrictions were introduced, there were not enough licences for all the fishermen to keep fishing. As a result, many fishermen were forced to stop fishing. This policy requires strict and rigid enforcement to make sure that the rules are followed at all times.

c. Stop fishing

Some people suggest that the only way to allow fish stocks to recover is to stop commercial fishing entirely. This would lead to increases in the number of fish. However, this would remove a major food source for humans. It would also be disastrous for the many people who rely on income generated by the fishing industry.

d. Quotas

A controversial attempt by the European Union (EU) to resolve the problem has been the introduction of the Common Fisheries Policy (CFP). This sets quotas (legal limits) on the numbers of different types of fish which can be caught by each country in the EU. The quotas for catches are set based on the estimation of the number of fish there are. Also, scientists make predictions about the number which need to be left in the North Sea, so that the population can survive and breed.

Fishermen's organisations often disagree with the quotas. They argue that the limits for the quotas should be raised, so that they can make enough money to survive in the industry. Often their interpretation of the research is that the numbers which are allowed to be caught are too low. They believe that stocks of some species have already recovered to allow larger quotas to be set. You can find out more about this at www.seafish.org .

The website for the fisheries section of the EU contains lots of information about the CFP. There is also, a user guide and information about how the quotas are generated.
http://ec.europa.eu/fisheries/index_en.htm

Enforcement of fishing quotas is difficult to manage. It is claimed that sometimes more fish are caught than the quota allows. It is known that trawlers sometimes catch fish which would take the catch over their quota. In this instance, these fish may be thrown back or discarded. They are often dead before they are returned to the sea, so the quota is not helping to preserve fish numbers. This practice is highly controversial and is under review.

The number of fish that are thrown back due to maximum catch quotas is given at: http://www.fao.org/docrep/w6602e/w6602E08.htm#T4

Additional useful websites
http://www.wwf.org.uk/what_we_do/safeguarding_the_natural_world/oceans_and_coasts/oceans_europe/sustainable_fisheries.cfm
http://www.telegraph.co.uk/earth/earthnews/6122954/EU-fisheries-minister-calls-for-an-end-to-dumping-millions-of-dead-fish.html

Administrative information

Published: May 2014 (version 1.2)

History of changes to Course Support Notes

Course details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013
	1.2	Updates to Mandatory Course Key Areas, Suggested Learning Activities and Exemplification of Key Areas. Amendment to assessor's recording evidence table for Experimental Investigation for Candidate 2. Amendment to exemplification material: Candidate 3's report.	Qualifications Manager	June 2014

Unit Support Notes

Unit Support Notes — Cell Biology (National 4)

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Cell Biology (National 4) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Specification*
- the *Course Specification*
- *Added Value Unit Specification*
- the *Course Support Notes*
- appropriate assessment support materials

General guidance on the Unit

Aims

The general aim of this Unit is to develop skills of scientific inquiry, investigation and analytical thinking, along with knowledge and understanding of cell biology.

Learners will apply these skills when considering the applications of cell biology 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:

- Cell division and its role in growth and repair
- DNA, genes and chromosomes
- Therapeutic use of cells
- Properties of enzymes and use in industries
- Properties of microorganisms and use in industries
- Photosynthesis — limiting factors
- Factors affecting respiration
- Controversial biological procedures

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Progression into this Unit

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 the following or equivalent qualifications and/or experience:

- National 3 Biology Course

There may also be progression from National 3 Chemistry, National 3 Environmental Science, National 3 Physics or National 3 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 4 Biology *Course Support Notes*.
If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the mandatory skills and key areas in ways which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- Other qualifications in Biology
- Further study, employment and/or training

Approaches to learning and teaching

Approaches to learning and teaching and suggested learning activities are covered in the *Course Support Notes*.

Developing skills for learning, skills for life and skills for work

Information about developing skills for learning, skills for life and skills for work in this Unit, is given in the relevant *Course Support Notes*.

Approaches to assessment and gathering evidence

The purpose of this section is to give advice on approaches to assessment for the Unit. There will be other documents produced for centres to provide exemplification of assessments and guidance on how to write them.

Approaches to the assessment of a Unit when it forms part of a Course may differ from approaches to assessing the same Unit when it is not being delivered as part of a Course. If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units.

Assessments must be valid, reliable and fit for purpose for the subject and level, and should fit in with learning and teaching approaches.

Unit assessment should support learning and teaching and, where possible, enable personalisation and choice for learners in assessment methods and processes. Teachers and lecturers should select the assessment methods they believe are most appropriate, taking into account the needs of their learners and the requirements of the Unit.

There is no mandatory order for delivery of the Outcomes. These should be overtaken throughout the Unit and are an integral part of learning and teaching. The table below gives guidance and advice on possible approaches to assessment and gathering evidence:

Strategies for gathering evidence
There may be opportunities in the day-to-day delivery of the Units in a Course to observe learners providing evidence, which satisfies completely, or partially, a Unit or Units. This is naturally occurring evidence and can be recorded as evidence for an Outcome or parts of an Outcome. In some cases, additional evidence may also be required to supplement and confirm the naturally occurring evidence. Approaches to assessment might cover the whole Unit or be combined across Outcomes. A holistic approach can enrich the assessment process for the learner by bringing together different Outcomes and/or Assessment Standards.

If a holistic approach is used, then it is necessary to be able to track individual Assessment Standard evidence.

Strategies for gathering evidence and ensuring that the learners' work is their own could include:

- personal interviews during which the teacher or lecturer can ask additional questions about completed work
- an oral presentation on their work
- writing reports in supervised conditions
- checklists to record the authenticity
- supplementary sources of evidence, such as witness testimony, film or audio clips

Evidence can be gathered from classwork, experiments, investigations and/or research carried out in this Unit. It can be obtained using one or more of the strategies outlined above or by alternative methods, which could include a test of knowledge, understanding and skills.

Equality and inclusion

The *Course Support Notes* provide full information on equality and inclusion for this Unit.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these Unit Support Notes is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and where the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications are available on SQA's website at: www.sqa.org.uk/sqa//14977.html.
- *Building the Curriculum 3: A framework for Learning and Teaching*
- *Building the Curriculum 4: Skills for learning, skills for life and skills for work*
- *Building the Curriculum 5: A framework for assessment*
- Course Specifications
- Design Principles for National Courses
- *Guide to Assessment (June 2008)*
- *Research Report 4 — Less is More: Good Practice in Reducing Assessment Time*
- *Coursework Authenticity — a Guide for Teachers and Lecturers*
- Science: A Portrait of current practice in Scottish schools (Nov 2008)
- *SCQF Handbook: User Guide* (published 2009) and SCQF level descriptors (to be reviewed during 2011 to 2012): www.sqa.org.uk/sqa/4595.html
- *SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*
- SQA Guidelines on e-assessment for Schools
- SQA Guidelines on Online Assessment for Further Education
- SQA e-assessment web page: www.sqa.org.uk/sqa/5606.html

Administrative information

Published: May 2014 (version 1.1)

History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013

Unit Support Notes

Unit Support Notes — Biology: Multicellular Organisms (National 4)

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Biology: Multicellular Organisms (National 4) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Specification*
- the *Course Specification*
- *Added Value Unit Specification*
- the *Course Support Notes*
- appropriate assessment support materials

General guidance on the Unit

Aims

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:

- Sexual and asexual reproduction and their importance for survival of species
- Propagating and growing plants
- Commercial use of plants
- Genetic information
- Growth and development of different organisms
- Biological actions in response to internal and external changes to maintain stable body conditions

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Progression into this Unit

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 the following or equivalent qualifications and/or experience:

- National 3 Biology Course

There may also be progression from National 3 Chemistry, National 3 Environmental Science, National 3 Physics or National 3 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 4 Biology *Course Support Notes*.
If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the mandatory skills and key areas in ways which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- Other qualifications in Biology
- Further study, employment and/or training

Approaches to learning and teaching

Approaches to learning and teaching and suggested learning activities are covered in the *Course Support N*otes.

Developing skills for learning, skills for life and skills for work

Information about developing skills for learning, skills for life and skills for work in this Unit, is given in the relevant *Course Support Notes*.

Approaches to assessment and gathering evidence

The purpose of this section is to give advice on approaches to assessment for the Unit. There will be other documents produced for centres to provide exemplification of assessments and guidance on how to write them.

Approaches to the assessment of a Unit when it forms part of a Course may differ from approaches to assessing the same Unit when it is not being delivered as part of a Course. If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units.

Assessments must be valid, reliable and fit for purpose for the subject and level, and should fit in with learning and teaching approaches.

Unit assessment should support learning and teaching and, where possible, enable personalisation and choice for learners in assessment methods and processes. Teachers and lecturers should select the assessment methods they believe are most appropriate, taking into account the needs of their learners and the requirements of the Unit.

There is no mandatory order for delivery of the Outcomes. These should be overtaken throughout the Unit and are an integral part of learning and teaching. The table below gives guidance and advice on possible approaches to assessment and gathering evidence:

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Assessment Standard evidence.
Strategies for gathering evidence and ensuring that the learners' work is their own could include:

- personal interviews during which the teacher or lecturer can ask additional questions about completed work
- an oral presentation on their work
- writing reports in supervised conditions
- checklists to record the authenticity
- supplementary sources of evidence, such as witness testimony, film or audio clips

Evidence can be gathered from classwork, experiments, investigations and/or research carried out in this Unit. It can be obtained using one or more of the strategies outlined above or by alternative methods, which could include a test of knowledge, understanding and skills.

Equality and inclusion

The *Course Support Notes* provide full information on equality and Inclusion for this Unit.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these Unit Support Notes is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and where the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications are available on SQA's website at: www.sqa.org.uk/sqa//14977.html.
- *Building the Curriculum 3: A framework for Learning and Teaching*
- *Building the Curriculum 4: Skills for learning, skills for life and skills for work*
- *Building the Curriculum 5: A framework for assessment*
- Course Specifications
- Design Principles for National Courses
- *Guide to Assessment (June 2008)*
- *Research Report 4 — Less is More: Good Practice in Reducing Assessment Time*
- *Coursework Authenticity — a Guide for Teachers and Lecturers*
- Science: A Portrait of current practice in Scottish schools (Nov 2008)
- *SCQF Handbook: User Guide* (published 2009) and SCQF level descriptors (to be reviewed during 2011 to 2012): www.sqa.org.uk/sqa/4595.html
- *SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*
- SQA Guidelines on e-assessment for Schools
- SQA Guidelines on Online Assessment for Further Education
- SQA e-assessment web page: www.sqa.org.uk/sqa/5606.html

Administrative information

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History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013

Unit Support Notes

Unit Support Notes — Biology: Life on Earth (National 4)

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Biology: Life on Earth (National 4) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Specification*
- the *Course Specification*
- *Added Value Unit Specification*
- the *Course Support Notes*
- appropriate assessment support materials

General guidance on the Unit

Aims

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:

- Animal and plants species depend on each other
- Impact of population growth and natural hazards on biodiversity
- Nitrogen cycle
- Fertiliser design and environmental impact of fertilisers
- Adaptations for survival
- Learned behaviour in response to stimuli linked to species survival

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Progression into this Unit

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 the following or equivalent qualifications and/or experience:

- National 3 Biology Course

There may also be progression from National 3 Chemistry, National 3 Environmental Science, National 3 Physics or National 3 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 4 Biology *Course Support Notes*.
If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the mandatory skills and key areas in ways which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- Other qualifications in Biology
- Further study, employment and/or training

Approaches to learning and teaching

Approaches to learning and teaching and suggested learning activities are covered in the *Course Support Notes*.

Developing skills for learning, skills for life and skills for work

Information about developing skills for learning, skills for life and skills for work in this Unit, is given in the relevant *Course Support Notes*.

Approaches to assessment and gathering evidence

The purpose of this section is to give advice on approaches to assessment for the Unit. There will be other documents produced for centres to provide exemplification of assessments and guidance on how to write them.

Approaches to the assessment of a Unit when it forms part of a Course may differ from approaches to assessing the same Unit when it is not being delivered as part of a Course. If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units.

Assessments must be valid, reliable and fit for purpose for the subject and level, and should fit in with learning and teaching approaches.

Unit assessment should support learning and teaching and, where possible, enable personalisation and choice for learners in assessment methods and processes. Teachers and lecturers should select the assessment methods they believe are most appropriate, taking into account the needs of their learners and the requirements of the Unit.

There is no mandatory order for delivery of the Outcomes. These should be overtaken throughout the Unit and are an integral part of learning and teaching.

The table below gives guidance and advice on possible approaches to assessment and gathering evidence:

Strategies for gathering evidence
There may be opportunities in the day-to-day delivery of the Units in a Course to observe learners providing evidence, which satisfies completely, or partially, a Unit or Units. This is naturally occurring evidence and can be recorded as evidence for an Outcome or parts of an Outcome. In some cases, additional evidence may also be required to supplement and confirm the naturally occurring evidence. Approaches to assessment might cover the whole Unit or be combined across Outcomes. A holistic approach can enrich the assessment process for the learner by bringing together different Outcomes and/or Assessment Standards. If a

holistic approach is used, then it is necessary to be able to track individual Assessment Standard evidence.
Strategies for gathering evidence and ensuring that the learners' work is their own could include:

- personal interviews during which the teacher or lecturer can ask additional questions about completed work
- an oral presentation on their work
- writing reports in supervised conditions
- checklists to record the authenticity
- supplementary sources of evidence, such as witness testimony, film or audio clips

Evidence can be gathered from classwork, experiments, investigations and/or research carried out in this Unit. It can be obtained using one or more of the strategies outlined above or by alternative methods, which could include a test of knowledge, understanding and skills.

Equality and inclusion

The *Course Support Notes* provide full information on equality and Inclusion for this Unit.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these Unit Support Notes is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and where the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications are available on SQA's website at: www.sqa.org.uk/sqa//14977.html.
- *Building the Curriculum 3: A framework for Learning and Teaching*
- *Building the Curriculum 4: Skills for learning, skills for life and skills for work*
- *Building the Curriculum 5: A framework for assessment*
- Course Specifications
- Design Principles for National Courses
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