Comparative document

(Version 1.0 April 2012 compared with Version 1.3 June 2014)

National 5 Biology Course Assessment Specification (C707 75)

The purpose of this document is to give a quick, visual guide to any amendments or clarifications made during the revision process.

Valid from August 2013

First edition: April 2012
Revised: June 2014, version 1.3

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

Course outline

Course title: National 5 Biology

SCQF level: 5 (24 SCQF credit points)

Course code: C707 75

Course assessment code: X707 75

The purpose of the Course Assessment Specification is to ensure consistent and transparent assessment year on year. It describes the structure of the Course assessment and the mandatory skills, knowledge and understanding that will be assessed.

Course assessment structure

Component 1 — question paper	80 marks
Component 2 — assignment	20 marks
Total marks	**100 marks**

This Course includes six SCQF credit points to allow additional time for preparation for Course assessment. The Course assessment covers the added value of the Course.

Equality and inclusion

This Course Assessment Specification has been designed to ensure that there are no unnecessary barriers to assessment. Assessments have been designed to promote equal opportunities while maintaining the integrity of the qualification.

For guidance on assessment arrangements for disabled learners and/or those with additional support needs, please follow the link to the Assessment Arrangements web page: www.sqa.org.uk/sqa/14977.html.

Guidance on inclusive approaches to delivery and assessment of this Course is provided in the *Course Support Notes*.

Assessment

To gain the award of the Course, the learner must pass all of the Units as well as the Course assessment. Course assessment will provide the basis for grading attainment in the Course award.

Course assessment

SQA will produce and give instructions for the production and conduct of Course assessments based on the information provided in this document.

Added value

The purpose of the Course assessment is to assess added value of the Course as well as confirming attainment in the Course and providing a grade. The added value for the Course will address the key purposes and aims of the Course, as defined in the Course Rationale. It will do this by addressing one or more of breadth, challenge, or application.

In this Course assessment, added value will focus on the following:

- breadth — drawing on knowledge and skills from across the Course
- challenge — requiring greater depth or extension of knowledge and/or skills
- application — requiring application of knowledge and/or skills in practical or theoretical contexts as appropriate

This added value consists of:

- a question paper, which requires learners to demonstrate aspects of breadth, challenge and application; learners will apply breadth and depth of skills, knowledge and understanding from across the Course to answer questions in biology
- an assignment, which requires learners to demonstrate aspects of challenge and application; learners will apply skills of scientific inquiry, using related knowledge, to carry out a meaningful and appropriately challenging task in biology and communicate findings

Grading

Course assessment will provide the basis for grading attainment in the Course award.

The Course assessment is graded A–D. The grade is determined on the basis of the total mark for all Course assessments together.

A learner's overall grade will be determined by their performance across the Course assessment.

Grade description for C
For the award of Grade C, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated successful performance in relation to the mandatory skills, knowledge and understanding for the Course.

Grade description for A
For the award of Grade A, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated a consistently high level of performance in relation to the mandatory skills, knowledge and understanding for the Course.

In addition, learners achieving a Grade A will have demonstrated a high overall level of performance by:

- retaining knowledge and understanding over a long period of time
- showing a deeper level of knowledge and understanding
- integrating and applying skills, knowledge and understanding across the three component Units of the Course
- displaying problem solving skills in less familiar and more complex contexts
- applying skills of scientific inquiry and analytical thinking in complex contexts that involve more complex data

Credit
To take account of the extended range of learning and teaching approaches, remediation, consolidation of learning and integration needed for preparation for external assessment, six SCQF credit points are available in Courses at National 5 and Higher, and eight SCQF credit points in Courses at Advanced Higher. These points will be awarded when a grade D or better is achieved.

Structure and coverage of the Course assessment

The Course assessment will consist of two Components: a question paper and an assignment. The question paper will have two Sections. The assignment will have one Section.

Component 1 — question paper

The purpose of the question paper is to assess breadth and depth of knowledge and understanding from across the Units.

The question paper will assess scientific inquiry skills, analytical thinking skills and the impact of applications on society and the environment.

The question paper will give learners an opportunity to demonstrate the following skills, knowledge and understanding by:

- demonstrating knowledge and understanding of biology by making statements, describing information, providing explanations and integrating knowledge
- applying knowledge of biology to new situations, interpreting information and solving problems
- planning or designing experiments/practical investigations to test given hypotheses or to illustrate particular effects, applying safety measures
- selecting information from a variety of sources
- presenting information appropriately in a variety of forms
- processing information (using calculations and units, where appropriate)
- making predictions and generalisations based on evidence/information
- drawing valid conclusions and giving explanations supported by evidence/justification
- suggesting improvements to experiments/practical investigations

The mandatory skills and knowledge are specified in the 'Further mandatory information on Course coverage' section at the end of this Course Assessment Specification.

The question paper will have 80 marks out of a total of 100 marks. This is 80% of the overall marks for the Course assessment.

The question paper will have two Sections.

Section 1 (Objective Test) will have 20 marks.

Section 2 will contain restricted and extended response questions and will have 60 marks.
Marks will be distributed, approximately proportionately, across the Units.
The majority of the marks will be awarded for applying knowledge and understanding.
The other marks will be awarded for applying scientific inquiry, scientific analytical thinking and problem solving skills.

Component 2 — assignment

The purpose of the assignment is to assess the application of skills of scientific inquiry and related biology knowledge and understanding.

The assignment requires learners to apply skills, knowledge and understanding to investigate a relevant topic in biology and its effect on the environment and/or society. The effect may be positive and/or negative. The topic should draw on one or more of the key areas of the Course, and should be chosen with guidance from the assessor.

The assignment will give learners an opportunity to demonstrate the following skills, knowledge and understanding by:

- applying knowledge of biology to new situations and interpreting information
- selecting information from a variety of sources
- presenting information appropriately in a variety of forms
- processing the information (using calculations and units, where appropriate)
- drawing valid conclusions and giving explanations supported by evidence/justification
- communicating findings/information

The assignment will have 20 marks out of a total of 100 marks. This is 20% of the overall marks for the Course assessment.

The majority of the marks will be awarded for applying scientific inquiry and analytical thinking skills. The other marks will be awarded for applying knowledge and understanding related to the topic chosen.

The assignment offers challenge by requiring skills, knowledge and understanding to be applied in a context that is one or more of the following:

- unfamiliar
- familiar but investigated in greater depth
- integrates a number of familiar contexts

This assignment has two stages:

- a research stage
- a communication stage

For their assignment, learners are required to:

- choose, with support, a relevant topic in biology that has an effect on the environment and/or society
- devise an appropriate aim
- describe the relevant application(s) of biology and explain the effect on the environment/society
- research the topic by selecting, processing and presenting relevant data/information
- draw a conclusion
- describe underpinning biology knowledge and understanding and explain its relevance to the topic researched
- communicate the findings of the research in a report

Setting, conducting and marking of assessment

Question paper

This question paper will be set and marked by SQA, and conducted in centres under conditions specified for external examinations by SQA. Learners will complete this in 2 hours.

Controlled assessment — assignment

This assignment is:

- set by centres within SQA guidelines
- conducted under a high degree of supervision and control

Evidence will be submitted to SQA for external marking.

All marking will be quality assured by SQA.

Setting the assessment

Set by centres within SQA guidelines.

Conducting the assessment

The **research** stage will be conducted under some supervision and control.

The **communication** stage will be conducted under a high degree of supervision. SQA will provide Assignment General assessment information and Assignment Assessment task documents. SQA will specify the material to be taken into the communication stage of the assignment.

The production of the report will be carried out:

- in time to meet a submission date set by SQA
- independently by the learner

Further mandatory information on Course coverage

The following gives details of mandatory skills, knowledge and understanding for the National 5 Biology Course. Course assessment will involve sampling the skills, knowledge and understanding. This list of skills, knowledge and understanding also provides the basis for the assessment of Units of the Course.

The following gives details of the skills:

- demonstrating knowledge and understanding of biology by making statements, describing information, providing explanations and integrating knowledge
- applying knowledge of biology to new situations, interpreting information and solving problems
- planning, designing, and safely carrying out experiments/practical investigations to test given hypotheses or to illustrate particular effects
- selecting information from a variety of sources
- presenting information appropriately in a variety of forms
- processing information (using calculations and units, where appropriate)
- making predictions and generalisations based on evidence/information
- drawing valid conclusions and giving explanations supported by evidence/justification
- suggesting improvements to experiments/practical investigations
- communicating findings/information

These skills will be assessed, across the Course, in the context of the mandatory knowledge.

Component 1 – question paper

The purpose of the question paper is to assess breadth and depth of knowledge and understanding from across the Units.

The question paper will assess scientific inquiry skills, analytical thinking skills and the impact of applications on society and the environment.
The following table specifies the mandatory knowledge for the National 5 Biology question paper.

Cell Biology
1 Cell structure Cell ultrastructure and functions to include cell wall, mitochondrion, chloroplast, cell membrane, cytoplasm, vacuole, nucleus, ribosome and plasmid using examples from typical plant, animal, fungi and bacterial cells. Cell wall structure in fungal and bacterial cells is different from plant cells, ie not cellulose.
2 Transport across cell membranes a. The cell membrane consists of ~~lipids~~phospholipids and proteins and is selectively permeable. b. Passive transport is ~~along~~down a concentration gradient and does not require energy. c. Diffusion in cells as the movement of molecules down a concentration gradient. d. Osmosis ~~as~~is the movement of water molecules ~~across~~from a ~~membrane in~~

~~terms of~~higher water concentration to a lower water concentration through a selectively permeable membrane.

e. Animal cells can burst or shrink and plant cells can become turgid or plasmolysed in different solutions.

f. Active transport requires energy for membrane proteins to move molecules and ions against the concentration gradient.

3 Producing new cells

~~a~~a. ~~. Maintenance of diploid chromosome complement by mitosis.~~

~~b.~~ Sequence of events of mitosis~~,~~ (including the terms chromatids, equator and spindle fibres~~.~~).

b. Maintenance of diploid chromosome complement by mitosis.

c. Mitosis is required for growth and repair.

~~c~~d. Cell production by cell culture requires aseptic techniques, an appropriate medium and the control of other factors.

~~d. Mitosis is required for growth and repair.~~

4 DNA and the production of proteins

a. Structure of DNA: double-stranded helix held by complementary base pairs. DNA carries the genetic information for making proteins. The four bases Adenine, Cytosine, Guanine and Thymine (A, C, G and T) make up the genetic code. A is always paired with T and C is always paired with G. The base sequence determines amino acid sequence in protein.

b. Messenger RNA (mRNA) is a molecule which carries a complimentary copy of the code from the DNA, in the nucleus, to a ribosome, where the protein is assembled from amino acids.

5 Proteins and enzymes

a. The variety of protein shapes and functions arises from the sequence of amino acids.

b. Functions of proteins to include structural, enzymes, hormones, antibodies and receptors.

c. Enzymes function as biological catalysts and are made by all living cells. They speed up cellular reactions and are unchanged in the process. The shape of the active site of an enzyme ~~molecules~~molecule is complementary to ~~a~~its specific substrate~~.~~ (s). Enzyme action results in product(s). Enzymes can be involved in degradation and synthesis reactions. Examples should relate enzymes to their specific substrate(s) and products(s)

d. Each enzyme works best in its optimum conditions. Enzymes and other proteins can be affected by temperature and pH. Enzymes can be denatured, resulting in a change in their shape which will affect the rate of reaction.

6 Genetic engineering

Genetic information can be transferred from one cell to another naturally or by genetic engineering. Stages of genetic engineering to include: identify section of DNA that contains required gene from source chromosome, extract required gene, extract plasmid from vector/ bacterial cell, insert required gene into vector/bacterial plasmid, insert plasmid into host cell and grow ~~transformed~~modified cells to produce a genetically modified (GM) organism. Use of enzymes in this process.

7 Photosynthesis

a. Photosynthesis is a two-stage process:
   1. Light reactions: the light energy from the sun is trapped by chlorophyll in the chloroplasts and is converted into chemical energy in the form of ATP. Water is split to produce hydrogen and oxygen. Hydrogen attaches to hydrogen acceptor molecules. Excess oxygen diffuses from the cell.
   2. Carbon fixation: a series of enzyme-controlled reactions, which use hydrogen and ATP~~,~~ (produced by the light reactions~~,~~) with carbon dioxide to produce sugar.

b. The chemical energy in sugar is available for respiration or can be converted into other substances, such as starch (storage) and cellulose~~.~~ (structural).

c. Limiting factors: carbon dioxide concentration, light intensity and temperature and their impact on photosynthesis and plant growth. Analysis of limiting factors graphs.

8 Respiration

a. The chemical energy stored in glucose must be released by all cells through a series of enzyme-controlled reactions called respiration.

b. The energy released from the breakdown of glucose is used to generate ATP from ADP and inorganic phosphate (Pi). The chemical energy stored in ATP can be released by breaking it down to ADP and inorganic phosphate. This energy can be used for cellular activities including muscle cell contraction, cell division, protein synthesis and transmission of nerve impulses. ATP can be regenerated during respiration.
   The breakdown of each glucose molecule via pyruvate to carbon dioxide and water in the presence of oxygen yields 38 molecules of ATP.
   The breakdown of each glucose molecule via the fermentation pathway yields two molecules of ATP when oxygen is not present. Breakdown of glucose to lactic acid via pyruvate in animal cells. Breakdown of glucose to alcohol/ethanol and carbon dioxide via pyruvate in plant and yeast cells.

c. Respiration begins in the cytoplasm. The process of fermentation is completed in the cytoplasm. Aerobic respiration starts in the cytoplasm and is completed in the mitochondria.

d. Use of respirometers to measure rate of respiration.

Multicellular Organisms

1 Cells, tissues and organs

Specialisation of cells, in animals and plants, leads to the formation of a variety of tissues and organs. Groups of organs which work together form systems.

2 Stem cells and meristems

a. Stem cells in animals can divide and have the potential to become different types of cell. Stem cells are involved in growth and repair.

b. Meristems are the sites of production of non-specialised cells in plants and are the sites for mitosis in a plant. These cells have the potential to become other types of plant cell and they contribute to plant growth.

3 Control and communication

a. Nervous control

i. Nervous ~~control in animals, including structure and function~~system consists of central nervous system (CNS) and ~~the~~nerves. CNS consists of brain~~,~~ and spinal cord. Structure and function of brain to include cerebrum, cerebellum and medulla.

~~b. Rapid reflex action and reflex arc:~~ Neurons are of three types, sensory, relay and motor ~~neurons~~. Receptors detect sensory input/stimuli. Electrical impulses carry messages along neurons. A synapse occurs between neurons. Chemicals transfer these messages across synapses.

~~c~~ii. Structure and function of reflex arc.

b. Hormonal control

i. Endocrine glands release hormones into the blood stream. Hormones are chemical messengers. Target tissues have cells with receptor proteins for hormones, so only some tissues are affected by specific hormones.

~~d.~~ ii. Blood glucose regulation including the role of insulin, glucagon, glycogen, pancreas and liver.

4 Reproduction

~~a. Cells are diploid, except gametes, which are haploid.~~

a. The structure of gametes and the sites of their production in plants and animals. Cells are diploid, except gametes, which are haploid.

b. Fertilisation is the fusion of the nuclei of the two haploid gametes ~~produces~~to produce a diploid zygote ~~at fertilisation~~.

5 Variation and inheritance

a. Comparison of discrete and continuous variation.

b. Most features of an individual phenotype are polygenic and show continuous variation.

c. Genetic terms, including~~:~~ gene, allele, phenotype, genotype, dominant, recessive, homozygous, heterozygous and P, F_1 and F_2. Carry out monohybrid crosses from parents through to F_2. Reasons why predicted ratios are not always achieved.

6 The need for transport

a. Plant transport systems

i. ~~Water is required for transporting materials and for photosynthesis.~~

~~ii. Structures and processes involved in water movement~~Leaf structure to include ~~root hairs, guard cells, stomata,~~upper epidermis, palisade mesophyll, spongy mesophyll, vein, lower epidermis, guard cells and ~~transpiration.~~ stomata.

~~Water and~~ ii. Other parts of the plant involved in water transport including root hairs and xylem vessels. Water minerals are transported ~~through the stem~~ in xylem vessels. Xylem ~~cells/~~vessels are ~~lignified~~dead and contain lignin for support. Water is required for transporting materials and for photosynthesis.

~~iii.~~iii. The process of transpiration.

iv Sugar is transported up and down the plant in living phloem ~~cells~~. Structure of phloem tissue.

b. Animal transport and exchange systems

i. In mammals, nutrients, oxygen and carbon dioxide are transported in the blood.

ii. Pathway of oxygenated and deoxygenated blood through heart, lungs and body. Heart structure to include right and left atria and ventricles and location and function of valves. Blood vessels to include aorta, vena cava,

pulmonary arteries and veins ~~and,~~ coronary arteries and their function.

iii. Arteries have thick, muscular walls, a narrow central channel and carry blood under high pressure~~.~~ away from the heart. Veins carry blood under low pressure; have thinner walls and a wide channel. Veins contain valves to prevent backflow of blood~~.~~ and carry blood towards the heart. Capillaries form networks at organs and tissues, and are thin walled and have a large surface area, allowing exchange of materials.

iv. Red blood cells ~~contain haemoglobin and~~ are specialised by being biconcave in shape, having no nucleus and containing haemoglobin. This allows them to ~~carry~~transport oxygen ~~in~~efficiently in the form of oxyhaemoglobin.

v. Rings of cartilage keep main airways open. Oxygen and carbon dioxide are exchanged through the alveolar walls. Alveoli have a large surface area, thin walls and a good blood supply ~~and thin walls~~ for more efficient diffusion of gases.
Mucus traps dirt and microorganisms and cilia moves this up and out of the lungs.

vi. Food is moved through the digestive system by peristalsis. Villi in the small intestine ~~are thin walled,~~ have a large surface area, thin walls and a good blood supply to aid absorption of glucose and amino acids. The lacteals absorb fatty acids and glycerol (the products of fat digestion~~.~~).

7 Effects of lifestyle choices on human transport and exchange systems

Life on Earth

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.

b. Competition for resources, disease, food availability, grazing and predation are biotic factors~~;~~. Light intensity, moisture, PH and temperature are abiotic factors.

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.

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.

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, temperature and nutrient availability~~,~~ and its interactions with other organisms in the community~~,~~ including competition, parasitism and predation.

2 Energy in ecosystems

~~a.~~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 the energy is lost as heat, movement or undigested materials. 10% is used for growth~~.~~

~~b.~~c. Definitions and comparisons of pyramids of biomass, energy and numbers.

~~c~~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.

e. Nitrogen in ecosystems

~~Animal and~~. 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.

~~d. Other ecological terms, including: species, population, producer, consumer, herbivore, carnivore, and omnivore.~~

~~e. Competition in ecosystems~~

~~Interspecific competition is individuals of different species requiring similar resources in an ecosystem.~~

~~Intraspecific competition is individuals of the same species requiring the same resources.~~

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. ~~Measuring abiotic factors including light intensity, temperature, pH and soil moisture~~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.

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.

~~b.~~b. New allelles 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.

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.

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.

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 leads to~~

~~a reduction in oxygen levels~~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 passed along food chains, toxicity increases and can reach lethal levels.

~~d. Indicator species are species that by their presence or absence indicate environmental quality/levels of pollution.~~

e. Biological control ~~and~~may be an alternative to the use of pesticides. GM crops may be ~~alternatives~~an alternative to the use of fertilisers ~~and pesticides~~ .

Component 2 – assignment

The purpose of the assignment is to assess the application of skills of scientific inquiry and related biology knowledge and understanding.

The assignment requires learners to apply skills, knowledge and understanding to investigate a relevant topic in biology and its effect on the environment and/or society. The effect may be positive and/or negative. The topic should draw on one or more of the key areas of the Course in the table above, and should be chosen with guidance from the assessor.

Administrative information

Published: June 2014 (version 1.3)

History of changes to Course Assessment Specification

Course details	Version	Description of change	Authorised by	Date
	1.1	Further information and clarification on scope and structure of the question paper/ assignment given in the 'Structure and coverage of Course assessment' section. Setting, conducting and marking of assessment section: wording added to clarify assessment conditions; Further mandatory information section: divided into separate parts for question paper and assignment; amendment to wording to clarify activities in skills list, plus changes to wording in Course/Unit content to clarify meaning and benchmarking	Qualifications Development Manager	June 2013
	1.2	Page 11: inconsistency with other documents fixed. 'Xylem cells are lignified' changed to 'Xylem cells/vessels are lignified'.	Qualifications Manager	October 2013
	1.3	Updates to mandatory knowledge.	Qualifications Manager	June 2014