SCOTTISH QUALIFICATIONS AUTHORITY

BIOLOGY
Intermediate 2

Fourth Edition - published June 2002

SCOTTISH QUALIFICATIONS AUTHORITY

NOTE OF CHANGES TO ARRANGEMENTS
FOURTH EDITION PUBLISHED JUNE 2002

COURSE TITLE: Biology (Intermediate 2)

COURSE NUMBER: C007 11

National Course Specification

Course Details:

Clarification to Content and Notes throughout to give indication of depth of treatment.

Details of the Instruments for External Assessment: Section C of the course examination has been amended to delete the use of the coherence mark.

Assessment: section inserted which details Instruments for Internal Assessment and emphasises need for only one report for Outcome 3 being required across the course.

National Unit Specification:

All Units

Statement of Standards

Wording of Outcome 3 changed to refer to Intermediate 2 Biology instead of the title of the unit.

Evidence Requirements of Outcome 3 changed to refer to the context of the report being within the content and notes specified for Intermediate 2 Biology instead of within the context of each unit.

Support Notes

Guidance on Approaches to Assessment for the units includes:

- additional guidance which emphasises the need to produce only one report across the course and that a report from one unit may be used as evidence for Outcome 3 for the other units
- advice on redrafting only being required for the specific performance criterion in need of further attention
- advice on the conditions required to complete the report which indicates that reports may be completed outwith class time provided reasonable measures are taken to ensure that the report is the individual work of the candidate
- advice on the use of IT for production of the Outcome 3 report
- advice on the transfer of evidence.

SCOTTISH QUALIFICATIONS AUTHORITY

National Course Specification

BIOLOGY (INTERMEDIATE 2)

COURSE NUMBER C007 11

COURSE STRUCTURE

The course has three 40 hour units. The units cover the following content areas:

D026 11 ***Living Cells*** ***1 credit (40 hours)***

- *Cell Structure and Function*
- *Diffusion and Osmosis in Plant and Animal Cells*
- *Enzyme Action*
- *Aerobic and Anaerobic Respiration*
- *Photosynthesis*

D027 11 ***Environmental Biology and Genetics*** ***1 credit (40 hours)***

- *Ecosystems*
- *Factors Affecting Variety of Species in an Ecosystem*

D028 11 ***Animal Physiology*** ***1 credit (40 hours)***

- *Mammalian Nutrition*
- *Control of the Internal Environment*
- *Circulation and Gas Exchange*
- *Sensory Mechanisms and Processing of Information*

In common with all courses, this course includes a further 40 hours over and above the 120 hours for the component units. This may be used for induction, extending the range of learning and teaching approaches, support, consolidation, integration of learning and preparation for external assessment. This time is an important element of the course and advice on its use is included in the course details.

Administrative Information

Publication date: June 2002

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Version: 04

National Course Specification (cont)

COURSE Biology (Intermediate 2)

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- Standard Grade Biology with Knowledge and Understanding and Problem Solving at grades 3 or 4
- Intermediate 1 Biology or its component units.

Previous biology experience is not a requirement. The course is therefore also suitable for those wishing to study biology for the first time, eg adult returners and those with Standard Grade Physics, Chemistry or Science with Knowledge and Understanding and Problem Solving at grades 1-3.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Course Specification: course details

COURSE Biology (Intermediate 2)

RATIONALE

The course provides a broad-based, integrated study of the range of biological topics which are required for progression to the study of Higher Biology or Higher Human Biology as well as other areas of study or employment. The course develops an understanding of the way in which biological principles can be applied to the issues facing the individual and society, and fosters in candidates positive attitudes to themselves and others. The study of Intermediate 2 Biology contributes to the candidate's general and vocational education through the acquisition of relevant biological knowledge and skills, and to the development of the more general attitudes and abilities related to the processes of science.

The course provides opportunities for candidates to acquire:

- knowledge and understanding of biological concepts, facts, ideas and techniques and the applications of biology in society and industry
- skills in problem solving
- practical abilities associated with biology
- positive attitudes such as being open-minded and being willing to recognise alternative points of view, having an interest in biology, in themselves and their environment, being aware that they can make decisions which affect the well-being of themselves and others, and of the quality of their environment.

COURSE CONTENT

The Intermediate 2 Biology course comprises three units, each of which has a short introduction indicating links with Higher Biology and Higher Human Biology. The course further develops the Standard Grade elements and Intermediate 1 outcomes of knowledge and understanding, problem solving and practical abilities.

Knowledge and understanding

Candidates should develop the ability to recall and understand the facts and principles detailed in the course content statements and supplementary notes in the following tables.

Problem solving

Problem solving skills should be developed so that candidates can generally:

- select relevant information from texts, tables, charts, keys, graphs and diagrams
- present information appropriately in a variety of forms, including written summaries, extended writing, tables and graphs
- process information accurately, using calculations where appropriate
- plan, design and evaluate experimental procedures
- draw valid conclusions and give explanations supported by evidence
- make predictions and generalisations based on available evidence.

National Course Specification: course details (cont)

COURSE Biology (Intermediate 2)

Practical abilities

Practical work is essential in providing the contexts for the development of scientific problem solving skills. Practical work is necessary to underpin theoretical work and to develop skills. It fosters familiarity with apparatus, equipment and how it works as a useful preparation for further study or employment. As a result of engaging in practical work, candidates can generally:

- describe experimental procedures accurately
- record relevant measurements and observations in appropriate formats
- analyse and present experimental information in appropriate formats
- draw valid conclusions
- evaluate experimental procedures with supporting argument.

The following tables contain the content and suggested learning activities through which knowledge and understanding, problem solving and practical abilities are to be developed. The content statements and supplementary notes, which provide amplification and give an indication of depth of treatment, are required for the purposes of assessment.

National Course Specification: course details (cont)

Unit 1: Living Cells (Intermediate 2)

Introduction

The structure and function of a variety of cells including plant, animal and microbial cells should be studied so that candidates can appreciate that cells are functional living units. While specialised cells can be used to exemplify variety, the detailed structure and function of these should be dealt with in the context of other units, eg in Animal Physiology.

CONTENT	NOTES	LEARNING ACTIVITIES
a) Cell structure and function		
i Similarities and differences between animal, plant and microbial cells.	Cheek epithelial cells, leaf mesophyll cells and yeast cells should be used to illustrate typical plant, animal and microbial cells, their similarities and differences in structure.	Examine fresh and prepared slides of a range of plant, animal and microbial cells using appropriate stains and a light microscope. Suitable examples would include: cheek epithelium, onion epidermis, rhubarb epidermis, *Elodea*, yeast.
ii Function of cell structures.	Functions of nucleus, cytoplasm, cell membrane, cell wall, chloroplasts and vacuole.	
iii Commercial and industrial uses of cells.		
Bread making.	Anaerobic respiration in yeast produces carbon dioxide gas which causes dough to rise.	Select and present data on the commercial and industrial uses of micro-organisms.
Alcohol production.	Fermentation in yeast results in the production of alcohol (beer and wine).	

National Course Specification: course details (cont)

Unit 1: Living Cells (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
Antibiotic production.	Fungi used to produce wide range of antibiotics that can destroy bacteria; resistant bacteria are unaffected by antibiotics and are on the increase due to overuse of antibiotics.	Carry out experiments to demonstrate the effects of antibiotics on bacterial colonies.
Yoghurt production.	Bacteria convert sugar in milk (lactose) into lactic acid, causing curdling.	Carry out an experiment to demonstrate lactic acid production by yoghurt bacteria.
Alternative fuel production.	Biogas is produced when bacteria respire anaerobically to produce methane from waste products. Gasohol is produced when alcohol produced by the fermentation of sugar cane is mixed with petrol.	
b) Diffusion and osmosis in plant and animal cells		
i Diffusion as the movement of substances from a high concentration to a low concentration down a concentration gradient.	Examples of substances which enter and leave the cell by diffusion, eg glucose and amino acids (ie dissolved food), oxygen, carbon dioxide and waste products (eg urea).	Carry out an experiment to demonstrate diffusion.
ii The importance of diffusion to cells.	To gain raw materials for respiration and photosynthesis. To remove waste products.	

National Course Specification: course details (cont)

Unit 1: Living Cells (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
iii Osmosis as a 'special case' of diffusion of water.	Osmosis defined as the movement of water across a selectively permeable membrane as a result of a water concentration gradient.	
iv Osmotic effects in plant and animal cells.	Osmotic effects in plant and animal cells explained in terms of the movement of water down a water concentration gradient. The effects of placing plant and animal cells in hypertonic, hypotonic and isotonic solutions should be studied. The terms plasmolysed, turgid and flaccid should be known.	Carry out experiments to demonstrate osmosis using Visking tubing model cells and potato or other plant material. Microscopic examination of rhubarb epidermis or red onion cells in different concentrations of solutions.
c) Enzyme action		
1 Enzyme properties		
i Properties of catalysts and enzymes.	The properties and functions of catalysts: lower the energy input required for chemical reactions, speed up chemical reactions, take part in reactions but remain unchanged. Enzymes are biological catalysts made by all living cells. Enzymes are proteins required for the functioning of all living cells.	Demonstrate the breakdown of hydrogen peroxide by heating compared to catalysis with manganese dioxide and catalase.
ii Specificity of enzymes for their substrates.	The characteristic shape of enzyme molecules complementary to their substrate. Presence of specific active site.	Carry out an experiment to demonstrate the specificity of enzymes.

National Course Specification: course details (cont)

Unit 1: Living Cells (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
iii Enzymes involved in degradation and in synthesis.	Degradation: the chemical breakdown of a substance as illustrated by amylase and catalase. Synthesis: the building of a complex molecule from simpler molecules as illustrated by phosphorylase. Details of their substrates and products are required.	Carry out an experiment to demonstrate the synthesis of starch.
2 Factors affecting activity	The influence of temperature and pH on enzyme activity giving rise to optimum operating conditions and denaturing (protein structure alters resulting in change in shape of active site and inactivation of enzyme).	Plan and design investigations into the influence of temperature and pH on enzyme activity.
d) Aerobic and anaerobic respiration		
1 Energy release		
i Glucose as a source of energy in the cell.	The chemical energy stored in glucose is released by a series of enzyme-controlled reactions called respiration. Some energy is released as heat from cells during respiration but most is used for cellular activities such as muscle contraction, cell division, synthesis of proteins and transmission of nerve impulses.	Select and present data on the energy content of foods.

National Course Specification: course details (cont)

Unit 1: Living Cells (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
ii Role of ATP.	Energy released from the breakdown of glucose is used to synthesise ATP from ADP and Pi. The ATP can then be used by the cell as an energy source.	
iii Comparison of energy yield in aerobic and anaerobic respiration.	Aerobic respiration yields 38 molecules of ATP per glucose molecule. Anaerobic respiration yields 2 molecules of ATP per glucose molecule.	
2 Products		
i Aerobic Pathway.	Breakdown of glucose to pyruvic acid by glycolysis. Further breakdown of pyruvic acid to carbon dioxide and water in presence of oxygen.	Plan and design an investigation into anaerobic respiration in yeast.
ii Anaerobic Pathway.	Breakdown of glucose to pyruvic acid by glycolysis. Reversible anaerobic conversion of pyruvic acid to lactic acid in animals. Effect of lactic acid on muscle cells (ie muscle fatigue) and subsequent repayment of oxygen debt. Irreversible anaerobic conversion of pyruvic acid to ethanol and carbon dioxide in plants and yeast.	

National Course Specification: course details (cont)

Unit 1: Living Cells (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
e) Photosynthesis	Photosynthesis is a series of enzyme-controlled reactions which allow green plants to make their own food.	
1 Energy fixation		
i Sunlight as the source of energy.	The light energy from the sun is trapped by chlorophyll in the chloroplasts and is converted into chemical energy in the form of ATP which is used in the production of glucose.	
ii Summary equation for photosynthesis.	Carbon dioxide and water as raw materials for the production of glucose and oxygen as a by-product. Occurs in the presence of chlorophyll and light. The importance of diffusion in the movement of carbon dioxide and oxygen into and out of the leaf cells.	Carry out experiments to compare photosynthesis in light and dark conditions and in the presence and absence of carbon dioxide.

National Course Specification: course details (cont)

Unit 1: Living Cells (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
iii Photosynthesis as a set of two summary reactions: photolysis followed by carbon fixation.	Photolysis as the breakdown of water to provide hydrogen, ATP and oxygen. The oxygen is released as a by-product and the hydrogen is picked up by a hydrogen carrier molecule (specific name not required). Carbon fixation as the combining of the hydrogen produced by photolysis with carbon dioxide to form glucose using the ATP produced during photolysis.	
iv Conversion of glucose to other carbohydrates.	Starch as a storage carbohydrate and cellulose as a structural component of the cell wall.	
2 Factors affecting rate of photosynthesis		
i Limiting factors.	Light intensity, carbon dioxide concentration and temperature as limiting factors.	Carry out experiments using *Elodea* to demonstrate the effect of limiting factors. Use computer simulations which illustrate the effect of limiting factors.
ii Production of early crops in horticulture.	The use of supplementary lighting, carbon dioxide enrichment and heating to produce early crops in horticulture.	

National Course Specification: course details (cont)

Unit 2: Environmental Biology and Genetics (Intermediate 2)

Introduction

Environmental biology and genetics are of considerable economic and social importance. This unit focuses on the importance of biodiversity and illustrates this through a study of ecology which explores energy flow and the factors that affect the variety of species in an ecosystem. The contribution to biodiversity by variation within a species is illustrated through the study of fertilisation and genetics.

CONTENT	NOTES	LEARNING ACTIVITIES
a) Ecosystems 1 Energy flow i Components of an ecosystem.	Habitats, populations and communities as components of an ecosystem. The niche of an organism within an ecosystem.	Use a case study of a local or topical ecosystem to identify its component parts and inter-relationships.
ii Food chains and food webs.	Producers, primary and secondary consumers, herbivores, carnivores, omnivores, predators, prey and decomposers in ecosystems as illustrated in food chains and food webs. The flow and loss of energy in ecosystems as seen in food chains. Pyramids of energy, numbers and biomass in ecosystems.	

National Course Specification: course details (cont)

Unit 2: Environmental Biology and Genetics (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
2 Factors affecting the variety of species in an ecosystem		
i The importance of biodiversity at species level.	Biodiversity defined as the range of species in an ecosystem. A species defined as a group of organisms which can interbreed to produce fertile offspring. A stable ecosystem has a wide range of species and food webs. The removal of one or more species and the consequences this has on other organisms/populations in the food web.	
ii Factors affecting biodiversity.		
Adaptations to habitat and niche.	As illustrated by Darwin's finches (adaptations of beak shape and size) and desert plants (adaptations of roots, reduced leaf surface area and presence of thick waxy cuticle on leaves).	
Effects of grazing.	High intensity of grazing will maintain species diversity. Very high or low intensity or grazing will decrease diversity.	
Effects of human activity.	Pollution and habitat destruction lead to decrease in species diversity.	

National Course Specification: course details (cont)

Unit 2: Environmental Biology and Genetics (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
Competition in plants and animals.	Plants compete mainly for water, light and soil nutrients. Animals compete for food (eg predator-prey interactions), water and shelter.	Design and carry out experiments to demonstrate the effects of competition on population growth using for example, cress or radish seedlings.
iii Behavioural adaptations in animals and their adaptive significance.	As illustrated by responses to light and relative humidity in woodlice.	Carry out experiments to demonstrate animal responses to environmental stimuli, using choice chambers or similar apparatus.
b) Factors affecting variation in a species	Continuous and discontinuous variation using examples in both plants and animals.	
1 Fertilisation		
i Gamete (sex cell) production.		
Site of production of male and female gametes in mammals.	Mammals: sperm are produced in the testes and eggs are produced in the ovaries.	
Site of production of male and female gametes in flowering plants.	Flowering plants: anther produces pollen which contains the male gamete, ovary produces ovules which contain the female gamete.	
ii Fusion of nuclei.	Fusion of nuclei forms a zygote producing variation by random combination of parental gametes.	

National Course Specification: course details (cont)

Unit 2: Environmental Biology and Genetics (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
2 Genetics		
i The importance of chromosome structure to an organism's characteristics.	Chromosomes contain genetic information that gives rise to an organism's characteristics. Chromosomes should be described in terms of a chain of DNA bases.	
The relationship between DNA sequence and protein synthesised.	The order of DNA bases encodes information for the sequences of amino acids in proteins. These in turn dictate the structures and therefore functions of these proteins. No detail of DNA structure or the mechanism of protein synthesis is required.	
The relationship between proteins present in a cell and the organism's characteristics.	eg the protein haemoglobin gives red blood cells their characteristic colour. Role of enzymes and hormones.	
ii Division of the nucleus in gamete production (meiosis).	Gametes have one set of chromosomes. Body cells have two matching sets of chromosomes. The reduction in number of chromosomes to a single set occurs during gamete formation. The two sets of chromosomes are restored at fertilisation. Matching chromosomes pair and then separate during meiosis. The random assortment of chromosomes during meiosis leads to variation in offspring. Reference to chiasmata and crossing over should not be made.	Use a card simulation to show random assortment of chromosomes.

National Course Specification: course details (cont)

Unit 2: Environmental Biology and Genetics (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
iii Chromosome numbers in different species.	Humans have 23 chromosomes in one set giving a total of 46 chromosomes in a normal body cell. Different species have different numbers of chromosomes (chromosome complement).	
iv Sex determination.	In humans, each male gamete has an X or a Y chromosome, while each female gamete has an X chromosome.	
v Characteristics controlled by forms of a gene called alleles.	Genes are parts of chromosomes. Different forms of a gene are called alleles. Each gamete carries one allele of the gene. Use of the terms homozygous, heterozygous, dominant and recessive.	Select and present information to show that characteristics are inherited from both parents.
vi Genotype and phenotype.	Relationship of genotype to phenotype. Examples of the same phenotype with different genotypes.	
vii Monohybrid crosses.	Use of terms true breeding, P, F_1 and F_2 Parents in experimental monohybrid crosses are usually true breeding and show different phenotypes.	Solve problems related to monohybrid crosses in plants and animals.
	Candidates should be able to solve problems in relation to monohybrid crosses following through from the P generation to the F_2 generation, using dominant and recessive alleles.	Use computer models to illustrate monohybrid crosses.

National Course Specification: course details (cont)

Unit 2: Environmental Biology and Genetics (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
viii Proportions and ratios of phenotypes of the F_1 and F_2 offspring.	Reasons for differences between observed and predicted figures in monohybrid crosses should be known.	Germinate albino and wild type tobacco seeds and their offspring to illustrate the proportions of phenotypes of the F_1 and F_2 offspring.
ix Co-dominance.	Two alleles of a gene can be co-dominant when neither is dominant nor recessive. Both alleles are displayed in the phenotype. Candidates should be able to solve problems related to crosses involving co-dominant alleles.	
x Polygenic inheritance.	A range of phenotypes is produced eg skin colour in humans, and seed mass in plants. The characteristics arise due to the interaction of the alleles of several genes.	Solve problems in relation to genetic crosses involving co-dominant alleles.
xi Environmental impact on phenotype.	The final appearance of an organism (phenotype) is the result of its genotype and the effects of the environment. If organisms of identical genotype are subject to different environmental conditions they show considerable variation. Such changes have little evolutionary significance as they are not passed from one generation to the next.	
xii Natural selection.	The process by which organisms that are better adapted to their environment survive and breed, while those less well adapted fail to do so. The better adapted organisms are more likely to pass their characteristics to succeeding generations. As illustrated by the Peppered Moth.	

National Course Specification: course details (cont)

Unit 2: Environmental Biology and Genetics (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
xiii Selective Breeding.	The selective breeding of plants and animals showing desirable characteristics. Over several generations improved offspring may result. Takes a relatively long period of time and the results are not always guaranteed.	
xiii Genetic Engineering.		
Stages in the production of desired product by genetic engineering.	To include the following stages: identification and removal of required gene from source chromosome; insertion of required gene into bacterial plasmid; insertion of plasmid into bacterial cell; synthesis of required product by bacteria.	Select, present and discuss information on the applications and issues arising from genetic engineering.
Applications of the products of genetic engineering.	Production of medicines for human use eg insulin and growth hormone.	
Advantages and disadvantages of genetic engineering.	Advantages to include increased range of products and increased rate of production. Disadvantages to include the possible release of genetically engineered bacteria into the environment and cost of development.	

National Course Specification: course details (cont)

Unit 3: Animal Physiology (Intermediate 2)

Introduction

This unit explores the ways in which animals are adapted for survival and respond to changes in their internal and external environments. The emphasis is on vertebrates, particularly mammals, and explores the relationship between structure and function.

CONTENT	NOTES	LEARNING ACTIVITIES
a) Mammalian nutrition		
1 Breakdown of food		
i Requirement for food.	The main food groups: carbohydrates, proteins, fats, vitamins and minerals and their roles in the body. Simple structure of carbohydrates, proteins and fats in terms of chemical elements present, simple sugars, amino acids, fatty acids and glycerol.	Select and present information on the incidence of carbohydrates, proteins and fats in common foodstuffs.
ii Food tests for starch, glucose, protein and fat.		Carry out food tests using Iodine, Benedict's, Biuret and the translucent spot.
iii Energy content of food.	Different food groups have different energy contents eg fat contains more energy than protein and carbohydrate.	
iv The need for digestion.	Digestion involves the breakdown of large, insoluble food molecules into smaller, soluble food molecules to allow absorption into the blood stream through the lining of the small intestine.	Carry out an experiment to demonstrate the purpose of digestion and absorption using Visking tubing as a model gut.

National Course Specification: course details (cont)

Unit 3: Animal Physiology (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
2 The structure and function of the alimentary canal and associated organs.		
i The mouth, salivary glands and oesophagus.	The mechanical breakdown of food in the mouth. Saliva contains amylase which digests starch into maltose. Mucus in saliva from salivary glands helps lubricate mouth and food to aid swallowing. Oesophagus and the mechanism of peristalsis. It should be noted that peristalsis occurs throughout the length of the alimentary canal and not just in the oesophagus. Details of the teeth are not required.	Select and present information to illustrate peristalsis.
ii The role of the stomach.	Food is churned in the stomach by the action of longitudinal and circular muscles to mix food with gastric juices. Chemical breakdown of protein by pepsin. Functions of mucus-secreting cells, enzyme-secreting cells, and acid-secreting cells.	Design and carry out experiments to demonstrate the effects of pH and temperature on the digestion of protein.

National Course Specification: course details (cont)

Unit 3: Animal Physiology (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
iii The role of the small intestine in the absorption and secretion of food.	To include further digestion of fat by lipase and protein by trypsin. The absorption of food by diffusion. The structure of a villus, including the lacteal and blood capillaries and the food molecules each absorbs. The fate of absorbed materials to include storage, energy source, raw materials for synthesis and deamination.	Examine slides of villi.
iv The role of the pancreas, liver and gall bladder.	Pancreas produces lipase, trypsin and amylase for fat digestion. Liver stores excess glucose as glycogen and is the site of deamination. Gall bladder stores bile which emulsifies fats to aid digestion.	
v The role of the large intestine, rectum and anus.	Water absorption and elimination of undigested material.	Select and present information to illustrate the incidence of colonic cancer in Scotland.
b) Control of the internal environment		
i The structure of the human urinary system.	To include kidney, renal artery, renal vein, ureter, bladder and urethra.	Select and present data relating water consumption to volume and concentration of urine.

National Course Specification: course details (cont)

Unit 3: Animal Physiology (Int 2)

CONTENT	NOTES	LEARNING ACTIVITIES
ii The role of the mammalian kidney.		
Osmoregulation.	Osmoregulation is the regulation of water content in organisms. The kidneys as main organs for osmoregulation in mammals. Water gain through drinking, food and metabolic water; water loss through sweat, breath, faeces and urine.	
Production of urea and its removal in urine.	The role of the urine in the excretion of nitrogenous waste. Urea as the waste product from breakdown of excess amino acids in the liver ie deamination, its transportation in the blood to the kidney and removal in urine.	
The structure and function of the kidney.	To include filtration, reabsorption and urine production in the kidney as related to the structure of the nephron, including the Bowman's capsule, glomerulus, blood capillaries and collecting duct.	

National Course Specification: course details (cont)

Unit 3: Animal Physiology (Int 2)

CONTENT	NOTES	LEARNING ACTIVITIES
iii Negative feedback control by ADH.	Osmoreceptors in the hypothalamus are stimulated by a change in water concentration in the blood. A decrease in water concentration triggers an increase in the release of antidiuretic hormone (ADH) from the pituitary. ADH increases the permeability of the kidney tubules and collecting duct, resulting in more water being reabsorbed into the blood stream. As the water concentration of the blood rises, less ADH is released resulting in less water being reabsorbed. Concentration and volume of urine produced as a result.	Select and present information on the role of ADH.
iv Osmoregulation in marine and freshwater bony fish.	Marine bony fish: hypotonic tissues, dehydration problem, overcome by drinking water and excreting excess salt and small volume of concentrated urine. Freshwater bony fish: hypertonic tissues, problem of influx of water, overcome by excreting copious and very dilute urine.	

National Course Specification: course details (cont)

Unit 3: Animal Physiology (Int 2)

CONTENT	NOTES	LEARNING ACTIVITIES
c) Circulation and gas exchange 1 The structure and function of the heart and blood vessels		
i The structure of the heart related to its function as a muscular pump.	The structure of the heart including the names of the four chambers of the heart; the position and function of valves (bicuspid, tricuspid and semi-lunar); the reason for the differences in thickness of walls of the ventricles; the heart obtains its blood supply from the coronary arteries. The effect of blocked coronary artery.	View and discuss video material on circulation. Examine a mammalian heart to identify structures and relate to their function.
ii Blood vessels.	The path of blood flow through the heart and its associated vessels; blood leaves heart in arteries, flows through capillaries and returns to heart in veins; the pulse indicates that blood is pumped through arteries; structural adaptations of arteries, veins and capillaries related to function. Names and positions of pulmonary artery and vein, aorta and vena cava, hepatic artery, hepatic vein, mesenteric artery, hepatic portal vein, renal arteries and renal veins.	

National Course Specification: course details (cont)

Unit 3: Animal Physiology (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
2 Structure and function of lungs in gas exchange and the capillary network		
i Internal structure of lungs and features which make them efficient gas exchange structures.	Structure to include trachea, bronchi, bronchioles and alveoli (air sacs). Features of alveoli which allow efficient gas exchange: large surface area, thin walls, moist surfaces and good blood supply. The role of diffusion in exchange of oxygen and carbon dioxide.	View and discuss video material on gas exchange.
ii Features of capillary network which allow efficient gas exchange in tissues.	To include large surface area, in close contact with tissue cells, thin walled.	
3 Composition and functions of blood		
i Function of red blood cells and plasma in the transport of respiratory gases and food.	Oxygen carried in red blood cells, carbon dioxide carried in red blood cells and dissolved in plasma. Concentration of carbon dioxide carried dissolved in plasma is limited by the increase in acidity carbon dioxide causes in the blood. Soluble foods carried dissolved in the plasma.	Examine prepared blood smears.
ii Function of haemoglobin in the transport of oxygen.	Ability of haemoglobin to combine with oxygen to form oxyhaemoglobin at high oxygen levels in the lungs and to release oxygen at low oxygen levels in the tissues.	

National Course Specification: course details (cont)

Unit 3: Animal Physiology (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
iii Functions of macrophages and lymphocytes in defence.	Phagocytosis by macrophages. Stages of phagocytosis (engulfing, then digestion). No requirement to name pseudopodia and lysosomes. Antibody production and specificity of antibodies	
d) Sensory mechanisms and processing of information		
1 The structure and function of the brain		
i Functions, in simple terms, of cerebrum, cerebellum, medulla and hyopthalmus.	Structures to include cerebrum, cerebellum, medulla and hypothalamus. Cerebrum as the site of conscious responses and higher centres, cerebellum as the centre of balance and co-ordination of movement, medulla as the site of the vital centres such as breathing and heart rate, hypothalamus as the centre for regulation of water balance and temperature.	
ii Discrete areas of cerebrum related to sensory/motor function.	Location of sensory and motor strip as discrete areas of the cerebrum.	

National Course Specification: course details (cont)

Unit 3: Animal Physiology (Intermediate 2)

CONTENT	NOTES	LEARNING ACTIVITIES
2 The structure and function of the nervous system		
i The brain, spinal cord and nerves.	Nerves carry impulses from the senses to the central nervous system and impulses from the central nervous system to the muscles.	
ii Relex action and the reflex arc.	Reflex arc as receptor, sensory neurone, relay fibre, motor neurone and effector. Detailed structure need not be known. Rapidity and protection as function of reflex response.	Demonstrate and explain a reflex action.
iii The role of the central nervous system (CNS).	To include: sorting out information (in the form of impulses) from the senses and sending messages (in the form of impulses) to muscles which can make the appropriate response.	Carry out an investigation into changes in body surface temperature in changing environmental conditions.
iv Temperature regulation as a negative feedback mechanism.	To include changes of temperature, motor responses, constriction and dilation of blood vessels, alterations in blood flow to the skin, shivering, sweating and consequent changes in body temperature.	

National Course Specification: course details (cont)

COURSE Biology (Intermediate 2)

ASSESSMENT

To gain the award of the course, the candidate must pass all the units of the course as well as the external assessment. External assessment will provide the basis for grading attainment in the course award.

When the units are taken as component parts of a course, candidates will have the opportunity to achieve a level beyond that required to attain each of the unit outcomes. This attainment may, where appropriate, be recorded and used to contribute towards course estimates and to provide evidence for appeals. Additional details are provided where appropriate, with the exemplar assessment materials. Further information on the key principles of assessment are provided in the paper *Assessment* (HSDU, 1996) and in *Managing Assessment* (HSDU, 1996).

DETAILS OF THE INSTRUMENTS FOR EXTERNAL ASSESSMENT

The external course examination will sample across all of the unit outcomes and achievement will be graded on the basis of cut-off scores.

The assessment of knowledge and understanding, problem solving and practical abilities will be based upon the course content described for the three units:

- *Living Cells (Int 2)*
- *Environmental Biology and Genetics (Int 2)*
- *Animal Physiology (Int 2).*

The content contexts of these units will be sampled equally in the course examination which will include familiar contexts as well as contexts which are less familiar and more complex than in the unit assessments. While there are no compulsory practicals for the purposes of external assessment, there will be questions set in the examination on practical work in contexts less familiar to the candidates.

The course examination will consist of one paper of 2 hours with a total of 100 marks. The paper will consist of three sections:

Section A

This section will contain 25 multiple choice questions (of these 9-11 will test problem solving and/or practical abilities, the remainder will test knowledge and understanding). Section A will have an allocation of 25 marks. Candidates will be expected to answer all the questions.

Section B

This section will contain structured questions with an allocation of 65 marks. Between 15 and 20 marks will test problem solving and/or practical abilities, the remainder will test knowledge and understanding. Candidates will be expected to answer all the questions.

Section C

This section will consist of four extended response questions to test the candidates' ability to select, organise and present relevant knowledge. Candidates will be expected to answer two of the four questions. Section C will have an allocation of 10 marks (5 marks to each extended response question).

GRADE DESCRIPTIONS

Grade C

Candidates at Grade C will have demonstrated success in achieving the component units of the course. In the course assessment, candidates will generally have demonstrated the ability to:

- retain knowledge and skills over an extended period of time
- integrate knowledge and understanding, problem solving and practical abilities acquired across component units
- apply knowledge and understanding, problem solving and practical abilities in contexts similar to those in the component units.

Grade A

In addition, candidates at Grade A will generally have demonstrated the ability to:

- retain an extensive range of knowledge and skills over an extended period of time
- integrate an extensive range of knowledge and understanding, problem solving and practical abilities acquired across component units
- apply knowledge and understanding, problem solving and practical abilities in contexts less familiar and more complex than in the component units.

Testing of the course outcomes

The following gives advice on how the course outcomes will be assessed.

Knowledge and understanding

Candidates should be tested on their ability to recall learning and understand facts and principles detailed in the content statements and supplementary notes in the content tables in the course specification.

Problem solving and practical abilities

Questions relating to each of the following points will be included in the course examination in order to test the candidates' ability to:

1. Select relevant information from texts, tables, charts, keys, graphs and/or diagrams.
2. Present information appropriately in a variety of forms, including written summaries, extended writing, tables and/or graphs.
3. Process information accurately using calculations where appropriate. Calculations to include percentages, averages and/or ratios. Significant figures and units should be used appropriately.
4. Plan and design experimental procedures to test given hypotheses or to illustrate particular effects. This could include identification of, controls and measurements or observations required.
5. Evaluate experimental procedures in situations that are unfamiliar, by commenting on the purpose of approach, the suitability and effectiveness of procedures, the control of variables, the limitations of equipment, possible sources of error and/or suggestions for improvement.
6. Draw valid conclusions and give explanations supported by evidence or justification. Conclusions should include reference to the overall pattern to readings or observations, trends in results or comment on the connection between variables and controls.
7. Make predictions and generalisations based on available evidence.

Complexity of Data

The following advice is intended as general guidelines in setting the complexity of data to be used in problem solving questions.

At Intermediate 2 typically one source of data (text, tables, charts, keys, diagrams or graphs) should be provided from which the problem has to be solved.

The provided data should typically have one to two patterns, trends, conditions, variables or sets of results from which information has to be selected and presented or which have to be used as sources of evidence for conclusions, explanations, predictions or generalisations. The analysis of data should involve one set of data.

The planning, designing and evaluation of experimental procedures should involve one of the following: one or two treatments, adequate controls, limitations of equipment, sources of error, and possible improvements as appropriate.

DETAILS OF THE INSTRUMENTS FOR INTERNAL ASSESSMENT

Outcomes 1 and 2

Outcomes 1 and 2 for each unit are assessed by a single holistic closed-book test with questions covering all the performance criteria for knowledge and understanding and problem solving. The ratio of the marks allocated to Outcomes 1 and 2 is 3:2.

Outcome 3

A report of one experimental activity is required covering all the performance criteria set out in the unit specifications.

Candidates are only required to produce one report for Outcome 3 which relates to the contents and notes specified for Intermediate 2 Biology. This report can then be used as evidence for Outcome 3 for all of the units of the course.

APPROACHES TO LEARNING AND TEACHING

Suggestions for appropriate learning activities are contained in the tables of course content. An investigative approach should be taken to the learning and teaching of biology. Such an approach not only draws heavily on experimental work but should provide opportunities to develop individual and group research using a variety of resources alongside the more traditional approaches of whole class teaching.

Practical work should contain a balance of illustrative experimental work and investigative practical work. Practical work can provide one way of delivering theoretical knowledge related to knowledge and understanding performance criteria. Fieldwork can also provide an opportunity for practical work, using first-hand experience of an ecosystem to develop knowledge and understanding and problem solving. Practical investigations should be used to develop both problem solving and practical skills and not just to provide reports for the purposes of internal assessment. For example, investigative work provides opportunities to develop the problem solving performance criteria of planning and designing an investigation and presents opportunities to make predictions and generalisations which can then be tested in practical contexts.

Laboratory work should include the use of instrumentation and equipment that reflects current scientific use. Opportunities should be taken to capture data through computer interfacing, data loggers or videos. Such data may then be analysed by information technology (IT) or used for control technology.

Use of the additional 40 hours

This time may be used:

- to provide an introduction to the course and assessment methods
- to allow more practical work to be undertaken by the candidates
- for remediation of particular aspects of work in which candidates require to be re-assessed
- for consolidation and integration of learning
- to practice techniques in answering multiple choice questions
- to develop extended response writing skills
- to practice applying knowledge and understanding, problem solving and practical abilities in contexts more complex than in the units
- to complete Outcome 3 reports.

National Course Specification: course details (cont)

COURSE Biology (Intermediate 2)

SPECIAL NEEDS

This course specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

SCOTTISH QUALIFICATIONS AUTHORITY

National Unit Specification: general information

UNIT Living Cells (Intermediate 2)

NUMBER D026 11

COURSE Biology (Intermediate 2)

SUMMARY

The unit seeks to develop knowledge and understanding, problem solving and practical abilities in the context of cell structure, diffusion and osmosis, enzyme action, aerobic and anaerobic respiration, and photosynthesis. This is a component unit of Intermediate 2 Biology.

OUTCOMES

1 Demonstrate knowledge and understanding related to living cells.
2 Solve problems related to living cells.
3 Collect and analyse information related to Intermediate 2 Biology obtained by experiment.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- Standard Grade Biology with Knowledge and Understanding and Problem Solving at grades 3 or 4
- Intermediate 1 Biology or its component units.

Previous biology experience is not a requirement. The unit is therefore also suitable for those wishing to study biology for the first time, eg adult returners and those with Standard Grade Physics, Chemistry or Science with Knowledge and Understanding and Problem Solving at grades 1-3.

Administrative Information

Superclass: RH

Publication date: June 2002

Source: Scottish Qualifications Authority

Version: 04

National Unit Specification: general information (cont)

UNIT Living Cells (Intermediate 2)

CREDIT VALUE

1 credit at Intermediate 2.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: statement of standards

UNIT Living Cells (Intermediate 2)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Demonstrate knowledge and understanding related to living cells.

Performance criteria

(a) A variety of cells is described correctly in relation to their structure and function.
(b) Diffusion and osmosis are described correctly in relation to their effects in plant and animal cells.
(c) Enzyme action is explained correctly in terms of enzyme properties and factors affecting activity.
(d) Aerobic and anaerobic respiration are compared correctly in terms of energy release and products.
(e) Photosynthesis is described correctly in terms of energy fixation and factors affecting rate.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed-book assessment with items covering all the above performance criteria.

OUTCOME 2

Solve problems related to living cells.

Performance criteria

(a) Relevant information is selected and presented in an appropriate format.
(b) Information is accurately processed, using calculations where appropriate.
(c) Conclusions drawn are valid and explanations given are supported by evidence.
(d) Experimental procedures are planned, designed and evaluated appropriately.
(e) Predictions and generalisations made are based on available evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed-book assessment with items covering all the above performance criteria, with problems set in the context of cell structure and function, diffusion and osmosis, enzyme action, aerobic and anaerobic respiration or photosynthesis.

National Unit Specification: statement of standards (cont)

UNIT Living Cells (Intermediate 2)

OUTCOME 3

Collect and analyse information related to Intermediate 2 Biology obtained by experiment.

Performance criteria

(a) The information is collected by active participation in the experiment.
(b) The experimental procedures are described accurately.
(c) Relevant measurements and observations are recorded in an appropriate format.
(d) Recorded experimental information is analysed and presented in an appropriate format.
(e) Conclusions drawn are valid.
(f) The experimental procedures are evaluated with supporting argument.

Evidence requirements

A report of one experimental activity is required, covering the above performance criteria in relation to the contents and notes specified for Intermediate 2 Biology.

The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in an experiment involving the candidate in planning the experiment; deciding how it is managed; identifying and obtaining the necessary resources, some of which must be unfamiliar; and carrying out the experiment. Depending on the activity, the collection of the information may be group work.

Evidence submitted in support of attainment of PC (d) must be in the format of a table or graph(s) as appropriate. Conclusions drawn should be justified by reference to supporting evidence.

The evaluation should cover all stages of the experiment, including the initial analysis of the situation and planning and organising the experimental procedure.

National Unit Specification: support notes

UNIT Living Cells (Intermediate 2)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

Outcome 1

a) Cell structure and function

i Similarities and differences between animal, plant and microbial cells.
ii Function of cell structures.
iii Commercial and industrial uses of cells.
Bread making.
Alcohol production.
Antibiotic production.
Yoghurt production
Alternative fuel production.

b) Diffusion and osmosis in plant and animal cells

i Diffusion as the movement of substances from a high concentration to a low concentration down a concentration gradient.
ii The importance of diffusion to cells.
iii Osmosis as a 'special case' of diffusion of water.
iv Osmotic effects in plant and animal cells.

c) Enzyme action

1 Enzyme properties
i Properties of catalysts and enzymes.
ii Specificity of enzymes for their substrates.
iii Enzymes involved in degradation and in synthesis.

2 Factors affecting activity

d) Aerobic and anaerobic respiration

1 Energy release
i Glucose as a source of energy in the cell.
ii Role of ATP.
iii Comparison of energy yield in aerobic and anaerobic respiration.

2 Products
i Aerobic Pathway.
ii Anaerobic Pathway.

National Unit Specification: support notes

UNIT Living Cells (Intermediate 2)

e) Photosynthesis

1 Energy Fixation

i Sunlight as the source of energy.
ii Summary equation for photosynthesis.
iii Photosynthesis as a set of two summary reactions: photolysis followed by carbon fixation.
iv Conversion of glucose to other carbohydrates.

2 Factors affecting rate of photosynthesis

i Limiting factors.
ii Production of early crops in horticulture.

Further detail is given in the supplementary notes in the course content section of the course specification.

Outcome 2

Examples of learning activities which provide suitable contexts for the development of problem solving skills include:

- select and present data on the commercial and industrial uses of micro-organisms
- plan and design an investigation into the influence of temperature and pH on enzyme activity
- select and present data on the energy content of foods
- plan and design an investigation into anaerobic respiration in yeast.

Outcome 3

Suitable experiments include:

- carry out an experiment to demonstrate lactic acid production by yoghurt bacteria
- carry out an experiment to demonstrate osmosis using Visking tubing model cells and potato or other plant material
- carry out an experiment to demonstrate the specificity of enzymes
- carry out an experiment to compare photosynthesis in light and dark conditions and in the presence and absence of carbon dioxide.

Candidates or centres could devise other appropriate experiments in the context of cell structure and function, diffusion and osmosis, enzyme action, aerobic and anaerobic respiration or photosynthesis.

The experiments chosen should allow all the performance criteria for this outcome to be achieved within any single report.

National Unit Specification: support notes (cont)

UNIT Living Cells (Intermediate 2)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Details of suitable approaches are detailed in the course specification.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

It is recommended that a holistic approach is taken to assessment, eg Outcomes 1 and 2 could be assessed by an integrated end of unit test with questions covering all the performance criteria for knowledge and understanding and problem solving.

Outcome 2

Test items should be constructed to allow candidates to generate evidence relating to the performance criteria as follows:

a) Selecting and presenting information:

- sources of information to include: texts, tables, charts, graphs and diagrams
- formats of presentation to include: written summaries, extended writing, tables and graphs.

b) Calculations to include: percentages, averages, ratios. Significant figures and units should be used appropriately.

c) Conclusions drawn should include some justification and explanations should be supported by evidence. Conclusions should contain a comment on trends or patterns and/or connections between variables and controls.

d) Candidates could plan and design procedures to test given hypotheses or to illustrate particular effects. This could include identification of variables, controls and measurements or observations required. The evaluation of given experimental procedures may include situations which are unfamiliar to candidates and could test the candidates' ability to comment on the purpose of approach or the suitability of given experimental procedures. Candidates could comment on the limitations of the set-up, apparatus, suggested measurements or observations, limitations of equipment, appropriateness of controls, sources of error and possible improvements.

e) Candidates could make predictions and generalisations from given experimental results or, given situations, predict what the results might be.

Outcome 3

Type of experimental activity

The teacher/lecturer should ensure that the experimental activity to be undertaken in connection with Outcome 3 affords opportunity for the candidate to demonstrate the ability to undertake the planning and organising of an experimental activity at an appropriate level of demand. The activity must relate to the Course content and candidates should be made aware of the range of skills which must be demonstrated to ensure attainment of Outcome 3.

National Unit Specification: support notes (cont)

UNIT Living Cells (Intermediate 2)

Assessment of Outcome 3

Candidates are only required to produce one report for Outcome 3 in relation to the contexts and notes specified for Intermediate 2 Biology. This report can then be used as evidence for Outcome 3 for the other units of the course.

In relation to PC (a), the teacher/lecturer checks by observation that the candidate participates in the collection of the experimental information by playing an active part in planning the experiment, deciding how it will be managed, identifying and obtaining resources (some of which must be unfamiliar to the candidate), and carrying out the experiment.

National Unit Specification: support notes (cont)

UNIT Living Cells (Intermediate 2)

Candidates should provide a report with an appropriate title. The report should relate to the performance criteria as follows:

(b) The experimental procedures are described accurately.	A clear statement of the aim of the experiment. A few brief concise sentences including as appropriate: • a labelled diagram or brief description of apparatus or instruments used • how the independent variable was altered • control measure used • how measurements were taken or observations made. There is no need for a detailed description. The use of the impersonal passive voice is to be encouraged as an example of good practice but this is not mandatory for meeting the performance criteria.
(c) Relevant measurements and observations are recorded in an appropriate format.	Readings or observations (raw data) must be recorded in a clear table with correct headings, appropriate units and results/ readings entered correctly.
(d) Recorded experimental information is analysed and presented in an appropriate format.	Data should be analysed and presented in tabular, graphical format or as a scatter diagram or equivalent, as appropriate: • for a tabular presentation this may be an extension of the table used for PC (c) above, and must include: suitable headings and units showing averages or other appropriate computations • for a graphical presentation this must include: data presented as a histogram, bar chart, connected points or line of best fit as appropriate, with suitable scales and axes labelled with variable and units and with data correctly plotted.
(e) Conclusions drawn are valid.	Conclusions should use evidence from the experiment and relate back to the aim of the experiment. At least one of the following should be included: • overall pattern to readings or observations (raw data) • trends in analysed information or results • connection between variables and controls.
(f) The experimental procedures are evaluated with supporting argument.	The evaluation could cover all stages of the activity including preparing for the activity, analysis of the activity and the results of the activity. The evaluation must include supporting argument in at least one of the following: • effectiveness of procedures • control of variables • limitations of equipment • possible sources of error • possible improvements.

National Unit Specification: support notes (cont)

UNIT Living Cells (Intermediate 2)

The bullet points under each performance criterion give an indication of what should be addressed to achieve a pass. The relevance of the bullet points will vary according to the experiment. These bullet points are intended as helpful guidance. The decision of pass or fail is to be made by the professional judgement of the presenting centre (subject to moderation) against the performance criteria. It is appropriate to support candidates in producing a report to meet the performance criteria. Re-drafting of a report after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment. Redrafting and resubmission is only required for the specific performance criterion identified in need of further attention ie the entire report does not need to be rewritten.

Conditions required to complete the report

Candidates may complete their reports outwith class time provided reasonable measures are taken to ensure that the report is the individual work of the candidate.

Teachers and lecturers may wish candidates to write up reports under their direct supervision so that they can provide appropriate advice and support. However, they may feel confident that any redrafting required need not be undertaken under such close supervision as it will be evident in the candidate's response that it is his or her unaided work. Under such circumstances it would be acceptable for such redrafting to take place outwith class time.

Use of IT

Candidates may, if they wish, present their reports in a word-processed format. Candidates may use Excel (or any other suitable data analysis software) when tackling Outcome 3. However, candidates must not be given a spreadsheet with pre-prepared column headings nor formulae, as they are being assessed on their ability to enter quantities and units into a table and to make decisions about appropriate scales and labels on graph axes. The use of clip art or images captured by digital camera may also be used in recording details of experimental methods.

Transfer of evidence

Candidates may transfer evidence for Outcome 3 from one level to the one below provided the experiment is in the context of the course concerned.

Candidates, who are repeating a course, may carry forward evidence of an appropriate standard, generated in a previous year.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

SCOTTISH QUALIFICATIONS AUTHORITY

National Unit Specification: general information

UNIT Environmental Biology and Genetics (Intermediate 2)

NUMBER D027 11

COURSE Biology (Intermediate 2)

SUMMARY

The unit seeks to develop knowledge and understanding, problem solving and practical abilities in the context of ecosystems and factors affecting variety in a species. This is a component unit of Intermediate 2 Biology.

OUTCOMES

1 Demonstrate knowledge and understanding related to environmental biology and genetics.
2 Solve problems related to environmental biology and genetics.
3 Collect and analyse information related to Intermediate 2 Biology obtained by experiment.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- Standard Grade Biology with Knowledge and Understanding and Problem Solving at grades 3 or 4
- Intermediate 1 Biology or its component units.

Previous biology experience is not a requirement. The unit is therefore also suitable for those wishing to study biology for the first time, eg adult returners and those with Standard Grade Physics, Chemistry or Science with Knowledge and Understanding and Problem Solving at grades 1-3.

Administrative Information

Superclass: RH

Publication date: June 2002

Source: Scottish Qualifications Authority

Version: 04

National Unit Specification: general information (cont)

UNIT Environmental Biology and Genetics (Intermediate 2)

CREDIT VALUE

1 credit at Intermediate 2.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: statement of standards

UNIT Environmental Biology and Genetics (Intermediate 2)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Demonstrate knowledge and understanding related to environmental biology and genetics.

Performance criteria

(a) Ecosystems are described correctly in terms of energy flow and factors affecting the variety of species.
(b) Factors affecting variety of species in an ecosystem are described correctly in terms of fertilisation and genetics.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed-book assessment with items covering all the above performance criteria.

OUTCOME 2

Solve problems related to environmental biology and genetics.

Performance criteria

(a) Relevant information is selected and presented in an appropriate format.
(b) Information is accurately processed, using calculations where appropriate.
(c) Conclusions drawn are valid and explanations given are supported by evidence.
(d) Experimental procedures are planned, designed and evaluated appropriately.
(e) Predictions and generalisations made are based on available evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed-book assessment with items covering all the above performance criteria in the context of ecosystems or factors affecting variety in a species.

National Unit Specification: statement of standards (cont)

UNIT Environmental Biology and Genetics (Intermediate 2)

OUTCOME 3

Collect and analyse information related to Intermediate 2 Biology obtained by experiment.

Performance criteria

(a) The information is collected by active participation in the experiment.
(b) The experimental procedures are described accurately.
(c) Relevant measurements and observations are recorded in an appropriate format.
(d) Recorded experimental information is analysed and presented in an appropriate format.
(e) Conclusions drawn are valid.
(f) The experimental procedures are evaluated with supporting argument.

Evidence requirements

A report of one experimental activity is required, covering the above performance criteria in relation to the contents and notes specified for Intermediate 2 Biology.

The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in an experiment involving the candidate in planning the experiment; deciding how it is managed; identifying and obtaining the necessary resources, some of which must be unfamiliar; and carrying out the experiment. Depending on the activity, the collection of the information may be group work.

Evidence submitted in support of attainment of PC (d) must be in the format of a table or graph(s) as appropriate. Conclusions drawn should be justified by reference to supporting evidence.

The evaluation should cover all stages of the experiment, including the initial analysis of the situation and planning and organising the experimental procedure.

National Unit Specification: support notes

UNIT Environmental Biology and Genetics (Intermediate 2)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

Outcome 1

a) Ecosystems

1 Energy flow

i Components of an ecosystem.
ii Food chains and food webs.

2 Factors affecting the variety of species in an ecosystem

i The importance of biodiversity at species level.
ii Factors affecting biodiversity.
Adaptations to habitat and niche.
Effects of grazing.
Effects of human activity.
Competition in plants and animals.
iii Behavioural adaptations in animals and their adaptive significance.

b) Factors affecting variety in a species

1 Fertilisation

i Gamete (sex cell) production.
Site and production of male and female gametes in mammals.
Site of production of male and female gametes in flowering plants.
ii Fusion of nuclei.

2 Genetics

i The importance of chromosome structure to an organisms characteristics.
The relationship between DNA sequence and protein synthesised.
The relationship between proteins present in a cell and the organism's characteristics.
ii Division of the nucleus in gamete production (meiosis).
iii Chromosome numbers in different species.
iv Sex determination.
v Characteristics controlled by forms of a gene called alleles.
vi Genotype and phenotype.
vii Monohybrid crosses.
viii Proportions and ratios of phenotypes of the F_1 and F_2 offspring.
ix Co-dominance.
x Polygenic inheritance.
xi Environmental impact on phenotype
xii Natural selection.

xiii Selective breeding.
xiv Genetic engineering.
Stages in the production of desired product by genetic engineering.
Applications of the products of genetic engineering.
Advantages and disadvantages of genetic engineering.

Further detail is given in the supplementary notes in the course content section of the course specification.

Outcome 2

Examples of learning activities which provide suitable contexts for the development of problem solving skills include:

- use a case study of a local or topical ecosystem to identify its component parts and inter-relationships
- design and carry out an experiment to demonstrate the effects of competition on population growth using, for example, cress seedlings
- select and present information to show that characteristics are inherited from both parents
- solve problems related to monohybrid crosses in plants and animals
- select and present information on the advantages and applications of genetic engineering.

Outcome 3

Suitable experiments in the context of this unit include:

- carry out an experiment to demonstrate animal responses to environmental stimuli using choice chambers or similar apparatus
- carry out an experiment to demonstrate the effects of competition on population growth using, for example, cress seedlings
- germinate albino and wild type tobacco seeds and their offspring to illustrate the proportions of phenotypes of F_1 and F_2 offspring.

Candidates or centres could devise other appropriate experiments in the context of ecosystems or factors affecting variety of species in an ecosystem.

The experiments chosen should allow all the performance criteria for this outcome to be achieved within any single report.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Details of suitable approaches are detailed in the course specification.

National Unit Specification: support notes (cont)

UNIT Environmental Biology and Genetics (Intermediate 2)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

It is recommended that a holistic approach is taken to assessment, eg Outcomes 1 and 2 could be assessed by an integrated end of unit test with questions covering all the performance criteria for knowledge and understanding and problem solving.

Outcome 2

Test items should be constructed to allow candidates to generate evidence relating to the performance criteria as follows:

a) Selecting and presenting information:

- sources of information to include: texts, tables, charts, graphs and diagrams
- formats of presentation to include: written summaries, extended writing, tables and graphs.

b) Calculations to include: percentages, averages, ratios. Significant figures and units should be used appropriately.

c) Conclusions drawn should include some justification.

d) Candidates could plan and design procedures to test given hypotheses or to illustrate particular effects. This could include identification of variables, controls and measurements or observations required. The evaluation of given experimental procedures may include situations which are unfamiliar to candidates and could test the candidate's ability to comment on the purpose of approach or the suitability of given experimental procedures. Candidates could comment on the limitations of the set-up, apparatus, suggested measurements or observations, limitations of equipment, appropriateness of controls, sources of error and possible improvements.

e) Candidates could make predictions and generalisations from given experimental results or, given situations, predict what the results might be.

Outcome 3

Type of experimental activity

The teacher/lecturer should ensure that the experimental activity to be undertaken in connection with Outcome 3 affords opportunity for the candidate to demonstrate the ability to undertake the planning and organising of an experimental activity at an appropriate level of demand. The activity must relate to the Unit content and candidates should be made aware of the range of skills which must be demonstrated to ensure attainment of Outcome 3.

Assessment of Outcome 3

Candidates are only required to produce one report for Outcome 3 in relation to the contents and notes specified for Intermediate 2 Biology. This report can then be used as evidence for Outcome 3 for the other units of the course.

Assessment of Outcome 3

In relation to PC (a), the teacher/lecturer checks by observation that the candidate participates in the collection of the experimental information by playing an active part in planning the experiment, deciding how it will be managed, identifying and obtaining resources (some of which must be unfamiliar to the candidate), and carrying out the experiment.

National Unit Specification: support notes (cont)

UNIT Environmental Biology and Genetics (Intermediate 2)

Candidates should provide a report with an appropriate title. The report should relate to the performance criteria as follows:

(b) The experimental procedures are described accurately.	A clear statement of the aim of the experiment. A few brief concise sentences including as appropriate: • a labelled diagram or brief description of apparatus or instruments used • how the independent variable was altered • control measure used • how measurements were taken or observations made. There is no need for a detailed description. The use of the impersonal passive voice is to be encouraged as an example of good practice but this is not mandatory for meeting the performance criteria.
(c) Relevant measurements and observations are recorded in an appropriate format.	Readings or observations (raw data) must be recorded in a clear table with correct headings, appropriate units and results/ readings entered correctly.
(d) Recorded experimental information is analysed and presented in an appropriate format.	Data should be analysed and presented in tabular, graphical format or as a scatter diagram or equivalent, as appropriate: • for a tabular presentation this may be an extension of the table used for PC (c) above, and must include: suitable headings and units showing averages or other appropriate computations • for a graphical presentation this must include: data presented as a histogram, bar chart, connected points or line of best fit as appropriate, with suitable scales and axes labelled with variable and units and with data correctly plotted.
(e) Conclusions drawn are valid.	Conclusions should use evidence from the experiment and relate back to the aim of the experiment. At least one of the following should be included: • overall pattern to readings or observations (raw data) • trends in analysed information or results • connection between variables and controls.
(f) The experimental procedures are evaluated with supporting argument.	The evaluation could cover all stages of the activity including preparing for the activity, analysis of the activity and the results of the activity. The evaluation must include supporting argument in at least one of the following: • effectiveness of procedures • control of variables • limitations of equipment • possible sources of error • possible improvements.

The bullet points under each performance criterion give an indication of what should be addressed to achieve a pass. The relevance of the bullet points will vary according to the experiment. These bullet points are intended as helpful guidance. The decision of pass or fail is to be made by the professional judgement of the presenting centre (subject to moderation) against the performance criteria. It is appropriate to support candidates in producing a report to meet the performance criteria. Re-drafting of a report after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment. Redrafting and resubmission is only required for the specific performance criterion identified in need of further attention ie the entire report does not need to be rewritten.

Conditions required to complete the report

Candidates may complete their reports outwith class time provided reasonable measures are taken to ensure that the report is the individual work of the candidate.

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Transfer of evidence

Candidates may transfer evidence for Outcome 3 from one level to the one below provided the experiment is in the context of the course concerned.

Candidates, who are repeating a course, may carry forward evidence of an appropriate standard, generated in a previous year.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

SCOTTISH QUALIFICATIONS AUTHORITY

National Unit Specification: general information

UNIT Animal Physiology (Intermediate 2)

NUMBER D028 11

COURSE Biology (Intermediate 2)

SUMMARY

The unit seeks to develop knowledge and understanding, problem solving and practical abilities in the context of mammalian nutrition, control of the internal environment, circulation and gas exchange, sensory mechanisms and processing of information. This is a component unit of Intermediate 2 Biology.

OUTCOMES

1 Demonstrate knowledge and understanding related to animal physiology.
2 Solve problems related to animal physiology.
3 Collect and analyse information related to Intermediate 2 Biology obtained by experiment.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- Standard Grade Biology with Knowledge and Understanding and Problem Solving at grades 3 or 4
- Intermediate 1 Biology or its component units.

Previous biology experience is not a requirement. The unit is therefore also suitable for those wishing to study biology for the first time, eg adult returners and those with Standard Grade Physics, Chemistry or Science with Knowledge and Understanding and Problem Solving at grades 1-3.

Administrative Information

Superclass: RH

Publication date: June 2002

Source: Scottish Qualifications Authority

Version: 04

National Unit Specification: general information (cont)

UNIT Animal Physiology (Intermediate 2)

CREDIT VALUE

1 credit at Intermediate 2.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: statement of standards

UNIT Animal Physiology (Intermediate 2)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Demonstrate knowledge and understanding related to animal physiology.

Performance criteria

(a) Mammalian nutrition is described correctly in terms of the breakdown of food and the structure and function of the alimentary canal and associated organs.
(b) The control of the internal environment is explained correctly in relation to osmoregulation.
(c) Circulation and gas exchange is described correctly in terms of the structure and function of the heart and blood vessels, lungs and capillary network, and blood.
(d) Sensory mechanisms and the processing of information is described correctly in terms of the brain and nervous system.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed-book assessment with items covering all the above performance criteria.

OUTCOME 2

Solve problems related to animal physiology.

Performance criteria

(a) Relevant information is selected and presented in an appropriate format.
(b) Information is accurately processed, using calculations where appropriate.
(c) Conclusions drawn are valid and explanations given are supported by evidence.
(d) Experimental procedures are planned, designed and evaluated appropriately.
(e) Predictions and generalisations made are based on available evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed-book test with items covering all the above performance criteria in the context of mammalian nutrition, control of the internal environment, circulation and gas exchange, or sensory mechanisms and processing of information.

National Unit Specification: statement of standards (cont)

UNIT Animal Physiology (Intermediate 2)

OUTCOME 3

Collect and analyse information related to Intermediate 2 Biology obtained by experiment.

Performance criteria

(a) The information is collected by active participation in the experiment.
(b) The experimental procedures are described accurately.
(c) Relevant measurements and observations are recorded in an appropriate format.
(d) Recorded experimental information is analysed and presented in an appropriate format.
(e) Conclusions drawn are valid.
(f) The experimental procedures are evaluated with supporting argument.

Evidence requirements

A report of one experimental activity is required, covering the above performance criteria in relation to the contents and notes specified for Intermediate 2 Biology.

The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in an experiment involving the candidate in planning the experiment; deciding how it is managed; identifying and obtaining the necessary resources, some of which must be unfamiliar; and carrying out the experiment. Depending on the activity, the collection of one of the information may be group work.

Evidence submitted in support of attainment of PC(d) must be in the format of a table or graph(s) as appropriate. Conclusions drawn should be justified by reference to supporting evidence.

The evaluation should cover all stages of the experiment, including the initial analysis of the situation and planning and organising the experimental procedure.

National Unit Specification: support notes

UNIT Animal Physiology (Intermediate 2)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

Outcome 1

a) Mammalian nutrition

1 Breakdown of food

i Requirement for food.
ii Food tests for starch, glucose, protein and fat.
iii Energy content of food.
iv The need for digestion.

2 The structure and function of the alimentary canal and associated organs

i The mouth, salivary glands and oesophagus.
ii The role of the stomach.
iii The role of the small intestine in the absorption and secretion of food.
iv The role of the pancreas, liver and gall bladder.
v The role of the large intestine, rectum and anus.

b) Control of the internal environment

i The structure of the human urinary system.
ii The role of the mammalian kidney.
Osmoregulation.
Production of urea and its removal in urine.
The structure and function of the kidney.
iii Negative feedback control by ADH.
iv Osmoregulation in marine and freshwater bony fish.

c) Circulation and gas exchange

1 The structure and function of the heart and blood vessels

i The structure of the heart related to its function as a muscular pump.
ii Blood vessels.

2 Structure and function of lungs in gas exchange and the capillary network

i Internal structure of lungs and features which make them efficient gas exchange structures.
ii Features of capillary network which allow efficient gas exchange in tissues.

3 Composition and functions of blood

i Function of red blood cells and plasma in the transport of respiratory gases and food.
ii Function of haemoglobin in the transport of oxygen.
iii Function of macrophages and lymphocytes in defence.

d) Sensory mechanisms and processing of information

1 The structure and function of the brain

i Functions, in simple terms, of cerebrum, cerebellum, medulla and hyopthalmus.
ii Discrete areas of cerebrum related to sensory/motor function.

2 The structure and function of the nervous system

i The brain, spinal cord and nerves.
ii Relex action and the reflex arec.
iii The role of the central nervous system (CNS).
iv Temperature regulation as a negative feedback mechanism.

Further detail is given in the supplementary notes in the course content section of the course specification.

Outcome 2

Examples of learning activities which provide suitable contexts for the development of problem solving skills include:

- select and present information on the incidence of carbohydrates, proteins and fats in common foodstuffs
- select and present information to illustrate peristalsis
- design and carry out an investigation into the effects of pH and temperature on the digestion of protein
- select and present data relating water consumption to volume and concentration of urine
- select and present information on the role of ADH.

Outcome 3

Suitable experiments in the context of this unit include:

- carry out an experiment to demonstrate the purpose of digestion and absorption using Visking tubing as a model gut
- carry out an experiment to demonstrate the effects of pH and temperature on the digestion of protein
- carry out an investigation into changes in body temperature in changing environmental conditions.

Candidates or centres could devise other appropriate experiments in the context of mammalian nutrition, control of the internal environment, circulation and gas exchange or sensory mechanisms and processing of information.

The experiments chosen should allow all the performance criteria for this outcome to be achieved within any single report.

National Unit Specification: support notes (cont)

UNIT Animal Physiology (Intermediate 2)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Details of suitable approaches are detailed in the course specification.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

It is recommended that a holistic approach is taken to assessment, eg Outcomes 1 and 2 could be assessed by an integrated end of unit test with questions covering all the performance criteria for knowledge and understanding and problem solving.

Outcome 2

Test items should be constructed to allow candidates to generate evidence relating to the performance criteria as follows:

a) Selecting and presenting information:
- sources of information to include: texts, tables, charts, graphs and diagrams
- formats of presentation to include: written summaries, extended writing, tables and graphs.

b) Calculations to include: percentages, averages, ratios. Significant figures and units should be used appropriately.

c) Conclusions drawn should include some justification.

d) Candidates could plan and design procedures to test given hypotheses or to illustrate particular effects. This could include identification of variables, controls and measurements or observations required. The evaluation of given experimental procedures may include situations which are unfamiliar to candidates and could test the candidate's ability to comment on the purpose of approach or the suitability of given experimental procedures. Candidates could comment on the limitations of the set-up, apparatus, suggested measurements or observations, limitations of equipment, appropriateness of controls, sources of error and possible improvements.

e) Candidates could make predictions and generalisations from given experimental results or, given situations, predict what the results might be.

National Unit Specification: support notes (cont)

UNIT Animal Physiology (Intermediate 2)

Outcome 3

Type of experimental activity

The teacher/lecturer should ensure that the experimental activity to be undertaken in connection with Outcome 3 affords opportunity for the candidate to demonstrate the ability to undertake the planning and organising of an experimental activity at an appropriate level of demand. The activity must relate to the Unit content and candidates should be made aware of the range of skills which must be demonstrated to ensure attainment of Outcome 3.

Assessment of Outcome 3

Candidates are only required to produce one report for Outcome 3 in relation to the context and notes specified for Intermediate 2 Biology. This report can then be used as evidence for Outcome 3 for the other units of the course.

In relation to PC (a), the teacher/lecturer checks by observation that the candidate participates in the collection of the experimental information by playing an active part in planning the experiment, deciding how it will be managed, identifying and obtaining resources (some of which must be unfamiliar to the candidate), and carrying out the experiment.

National Unit Specification: support notes (cont)

UNIT Animal Physiology (Intermediate 2)

Candidates should provide a report with an appropriate title. The report should relate to the performance criteria as follows:

(b) The experimental procedures are described accurately.	A clear statement of the aim of the experiment. A few brief concise sentences including as appropriate: • a labelled diagram or brief description of apparatus or instruments used • how the independent variable was altered • control measure used • how measurements were taken or observations made. There is no need for a detailed description. The use of the impersonal passive voice is to be encouraged as an example of good practice but this is not mandatory for meeting the performance criteria.
(c) Relevant measurements and observations are recorded in an appropriate format.	Readings or observations (raw data) must be recorded in a clear table with correct headings, appropriate units and results/ readings entered correctly.
(d) Recorded experimental information is analysed and presented in an appropriate format.	Data should be analysed and presented in tabular, graphical format or as a scatter diagram or equivalent, as appropriate: • for a tabular presentation this may be an extension of the table used for PC (c) above, and must include: suitable headings and units showing averages or other appropriate computations • for a graphical presentation this must include: data presented as a histogram, bar chart, connected points or line of best fit as appropriate, with suitable scales and axes labelled with variable and units and with data correctly plotted.
(e) Conclusions drawn are valid.	Conclusions should use evidence from the experiment and relate back to the aim of the experiment. At least one of the following should be included: • overall pattern to readings or observations (raw data) • trends in analysed information or results • Connection between variables and controls.
(f) The experimental procedures are evaluated with supporting argument.	The evaluation could cover all stages of the activity including preparing for the activity, analysis of the activity and the results of the activity. The evaluation must include supporting argument in at least one of the following: • effectiveness of procedures • control of variables • limitations of equipment • possible sources of error • possible improvements

The bullet points under each performance criterion give an indication of what should be addressed to achieve a pass. The relevance of the bullet points will vary according to the experiment. These bullet points are intended as helpful guidance. The decision of pass or fail is to be made by the professional judgement of the presenting centre (subject to moderation) against the performance criteria. It is appropriate to support candidates in producing a report to meet the performance criteria. Re-drafting of a report after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment. Redrafting and resubmission is only required for the specific performance criterion identified in need of further attention ie the entire report does not need to be rewritten.

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