

Environmental and Land-Based Science

OCR GCSE in Environmental and Land-Based Science J650

Section 6.10 has been updated (amended in April 2008).

IMPORTANT

This is a wholly e-assessed qualification. Unit examinations are delivered electronically and taken on screen. Coursework is stored electronically and moderation samples submitted in their electronic format.

To offer this qualification, centres **MUST**:

1. Be a registered EDI (Electronic Data Information) user. For more information on EDI please go to the OCR website at www.ocr.org.uk or refer to the Entry Instructions within the *Administrative Guide and Entry Procedures (E3)* folder.
2. Be satisfied that they can run the Cambridge Assessment Connect software needed for computer-based tests on their systems. **Appendix F in this specification includes a list of technical requirements.** Centres must download the installation software from the OCR website prior to the start of teaching. Only registered OCR centres are able to download the installation software. This software will indicate to the centre whether or not it has the technical capability to run the Computer-based Tests.

Basic guidance on the production of electronic coursework is provided in Appendix G.

For further guidance on requirements for electronic coursework and computer-based tests, contact general.qualifications@ocr.org.uk

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Vertical black lines indicate a significant change to the previous printed version. Changes can be found on page 44.

1 About this Qualification

1.1 About this Environmental and Land-Based Science Specification

This booklet contains OCR's GCSE specification in Environmental and Land-Based Science for teaching from September 2006 and first certification in June 2008.

This course aims to equip candidates with the technical knowledge, skills and understanding needed for further study and eventual employment in the Land and Environment sector. The course requires candidates to apply science to issues relating to the Land and Environment sector, make both pragmatic and ethical judgements, evaluate evidence and consider the implications for society. Candidates consider and evaluate critically their own data and conclusions and use ICT to research, present and organise information. The course involves candidates in a range of practically-based activities which enable them to build a portfolio of their achievements. By following the course candidates develop the procedural and technical knowledge of science practice for GCSE Additional Applied Science, as outlined in the GCSE Criteria for Science.

This specification gives continuity of provision for users of the OCR specifications - GCSE Rural and Agricultural Science and GNVQ Land and Environment.

It can be taught as a stand-alone qualification or as a GCSE Additional Applied Science qualification, alongside or following a course in GCSE or Entry Level Science. This qualification, taken alone, does not cover the National Curriculum Programme of Study for Science for Key Stage 4.

This course is designed to enable candidates to:

- make informed decisions about issues related to the Land and Environment sector that involve science;
- relate experience in the classroom, science laboratory and in the field to a variety of vocational opportunities in the Land and Environment sector.

Candidates must take Unit B493, and two further units chosen from B491, B492, B494 or B495. They must also take Unit B496.

Unit	Unit Code	Title	Duration	Weighting	Total Mark
1	B491	Plant Cultivation	45 min	16.7%	36
2	B492	Amenity Horticulture	45 min	16.7%	36
3	B493	Management of the Natural Environment	45 min	16.7%	36
4	B494	Care of Animals	45 min	16.7%	36
5	B495	Livestock Husbandry	45 min	16.7%	36
6	B496	ELBS Portfolio: Practical Skills (12.4%) Work-Related Report (14.7%) Investigative Project (22.9%)	-	50.0%	109

Choice of Units

Choice of units needs to relate to the facilities and resources available at the centre and/or in the locality, and opportunities in the locality for relevant work experience (though this is not a requirement of the course). Candidates' possible future progression routes could also be a determining factor.

The table illustrates how each unit might link to vocational work and employment.

Unit	Unit Title	Possible vocational and employment links
B491	Plant Cultivation	Arable Farming, Horticulture, Forestry
B492	Amenity Horticulture	Gardens, Garden Centres, Garden Nurseries, Floristry, Park and Grounds Management
B493	Management of the Natural Environment	Conservation, Nature Reserves, Waste Management
B494	Care of Animals	Veterinary Assistants, Pet Shops
B495	Livestock Husbandry	Livestock Farming, Zoos

1.2 Qualification Titles and Levels

This qualification is shown on a certificate as OCR GCSE in Environmental and Land-Based Science.

This qualification is approved by the regulatory authorities (QCA, ACCAC and CEA) as part of the National Qualifications Framework (NQF).

Candidates who gain grades G to D will have achieved an award at Foundation Level (Level 1 of the NQF).

Candidates who gain grades C to A* will have achieved an award at Intermediate Level (Level 2 of the NQF).

1.3 Aims

The aims of this GCSE specification are to encourage candidates to:

- acquire a systematic body of scientific and technical knowledge, and the skills needed to apply this in new situations, such as the workplace or further education;
- develop skills that are relevant for eventual future employment in the Land and Environment sector;
- consider and evaluate critically their own data and conclusions, and those obtained from other sources using ICT;
- select, organise and present information clearly and logically, using appropriate scientific terms and conventions, and using ICT where appropriate;
- evaluate, in terms of their knowledge and understanding, the power and limitations of the nature of science, and the benefits and drawbacks of scientific and technological developments, including those related to the environment, ethical issues and quality of life;
- use electronic sources (internet, CD-ROMs, databases, simulations) and/or more traditional sources of information (books, magazines, leaflets).

1.4 Prior Learning/Attainment

Candidates entering this course should normally have achieved a general educational level equivalent to National Curriculum Level 3, or Grade 3 at Entry Level within the National Qualifications Framework. Many candidates will take a course in Environmental and Land-Based Science alongside or following a course in GCSE or Entry Level Science.

2 Summary of Content

Unit 1: Plant Cultivation (B491)

This unit focuses on plant biology through the growing of crop plants. It includes:

- soil and environmental factors affecting growth;
- nutrient requirements for producing a healthy crop;
- plant reproduction, both sexual and asexual;
- the breeding of improved varieties.

Unit 2: Amenity Horticulture (B492)

This unit focuses on conditions needed and methods employed for the cultivation of plants for gardens, parks and garden nurseries. It includes:

- disease control in intensive and extensive situations;
- working safely in the garden;
- correct use of garden equipment;
- the preparation and growing of plants for sale.

Unit 3: Management of the Natural Environment (B493)

This unit requires an understanding of the formation and structure of soil and its effect on the plants and animals it supports. It focuses on:

- the inter-relationships and energy requirements within ecosystems;
- the effects of human activities on the environment;
- traditional agricultural practices;
- alternative methods of food production.

Unit 4: Care of Animals (B494)

This unit focuses on the scientific basis for providing food and care for non-agricultural, small animals. It includes:

- breeding of animals;
- safe handling of animals;
- interaction of animals and people.

Unit 5: Livestock Husbandry (B495)

This unit focuses on the care of farm animals including the effects of different animal production systems on the yields, health and well being of livestock. This unit covers:

- causes of ill health;
- the safety of treatments;
- the application of recent scientific advances to the breeding of livestock;
- welfare issues;
- modern farming methods.

3 Content

The specification content is based on the GCSE Criteria for Additional Applied Science set in the context of the Land and Environment sector. Each unit deals with the knowledge, understanding and skills relevant to a particular vocational area. The unit on Management of the Natural Environment (Unit 3, B493) is mandatory, the other four units are optional. Each unit defines the required knowledge and understanding for three levels of demand across both Foundation and Higher tiers – Low Demand (Grades G, F, E); Standard Demand (Grades D, C) and High Demand (Grades B, A, A*).

In addition, each unit lists activities that candidates should be able to do, or have access to, at the three levels of demand during the course. These activities provide opportunities for the assessment of practical skills. They will not be tested in the externally assessed computer-based tests.

Questions are set for the three levels of demand (Low, Standard and Higher) shown in the specification content for each unit. The Foundation Tier tests assess Low and Standard demand. The Higher Tier tests assess Standard and High demand. As there is an overlap in demand between the Foundation and Higher Tier tests, they do contain some common questions.

UNIT 1 PLANT CULTIVATION (B491)

This unit focuses on plant biology through the growing of crop plants. It includes soil and environmental factors affecting growth, nutrient requirements for producing a healthy crop, plant reproduction, both sexual and asexual, and the breeding of improved varieties.

Candidates should be able to demonstrate knowledge of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> the purpose of husbandry is to keep plants healthy. the signs of a healthy plant. that plants need the major nutrients N, P, K. the structures of a flower: sepals, petals, stamens, anthers, pollen, stigma, style, ovary, and ovules. the terms 'dominant', 'recessive' and 'F1' and their meanings in relation to plant breeding. a named crop example of a bulb, a runner, and a rhizome. the conditions necessary for seed germination: air, water, light and temperature (limited to a brief description). the principles and purpose of soil cultivation by hand and machine. the problems associated with storing crops: relative perishability of crops and the importance of pests and diseases. the hazards associated with practical situations in crop production: related to behaviour, carrying equipment, and following instructions. 	<ul style="list-style-type: none"> plants need fertiliser, water and a suitable environment. the signs of an unhealthy plant: wilting, damage and poor growth and the effect on crop yield. the effects of N,P,K on plant growth and development. the function of each of the structures of a flower. the terms 'chromosomes', 'genes', 'phenotype' and 'genotype' and their meanings. how runners, rhizomes and bulbs propagate (using a named crop example in each case). the structure of a pea or bean seed, to include the testa, cotyledon, plumule, and radicle. the importance of soil (crumb) structure; the use of humus and manure in maintaining soil fertility. that systems for crop storage can extend storage life by controlling humidity, temperature, pests and diseases: one root crop example and one cereal example. the hazards associated with practical situations in crop production: safety with moving equipment, use of chemicals and using sharp equipment. 	<ul style="list-style-type: none"> the importance of the plant growing medium and environment including temperature, light and humidity. possible causes of plant ill health: pests, including aphids; fungal disease including damping off. the effects of excess N and deficiencies of N,P,K on plant growth and development. how each of these structures is involved in the plant fertilisation process and that fertilisation is followed by seed and fruit production. how to apply the mechanism of simple monohybrid inheritance, where there are dominant and recessive alleles, to plant breeding. how asexual reproduction can be used commercially and its importance to agriculture and horticulture. the function of testa, cotyledon, plumule, and radicle and their role in germination (related to the conditions required for germination). methods of improving soil fertility and structure using lime, and ways of improving drainage. how controlled atmosphere storage can be used to extend storage life. how to carry out a risk assessment for a practical situation, when growing crops.

UNIT 1 PLANT CULTIVATION (B491) CONTINUED

Candidates should be able to demonstrate understanding of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> the differences between organic and inorganic fertilisers. 	<ul style="list-style-type: none"> the advantages and disadvantages of organic and inorganic fertilisers. 	<ul style="list-style-type: none"> how plant nutrient ratios in common fertilisers: general purpose (1:1:1), high N (2:1:1), high P (1:2:1) and high K (1:1:2), relate to their use for brassicas, grasses, legumes, root crops and tomatoes.
<ul style="list-style-type: none"> the adaptations necessary for wind and insect pollination in plants. 	<ul style="list-style-type: none"> how pollination occurs, and the relevance of different types of pollination, in a commercial setting including the need for insects / wind in an artificial growing environment. 	<ul style="list-style-type: none"> the features and consequences of cross and self pollination.
<ul style="list-style-type: none"> how to raise plants from seed. 	<ul style="list-style-type: none"> the need for provision of heating, lighting, ventilation and irrigation to raise plants from seed. 	<ul style="list-style-type: none"> the advantages of heated propagators, mist propagators and capillary matting when raising plants from seed.
<ul style="list-style-type: none"> the basic needs of a healthy plant. 	<ul style="list-style-type: none"> how different methods for providing water and fertiliser to plants are applied to 2 different crops /plant production systems. 	<ul style="list-style-type: none"> how plants are affected by poor environmental conditions.
	<ul style="list-style-type: none"> how ICT can be used for efficient record keeping and environmental monitoring in plant care (to include the use of dataloggers). 	<ul style="list-style-type: none"> the advantages of using ICT in plant care.

To provide practical contexts for learning at an appropriate level of demand, candidates should be able to do some/all of the following tasks. These will provide opportunities for the assessment of practical skills. They will not be tested in the computer-based tests.

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> grow plants from seed and take softwood cuttings. 	<ul style="list-style-type: none"> propagate plants using softwood cuttings and another asexual method. 	<ul style="list-style-type: none"> use three different methods of plant propagation.
<ul style="list-style-type: none"> apply fertilizer appropriately to a named crop. 	<ul style="list-style-type: none"> apply fertilizer by two different methods and note the effect(s) on plant growth of varying N applications in the field, glasshouse or cloche. 	<ul style="list-style-type: none"> use data given on fertiliser bags to determine appropriate applications and the quantities needed for the crop concerned.
<ul style="list-style-type: none"> cultivate a crop in a field or garden. 	<ul style="list-style-type: none"> cultivate a crop under cover: glasshouse or polytunnel or cold frame or cloche. 	<ul style="list-style-type: none"> use tissue culture or hydroponics for plant production.
<ul style="list-style-type: none"> identify whether a plant is healthy or not. 	<ul style="list-style-type: none"> recognise signs of ill health: wilting, change in appearance, evidence of pests and disease. 	<ul style="list-style-type: none"> identify/use suitable treatments for ill health, both biological and chemical.

In all situations, suitable health and safety procedures must be followed (see Appendix D).

UNIT 2 AMENITY HORTICULTURE (B492)

This unit focuses on conditions needed and methods employed for the cultivation of plants for gardens, parks and garden nurseries. It includes disease control in intensive and extensive situations, working safely in the garden, correct use of garden equipment and the preparation and growing of plants for sale.

Candidates should be able to demonstrate knowledge of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> the functions of glasshouses and cloches. the conditions needed for growth: growing medium, water, nutrients, temperature; limited to a brief description with examples, including hanging baskets, glasshouses, tubs, beds. how plants are grown from seed including the process of: sowing, thinning, pricking out, potting on. named examples of plants used in bedding schemes, tubs and baskets. named examples of plants used as cut flowers and pot plants. the different types of lawnmower: rotary and sidewheel/blade (cylinder). how to maintain permanent planting by watering and feeding, both organic and inorganic. that plants are selectively bred to improve yield, disease resistance, hardiness and appearance. the hazards associated with practical work in growing plants: related to behaviour, carrying equipment, and following instructions. the dangers of using electrical mowers and hedge cutting equipment: damp conditions, cutting cables and poor insulation. 	<ul style="list-style-type: none"> the functions of glasshouses, cloches, polytunnels and fleece ground cover, and their uses, advantages and disadvantages. how growing medium, water, nutrients and temperature can be controlled and how they affect plant growth. the reasons for thinning, pricking out, potting on. features of plants used in permanent planting (including the term: herbaceous) and the differences between these and the plants in bedding schemes, tubs and baskets. named examples of trees and shrubs used in parks, gardens and street plantings. the advantages and disadvantages of both types of lawnmower, powered by petrol and electricity, including hover mowers. how to maintain permanent planting by weed control: mechanical, chemical, cultural. the meaning and importance of hybrid vigour. the hazards associated with practical situations in growing plants: safety with moving equipment, use of chemicals and using sharp equipment. the importance of using fuses and circuit breakers. 	<ul style="list-style-type: none"> the functions of cold frames, their uses, and their importance in commercial production. how CO₂ and light can be controlled and how they affect plant growth, including consideration of limiting factors. the factors which determine the choice of plants used in different situations to include aspect, shade, drainage. how plants are maintained as cut flowers and pot plants indoors. how to set the height of cutting appropriate to the grass condition and season, and its use. how to maintain permanent planting by pruning: reasons for pruning and basic techniques. the uses and advantages of genetic engineering, and the ethical issues arising. how to carry out a risk assessment for a practical situation, when growing plants. how to carry out a risk assessment of the hazards associated with using electrical equipment in gardens and nurseries.

UNIT 2 AMENITY HORTICULTURE (B492) CONTINUED

Candidates should be able to demonstrate understanding of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> • how disease control increases the quality of the product. • the dangers associated with growing plants year after year in glasshouse soil. • the factors involved in siting a glasshouse correctly. • how plants can be displayed to market them effectively, from nurseries or garden centres. • the differences between annual, biennial and perennial life cycles. • the process of producing a lawn from seed; the different uses of lawns. 	<ul style="list-style-type: none"> • the differences between biological and non-biological methods of disease control. • how ICT can be used to control environmental conditions in glasshouses. • the differences between the types of compost available: soil based, peat based, soil-less and peat-free soil-less. • the advantages and disadvantages of different materials used in glasshouse construction. • the methods of marketing used by supermarkets and shops and how these might differ from nurseries and garden centres. • how plants are propagated asexually: bulbs, corms, rhizomes, tubers and runners, using named examples of plants used in amenity horticulture. • the process of producing a lawn from turf, including the cultivation of the turf; examples of grasses used in lawns. 	<ul style="list-style-type: none"> • the disease control implications of the use of protective culture to grow crops out of season. • the advantages of using ICT to control glasshouse conditions. • the advantages and disadvantages of using different growing media in the glasshouse, including ethical considerations in the use of peat. • the economic factors involved when using a glasshouse: usage all year round, temperature control and automation to reduce labour costs. • the advantages and disadvantages of all types of marketing to include, additionally, methods of marketing plants by mail order and the internet. • the advantages and disadvantages of growing plants from seed (i.e. as a result of sexual reproduction) or asexually. • the advantages and disadvantages of producing a lawn from seed or turf; the characteristics of turf for different purposes.

To provide practical contexts for learning at an appropriate level of demand, candidates should be able to do some/all of the following tasks. These will provide opportunities for the assessment of practical skills. They will not be tested in the computer-based tests.

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> • measure and produce a plan for an area for planting. • work safely when growing plants both from seeds and by propagation. • grow plants from seed. • follow instructions to use a lawn mower to cut a lawn safely, under supervision. 	<ul style="list-style-type: none"> • cultivate and prepare an area for planting. • provide plants with sufficient space to grow by pricking out, thinning seedlings and potting on. • grow plants using vegetative propagation. • cut a lawn safely with a lawn mower. 	<ul style="list-style-type: none"> • use recommended planting distances to calculate the number of plants required for an area. • plant out seedlings and cuttings, raise them to maturity and prepare plants for sale. Use tissue culture or hydroponics for plant production. • adjust the cutting height of a lawn mower.

In all situations, suitable health and safety procedures must be followed (see Appendix D).

UNIT 3 MANAGEMENT OF THE NATURAL ENVIRONMENT (B493)

This unit requires an understanding of the formation and structure of soil and its effect on the plants and animals it supports. It focuses on the inter-relationships and energy requirements within ecosystems and the effects of human activities on the environment. These activities include traditional agricultural practices and those resulting from alternative methods of food production.

Candidates should be able to demonstrate knowledge of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> that a habitat is a place where organisms live. 	<ul style="list-style-type: none"> the factors that affect habitat: climate, soil, and organisms. 	<ul style="list-style-type: none"> the major types of ecosystem in the UK: deciduous and coniferous woodland, meadows, ley grassland, wetland, moorland and lowland heath, and the plants and animals they support.
<ul style="list-style-type: none"> examples of organisms living in the soil; to include slugs, earthworms and woodlice. 	<ul style="list-style-type: none"> the role of soil organisms in maintaining the soil environment. 	<ul style="list-style-type: none"> how soil organisms contribute to recycling, aeration and soil formation.
<ul style="list-style-type: none"> that plants and animals are adapted to the ecosystem in which they live. 	<ul style="list-style-type: none"> how adaptations help plants and animals to survive in the ecosystem in which they live. 	<ul style="list-style-type: none"> the ways that human activity can impact on organisms so changing the balance of plants and animals in an ecosystem.
<ul style="list-style-type: none"> that soil is a habitat in which plants grow. 	<ul style="list-style-type: none"> the main soil types, their characteristics and their components: sand, clay and loam. 	<ul style="list-style-type: none"> the characteristics of the mineral particles in soil: sand, clay, gravel; and organic matter (humus).
<ul style="list-style-type: none"> that weeds need to be controlled to prevent competition with crops for light, water and nutrients. 	<ul style="list-style-type: none"> the differences between chemical weed control (herbicides) and cultural weed control (mulch, polythene and hoeing); organic weed control. 	<ul style="list-style-type: none"> the possible effects of these control methods on the environment: effects on food chains, water courses and soil.
<ul style="list-style-type: none"> the meaning of the terms 'organic' and 'GM' food. 	<ul style="list-style-type: none"> how organic and GM foods are produced and how this may affect the environment. 	<ul style="list-style-type: none"> the advantages and disadvantages of organic, inorganic and GM food production in terms of quality, cost, yield, inputs, and environmental considerations.
<ul style="list-style-type: none"> the meaning of the terms 'mixed cultivation' and 'monoculture'. 	<ul style="list-style-type: none"> the effect that intensive monoculture has on the natural environment: to include hedgerow destruction and loss of wildlife habitats. 	<ul style="list-style-type: none"> the effects that mixed and monoculture cultivations have on the soil environment.
<ul style="list-style-type: none"> what is meant by pollution with reference to examples of air, water, noise, smell and visual pollution. 	<ul style="list-style-type: none"> that pollution can result from human activity to include waste disposal and agricultural practices (use of fertilisers, pesticides and herbicides). 	<ul style="list-style-type: none"> the effects of water pollution with reference to nitrates; the effects of pesticides and herbicides with reference to loss of habitats and beneficial organisms, and chemical persistence in soil.
<ul style="list-style-type: none"> the aims of one conservation body e.g. World Wide Fund for Nature, RSPB, English Nature and RBST. 	<ul style="list-style-type: none"> the details of projects successfully carried out by one conservation body. 	<ul style="list-style-type: none"> the difference between preservation and conservation and that conservation is the management of the environment to maintain natural balances; how the conservation body studied contributes to conservation.
<ul style="list-style-type: none"> the hazards associated with field work: related to behaviour, carrying equipment, and following instructions. 	<ul style="list-style-type: none"> the hazards associated with field work: the weather, rivers and lakes, the sea, unsafe ground, disease, chemical hazards (e.g. pesticides). 	<ul style="list-style-type: none"> how to carry out a risk assessment for field work.

UNIT 3 MANAGEMENT OF THE NATURAL ENVIRONMENT (B493) CONTINUED

Candidates should be able to demonstrate understanding of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> • how rock is weathered to produce soil to include biological, chemical, physical agents. • how to carry out a pH test and the pH scale. • food chains and webs; the inter-relationships between plants and animals in the food chain; the terms: herbivore, carnivore, predator, producer. • the significance of legumes in crop rotation. • the characteristics of intensive and extensive animal and plant production systems. • the responsibility those who manage land have in: maintaining the character of the landscape, improving biodiversity, managing public access, preserving historical features, protecting resources (including soil and water). • the reasons for using larger and more powerful machines in agriculture including combines, sprayers. • the need for energy, and the reasons why there may be a shortage. 	<ul style="list-style-type: none"> • how weathering, erosion and deposition are involved in the formation of soil and landscapes • the importance of pH and the effects of lime on cropping. • the inter-relationships between plants and animals in the food web; how energy is lost between trophic levels; pyramids of number and biomass. • the nitrogen cycle: the terms 'fixation', 'decay', 'nitrification'; that plants take up nitrates. • the environmental advantages and disadvantages of intensive and extensive animal and plant production systems. • the roles of local and national government in land management including: planning regulations and green belt land, the environmental stewardship scheme, legislation for open access. • the effects of using larger machinery on soil (compaction) and the environment (loss of hedgerows). • alternative methods of generating electricity: wind, water, solar, crops. • how ICT can be used to monitor environmental conditions, including pollution. 	<ul style="list-style-type: none"> • how plants and animals may affect the formation of soil and landscapes. • the effects of lime and pH on mineral availability in the soil. • the concept of energy transfer in the food chain; pyramids of energy. • the role of bacteria in the nitrogen cycle, limited to nitrogen fixing, nitrifying and denitrifying (names of bacteria not required). • that different production systems have consequences for agriculture, industrial activity, urbanization and leisure, and that priorities change over time. • how the influence of local and national government can affect: the character of the landscape, biodiversity, soil and water resources. • how growers and manufacturers can reduce the effects of larger machinery on soil and the environment. • the arguments for and against using alternative energy sources, rather than coal, gas, nuclear, to include an appreciation of why the arguments might change over time. • the advantages of the use of ICT to monitor environmental conditions.

UNIT 3 MANAGEMENT OF THE NATURAL ENVIRONMENT (B493) CONTINUED

To provide practical contexts for learning at an appropriate level of demand, candidates should be able to do some/all of the following tasks. These will provide opportunities for the assessment of practical skills. They will not be tested in the computer-based tests.

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none">• identify sand, clay and loam soils.• carry out tests on soil samples for pH.• identify appropriate methods for collecting data on climatic factors.• identify appropriate methods for collecting data about a habitat.• use ICT to identify information about a conservation body.	<ul style="list-style-type: none">• determine the water and organic content of different soil types.• take random soil samples and determine their pH.• measure variations in climate that can affect land use.• use appropriate methods for collecting data about a habitat.• use ICT to select relevant information about the projects carried out by a conservation body.	<ul style="list-style-type: none">• determine the drainage characteristics and air content of different soil types.• compare the pH in two areas and relate this difference to the plants/crops that grow there.• carry out a survey to show how microclimates can affect plant growth.• carry out a survey of a habitat, investigating the relationships that exist between the distribution of plants and animals in the habitat and the environmental conditions.• use ICT to research the contribution made by the conservation body studied to conservation.

In all situations, suitable health and safety procedures must be followed (see Appendix D).

UNIT 4 CARE OF ANIMALS (B494)

This unit focuses on the scientific basis for providing food and care for non-agricultural, small animals. This includes breeding of animals, safe handling of animals and interaction of animals and people.

Candidates should be able to demonstrate knowledge of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none">that animals can be kept for pets, food, research, competition, conservation, or hunting.that different breeds have different characteristics, including size, temperament.the importance and major uses of carbohydrate, protein and fat in an animal's diet.the different forms of housing used for small mammals, birds, and fish or reptiles.how water and food can be provided for animals.the basic differences in reproduction in mammals and birds.the hazards associated with practical work with small animals: related to behaviour, carrying equipment, and following instructions.	<ul style="list-style-type: none">that animals are treated differently for different purposes: space, exercise, security.that breeds are selected for different purposes; the reasons for selecting animals for size and temperament.the importance of fibre and water in an animal's diet.the characteristics of good small mammal housing: dry, adequate ventilation, draught free, suitable temperature.the regular routine husbandry for small mammals, birds and reptiles or fish, including feeding and cleaning.the reproductive cycles of a named mammal and a named bird.the hazards associated with practical work with small animals: disease (tetanus, salmonella), being bitten, parasites.how ICT can be used to maintain records necessary for efficient animal care.	<ul style="list-style-type: none">that when keeping animals it is important to consider animal interaction with people and other animals.the difference between cross breeding and line breeding in developing desirable characteristics in the breed; the different management techniques required for selecting animals.the importance of a balanced animal diet, including vitamins (A and D) and minerals (Ca and Fe); the effects of a poor diet.the risks associated with inadequate housing and poor management of small animals.the regular routine husbandry for small mammals, birds, and reptiles or fish, including the routine health care procedures that may have to be used.the care needed for pregnant mammals and very young mammals and birds, including housing, diet, health care.how to carry out a risk assessment in the context of small animal care.how ICT can be used for efficient record keeping and environmental monitoring and control in animal care.

UNIT 4 CARE OF ANIMALS (B494) CONTINUED

Candidates should be able to demonstrate understanding of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> the importance of handling small animals in the correct manner. the differences in the structure of the digestive systems of a rabbit, and a bird; the significance of the caecum in rabbits and of grit in the diet of seed-eating birds. what to look for in a named show animal: correct conformation and markings. the range of different types of food used for small animals. the main causes of ill health in animals: bacterial, viral and fungal diseases, parasites. the routine health care for a named animal. 	<ul style="list-style-type: none"> how to transport / move small animals correctly. the functions, in outline, of the mouth, stomach, small intestine, large intestine, caecum/caeca, rectum, anus, crop and gizzard, in digestion in small animals. the role of selective breeding to produce characteristics of a show animal. the difference between roughage, succulent and concentrate foods and an example of each. the signs of ill health in animals: loss of condition, evidence of parasites and disease. the reasons for the routine health care of a named animal. 	<ul style="list-style-type: none"> how to weigh small animals correctly. the principle of enzyme action in digestion (no specific enzyme details needed); the role of microorganisms in cellulose digestion in the caecum. the dangers associated with inbreeding. the differences between feeding a ration and feeding ad lib and the advantages/disadvantages of each. how treatments for ill health in a named animal are effective. the health and safety risks to the handler and other animals from the routine health care of a named animal.

To provide practical contexts for learning at an appropriate level of demand, candidates should be able to do some/all of the following tasks.

These will provide opportunities for the assessment of practical skills. They will not be tested in the computer-based tests.

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> safely handle a small animal. follow instructions and carry out care tasks for a small animal successfully and safely, under supervision. identify whether an animal is healthy or not. identify when an animal needs cleaning out. 	<ul style="list-style-type: none"> safely pick up and move a small animal. carry out the routine husbandry of a small animal. identify signs of ill health of an animal: loss of condition, evidence of parasites and disease. clean out old bedding and provide new bedding for an animal. 	<ul style="list-style-type: none"> safely weigh a small animal and record the results. carry out the routine husbandry of a small animal, including routine health care when needed. identify suitable treatments for ill health in a named animal. prepare the housing for newborn animals.

In all situations, suitable health and safety procedures must be followed (see Appendix D).

UNIT 5 LIVESTOCK HUSBANDRY (B495)

This unit focuses on the care of farm animals including the effects of different animal production systems on the yields, health and well being of livestock. The unit covers causes of ill health, the safety of treatments, the application of recent scientific advances to the breeding of livestock, welfare issues, and modern farming methods.

Candidates should be able to demonstrate knowledge of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none"> the purpose of husbandry is to keep animals healthy. the different forms of housing used for farm animals. the structure of male and female reproductive systems in a mammal. that animals are bred to improve yield, disease resistance, hardiness and conformation. the terms 'dominant', 'recessive' and 'F1' and their meanings in relation to breeding livestock. 	<ul style="list-style-type: none"> animals need food, water and a suitable environment for good health. that animal housing needs to be dry, have adequate ventilation and be draught free. the function of: ovary, oviduct, testis, sperm ducts, uterus, vagina and penis; formation of gametes, fertilisation, development and birth. the meaning and importance of hybrid vigour in animal production. the terms 'chromosomes', 'genes', 'phenotype' and 'genotype' and their meanings. how ICT can be used to maintain records necessary for efficient farm animal care. the difference between bulk and concentrate foods, and an example of each. the hazards associated with working with farm animals: disease (tetanus, TB, salmonella), physical dangers. how to move a large animal around the farm safely. 	<ul style="list-style-type: none"> the care needed for pregnant animals and for new-born animals, including housing, diet, health care. the risks associated with inadequate housing and poor management of farm livestock. how hormones control the timing of reproduction in animals; the main features of the lactation curve and how the principal components of milk differ during lactation. the uses and advantages of genetic engineering in breeding farm livestock. how to apply the mechanism of simple monohybrid inheritance, where there are dominant and recessive alleles, to animal breeding how ICT can be used for efficient record keeping and environmental monitoring and control in farm animal care. the difference between the role of maintenance and production rations, and an example of how each is used with farm livestock; food conversion ratios. how to carry out a risk assessment in the context of husbandry of farm livestock. how to weigh large animals safely and why weighing is an important management tool; the basic requirements for moving livestock beyond the farm, including legal requirements.

UNIT 5 LIVESTOCK HUSBANDRY (B495) CONTINUED

Candidates should be able to demonstrate understanding of the following:

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none">that farm livestock need to be kept healthy for reasons of profit and animal welfare; recognition of loss of condition.the signs that signify that an animal is on heat, ready to mate.the characteristics of named commercial breeds of cattle and how what is considered desirable has changed over time.the difference between intensive and extensive systems of livestock management.	<ul style="list-style-type: none">how ill health in farm animals (disease caused by bacteria, viruses, fungi and parasites) can be recognised (loss of condition and other evidence of parasites and disease).the techniques used in artificial insemination and embryo transfer.the role of selective breeding to produce characteristics of named commercial breeds of cattle and one other livestock.the advantages and disadvantages of intensive and extensive systems of livestock management.	<ul style="list-style-type: none">the health care strategies used in livestock husbandry aimed at preventing potential health problems; the effects and risks of routine use of antibiotics to prevent disease and enhance growth.how artificial insemination and embryo transfer are used in animal breeding, and their advantages and the ethical and animal welfare issues involved.the role of rare breeds in maintaining a wide genetic base, why certain breeds have fallen in popularity over time and why it is considered important to preserve these rare breeds.the ethical and animal welfare issues related to the intensive and extensive management of livestock.

To provide practical contexts for learning at an appropriate level of demand, candidates should be able to do some/all of the following tasks.

These will provide opportunities for the assessment of practical skills. They will not be tested in the computer-based tests.

Low Demand	Standard Demand	High Demand
<ul style="list-style-type: none">follow instructions and carry out care tasks for a farm animal successfully and safely, under supervision.identify a range of feeds commonly used for livestock.approach an animal safely.	<ul style="list-style-type: none">carry out the routine husbandry of a farm animal.record feed intake, growth rate or milk yield of an animal.move an animal safely.	<ul style="list-style-type: none">carry out the routine husbandry of a farm animal, including routine health care when needed.calculate the food conversion ratio for an animal.weigh a farm animal.

In all situations, suitable health and safety procedures must be followed (see Appendix D).

4 Scheme of Assessment

4.1 Units of Assessment

GCSE Environmental and Land-Based Science (J650)

Unit 1: Plant Cultivation (B491)

16.7% of the total GCSE marks
45 minute computer-based test
36 marks

This electronic test:

- is offered in Foundation and Higher Tiers;
- consists of objective questions (10 marks), short answer questions (12 marks), a data analysis question (6 marks) and a question that requires extended writing to evaluate or discuss applications of science (8 marks). There is no choice of questions;
- assesses knowledge and understanding of the specification and application of that knowledge and understanding.

Unit 2: Amenity Horticulture (B492)

16.7% of the total GCSE marks
45 minute computer-based test
36 marks

This electronic test:

- is offered in Foundation and Higher Tiers;
- consists of objective questions (10 marks), short answer questions (12 marks), a data analysis question (6 marks) and a question that requires extended writing to evaluate or discuss applications of science (8 marks). There is no choice of questions;
- assesses knowledge and understanding of the specification and application of that knowledge and understanding.

Unit 3: Management of the Natural Environment (B493)

16.7% of the total GCSE marks
45 minute computer-based test
36 marks

This electronic test:

- is offered in Foundation and Higher Tiers;
- consists of objective questions (10 marks), short answer questions (12 marks), a data analysis question (6 marks) and a question that requires extended writing to evaluate or discuss applications of science (8 marks). There is no choice of questions;
- assesses knowledge and understanding of the specification and application of that knowledge and understanding.

Unit 4: Care of Animals (B494)

16.7% of the total GCSE marks
45 minute computer-based test
36 marks

This electronic test:

- is offered in Foundation and Higher Tiers;
- consists of objective questions (10 marks), short answer questions (12 marks), a data analysis question (6 marks) and a question that requires extended writing to evaluate or discuss applications of science (8 marks). There is no choice of questions;
- assesses knowledge and understanding of the specification and application of that knowledge and understanding.

Unit 5: Livestock Husbandry (B495)

16.7% of the total GCSE marks
45 minute computer-based test
36 marks

This electronic test:

- is offered in Foundation and Higher Tiers;
- consists of objective questions (10 marks), short answer questions (12 marks), a data analysis question (6 marks) and a question that requires extended writing to evaluate or discuss applications of science (8 marks). There is no choice of questions;
- assesses knowledge and understanding of the specification and application of that knowledge and understanding.

Unit 6: ELBS Portfolio: Practical Skills, Work-Related Report, Investigative Project (B496)

50% of the total GCSE marks
Practical Skills 12.4%,
Work-Related Report 14.7%,
Investigative Project 22.9%
109 marks

This unit comprises **three** elements:

- practical skills (three per unit, maximum of 3 marks each);
- a work-related report (one only, maximum of 32 marks);
- investigative project (one only, maximum of 50 marks);

The portfolio is assessed by teachers (using the criteria given in Section 5), internally standardised, then externally moderated by OCR.

Evidence from a minimum of five practical tasks, the work-related report and investigative project should be stored electronically as part of each candidate's portfolio.

4.2 Unit Options

Candidates **must take Unit B493, and two further units** chosen from B491, B492, B494 or B495.

Where candidates have results for more than 3 of these units, the better or best combination will be used in aggregation to generate the overall grade for the specification.

They **must also take Unit B496**.

4.3 Tiers

Tests for Units B491-B495 are set in one of two tiers: Foundation Tier and Higher Tier. Foundation Tier computer-based tests assess Grades G to C and Higher Tier computer-based tests assess Grades D to A*. Candidates are entered for either the Foundation Tier or the Higher Tier using option codes F and H. Candidates may enter units at different tiers. Unit B496 (coursework) is not tiered.

Advice on tier of entry is given in Section 6.

4.4 Assessment Availability

There are two examination sessions each year, in January and June.

	Unit 1 (B491)	Unit 2 (B492)	Unit 3 (B493)	Unit 4 (B494)	Unit 5 (B495)	Unit 6 (B496)
June 2007	-	-	✓	-	-	-
January 2008	✓	✓	✓	✓	✓	-
June 2008	✓	✓	✓	✓	✓	✓

The first computer-based tests for Unit B493 will be in June 2007.

After January 2008, Units B491 – B495 will be available in the January and June sessions. Unit B496 will only be available in the June sessions

The Foundation and Higher Tier tests covering the same unit will be timetabled on the same day, and will commence at the same time. The tests timetabled simultaneously will contain common questions, or part questions, targeting the overlapping grades C and D.

4.5 Assessment Objectives

The Assessment Objectives describe the intellectual and practical skills which candidates should be able to demonstrate, and which will be assessed.

Assessment Objective 1 (AO1): Knowledge and understanding of science and how science works

Candidates should be able to:

- a) demonstrate knowledge and understanding of the scientific facts, concepts, techniques and terminology in the specification;
- b) show understanding of how scientific evidence is collected and its relationship with scientific explanations and theories;
- c) show understanding of how scientific knowledge and ideas change over time and how these changes are validated.

Assessment Objective 2 (AO2): Application of skills, knowledge and understanding

Candidates should be able to:

- a) apply concepts, develop arguments or draw conclusions related to familiar and unfamiliar situations;
- b) plan a scientific task, such as a practical procedure, testing an idea, answering a question, or solving a problem;
- c) show understanding of how decisions about science and technology are made in relation to different situations, including contemporary situations and those raising ethical issues;
- d) evaluate the impact of scientific developments or processes on individuals, businesses, enterprises, communities or the environment.

Assessment Objective 3 (AO3): Practical, enquiry and data-handling skills

Candidates should be able to:

- a) carry out practical tasks safely and skillfully;
- b) evaluate the methods they use when collecting first-hand and secondary data;
- c) analyse and interpret qualitative and quantitative data from different sources;
- d) consider the validity and reliability of data in presenting and justifying conclusions.

Weighting of Assessment Objectives

Assessment Objectives	Weighting
AO1: Knowledge and understanding	25%
AO2: Application of skills, knowledge and understanding	45%
AO3: Practical, enquiry and data-handling skills	30%

The relationship between the components and the assessment objectives of the scheme of assessment is shown in the following grid.

	Assessment Objective Weightings by Unit			
	AO1	AO2	AO3	Total
Units B491-B495	20%	30%	-	50%
Unit B496	5%	15%	30%	50%
Overall	25%	45%	30%	100%

All figures given are for guidance only and have a tolerance of $\pm 3\%$.

4.6 Quality of Written Communication

Candidates are expected to:

- present relevant information in a form that suits its purpose;
- ensure that spelling, punctuation and grammar are accurate, and meaning is clear.

Where appropriate they should also use a suitable structure and style of writing.

Candidates' quality of written communication will be assessed in Unit B496 in the Investigative Project and Work-Related Report.

5 Internal Assessment

5.1 Assessing Skills

Rationale

The coursework assessment in Unit B496 comprises three elements:

- practical skills;
- a work-related report;
- an investigative project.

The coursework aims to enable candidates to: develop skills specific for use in the Land and Environment sector; learn how science is used to research a problem; provide experience of the challenges of collecting valid and reliable data; understand how science can be used in the workplace.

For each candidate, the three elements together form a coursework portfolio, stored electronically. Further guidance on producing and submitting coursework electronically can be found in the coursework guidance materials for this specification.

Introduction

The coursework portfolio accounts for 50% of the marks for this specification. The three elements of the coursework are recorded electronically to make up each candidate's portfolio. The portfolio work is assessed by teachers, internally standardised and then externally moderated.

5.2 Marking Internally Assessed Work

Element 1: Practical Skills (Marks submitted out of 27)

Introduction

The facilities available within centres vary greatly, but a special feature of this specification is that candidates learn by experience of practical work. Each centre should incorporate as much practical work as possible into their programme. Teachers assess and record the skills that are learned during practical work.

Centres are required to submit marks for **9 skills: 3 from the 3 units taken** from B491-B495. Each skill is marked out of 0, 1, 2 or 3. Wherever possible, assessment should be an intrinsic part of the teaching strategy.

Because of the difficulties of assessing individual candidates in large classes, it is not expected that all candidates will be assessed at the same time.

Differentiation within the practical work will be achieved partly by the teacher agreeing or setting the task to be undertaken, which is appropriate to each candidate's level of ability, and partly by outcome. In other words, these assessments should be based on the principle of positive achievement - candidates should be given the opportunity to demonstrate what they understand and can do.

The person carrying out the assessment should normally be the teacher responsible for teaching the candidates.

Candidates should keep their own records of the skills achieved within their coursework portfolios, stored electronically. However, a record must also be kept by the teacher for verification.

Evidence for moderation should be provided for a minimum of five tasks for which marks are submitted for each candidate. Evidence will be in the form of video clips or photographs stored within candidates' portfolios. Further guidance about capturing evidence for the practical skills can be found in the coursework guidance materials for this specification.

Marking Criteria for Practical Skills

The marks for nine skills must be submitted (3 skills in each of the 3 units).

The practical skills are assessed by the teachers on a 4 point scale according to the following criteria.

0 mark	None of the required skills demonstrated.
1 mark	Follows written, diagrammatic or oral instructions to perform a simple practical operation. Uses familiar equipment and materials adequately, but needing reminders on points of practice or safety.
2 marks	Follows written, diagrammatic or oral instructions to perform a task involving a series of step-by-step practical operations. Uses familiar equipment, materials and techniques adequately and safely.
3 marks	Follows written, diagrammatic or oral instructions to perform a task involving a series of practical operations where there may be a need to make decisions to complete the task. Uses familiar equipment, materials and techniques with due care and attention for the plant or animal, or other people, safely, correctly and methodically.

If the performance does not satisfy the criteria for the award of 1 mark, a mark of 0 should be awarded.

Suggested Practical Skills for Assessment (Units B491-B495)

Unit B491 Plant Cultivation

Soil cultivation by mechanical means or by double digging

Preparing seed beds and drilling seeds.

Maintaining equipment for plant cultivation

Hoeing up potato banks

Transplanting brassicas or leeks

Layering strawberries

Taking softwood cuttings

Setting up irrigation systems

Identifying signs of health/disease in a crop

Demonstrating effects of nutrient deficiencies

Unit B492 Amenity Horticulture

Planting a bed of glasshouse tomatoes

Preparing hanging baskets

Side-shooting, tying up and feeding tomatoes

Pricking out a tray of seedlings and subsequent transplanting

Cloching crops with glass or plastic

Weeding crops

Harvesting crops (e.g. potatoes, strawberries, raspberries, cabbage, carrots, onions, peas)

Planting young trees

Pruning of roses or fruit trees

Mowing lawns

Maintaining a lawn mower

Unit B493 Management of the Natural Environment

Testing soil samples for pH

Investigating soil particle size

Sampling numbers of plant species or earthworms using quadrats

Investigating humus or water content of soil

Making a survey using a line transect over a contrasting habitat

Making a land use survey

Collecting animals to assess their numbers in a habitat

Measuring pollution using indicator species

Measuring physical factors in a habitat

Unit B494 Care of Animals

Collecting and grading eggs

Candling eggs

Sexing livestock (rabbits, guinea pigs or mice)

Handling and cleaning animals

Constructing brooding units for chicks

Feeding and daily caring of animals

Assessing health of animals

Taking temperatures of animals

Preparing animals for showing

Using an incubator

Unit B495 Livestock Husbandry

Measuring food intake or milk yield of an animal

Safely handling tractor and trailer/implement

Maintaining farmyard equipment

Grading lambs

Bottle feeding lambs

Preparing a sow for farrowing

Constructing a creep system for piglets

Mixing and feeding milk to calves

Milking goats or cows

Weighing and recording growth rates

General Tasks (in the context of one of the above units)

Assessing the risk of a practical activity

Using basic first aid in the workplace

Controlling and extinguishing a fire

The list above should be seen as a guide and further guidance will be given in the teacher guide for this specification. Centres are free to devise other skills for each unit, but these must be approved by OCR using the coursework consultancy service **before** being given to candidates.

Element 2: Work-Related Report (Marks submitted out of 32)

Introduction

This assignment should arise naturally from work on the course and should relate to one of the units chosen from Units B491-B495. It offers candidates the opportunity to research authentic contexts in which science is important to the Land and Environment sector. Candidates have the opportunity to learn through work, learn about workplace practice, and to make links to relevant scientific knowledge.

The assignment could arise from:

- work experience at an enterprise related to the course, e.g. production on a local farm, nursery, market garden, or garden centre;
- a visit or series of visits to an enterprise related to the course, e.g. veterinary practice, farm park, nature reserve;
- a school-based mini enterprise activity, e.g. production, marketing and selling of school produce.

And/or where this is not practical:

- information-based research in school/college, e.g. analysis of how zoos contribute to animal conservation.

Topics for study should be selected by candidates in discussion with the teacher, and should be seen as an extension or consolidation of studies undertaken as a normal part of the course.

The assignment will be in the form of a written report. However, candidates should be encouraged to include other styles of presentation as part of their report, for example:

- a news article;
- a power-point presentation;
- a video clip of a spoken report or interview;
- photographs.

In all cases, sufficient detail must be included to allow evaluation in all of the performance areas A-D below.

The Work-Related Report will form part of the coursework portfolio, stored electronically, for each candidate.

Arrival at Performance Area Marks

This task provides an opportunity for candidates to research authentic contexts in which science is applied. At the core of their report is a description of the nature of the work carried out. They should aim to focus on specific aspects of workplace practice, and make links to relevant scientific knowledge from one of the three units studied.

Writing this report requires several skills associated with scientific communication:

- collecting information and acknowledging sources;
- structuring a report appropriately;
- making effective use of visual material to convey information and ideas.

Candidates will be assessed on their ability to:

- select and use information sources;
- describe the workplace;
- make links to relevant scientific knowledge and understanding;
- produce a coherent report to present findings.

The award of marks is based on the professional judgement of the science teacher, working within a framework of descriptions of performance. Within each strand, each line in the marking grids represents a different aspect of performance. For each of these, a series of four descriptions of performance illustrates what might be expected for candidates working at different levels.

Marking decisions should be recorded on marking grids. A master copy is provided in the coursework guidance booklet. The completed grid should accompany the work if it is required for moderation.

Candidates may not always report their work in a particular order. So, evidence of achievement in a strand may be located almost anywhere in the report. Thus, it is necessary to look at the whole report for evidence of each strand in turn.

Within any one strand, each aspect should be considered in turn. A tick on the grid should be used to indicate the performance statement that best matches the work.

Where the maximum mark is 8, intermediate marks 1, 3, 5 or 7 can be used where performance exceeds that required by one statement, but does not adequately match that required by the next higher statement (e.g. if the work significantly exceeds what is required for 4 marks, but does not reach the standard for 6, then the tick should be placed on the dividing line between the 4 and 6 mark boxes).

Where a decision is based partly on the teacher's observation of the candidate at work, a record of this should be retained.

When each aspect of the performance within a strand has been assessed in this way, the pattern of achievement is interpreted by a 'best-fit' judgement to give a mark for that strand.

This method of marking can be applied even where there is a wide variation between performance in different aspects. Thus, weak performance in one aspect need not depress marks too far if other aspects show better performance.

Strand A Information sources

Aspect of Performance	Mark			
	2	4	6	8
(a) Initiative in collecting information	Information given is restricted to that provided by the original stimulus materials	Information from a few additional sources is provided, although some may be irrelevant or inappropriate.	Relevant information is collected, from a variety of sources including a practitioner and/or workplace.	Uses relevant information carefully selected, from a variety of sources including a practitioner and/or workplace.
(b) Reference to sources	Sources of information not identified	Sources are identified by incomplete or inadequate references	Sources are identified clearly but in limited detail	References to sources are clear and fully detailed
(c) Identification of source of particular information	-	Direct quotations are rarely indicated as such	Direct quotations are generally acknowledged	Direct quotations are appropriately used and acknowledged.

Strand B Description of workplace

Aspect of Performance	Mark			
	2	4	6	8
(a) Description of the expertise of an individual, or a working group, with the vocational qualifications and personal qualities required	Gives an account which is superficial or lacks detail or focuses on only one aspect	Gives a partial account of the expertise of an individual, or a working group, with the vocational qualifications or personal qualities required	Describes the expertise of an individual, or a working group, with the vocational qualifications or personal qualities required	Gives a clear account which explains the relevance to the work of the vocational qualifications and personal qualities required
(b) Description of the nature of the work, its purpose and place in the wider organisation	Gives an account which is superficial or lacks detail or focuses on only one aspect	Gives a partial account of the work, its purpose and place in the wider organisation	Gives an account of the work and describes its purpose and place in the wider organisation	Gives a full account of the work and explains its purpose and place in the wider organisation
© Understanding of the financial or regulatory context in which the work is done (e.g. health and safety regulations).	Makes a link between one financial or regulatory factor and the work.	Identifies one relevant example of the impact of a financial or regulatory factor on the work.	Describes one example of the impact of a financial or regulatory factor on the work.	Explains one example of the impact of a financial or regulatory factor on the work.

Strand C Scientific knowledge and skills applied

Aspect of Performance	Mark			
	2	4	6	8
(a) Scientific knowledge and understanding applied in the workplace	Makes a link between the work and one example of scientific knowledge.	Identifies scientific knowledge involved in the work described.	Describes scientific knowledge involved in the work.	Describes scientific knowledge and explains how it underpins the work described.
(b) Technical skills applied in the workplace	Makes a link between the work and one example of a technical skill	Identifies a relevant example of a technical skill applied in the workplace	Describes an example of a technical skill applied in the workplace	Describes and explains an example of a technical skill applied in the workplace

Strand D Quality of presentation

Aspect of Performance	Mark			
	2	4	6	8
(a) The structure and organisation of the report	The report has little or no structure or coherence, or follows a structure provided by worksheets.	The report has an appropriate sequence or structure	Information is effectively organised, with contents listing of key elements and page numbering	Considerable care has been taken to present the information clearly to a chosen audience.
(b) Use of visual means of communication (charts, graphs, pictures etc).	There is little or no visual material to support the text.	Visual material is simply decorative, rather than informative.	Visual material is used to convey information or illustrate ideas.	Visual material is used appropriately to convey information or illustrate ideas.
(c) General quality of communication	Spelling, punctuation and grammar are of generally poor quality. Little or no relevant technical or scientific vocabulary is used.	Use of appropriate vocabulary is limited. Spelling, punctuation and grammar are of very variable quality.	Appropriate scientific vocabulary is used. Spelling, punctuation and grammar are generally sound.	There is full and effective use of relevant scientific terminology. Spelling, punctuation and grammar are almost faultless.

Element 3: Investigative Project (Marks submitted out of 50)

Introduction

Candidates carry out and present a detailed report on one Investigative Project based on one or more of the topics studied within Units B491-B495.

The work is marked by the teacher and moderated by OCR.

The type of work required

The project work must be done by candidates working individually and be based on the following principles:

- a) The project work must be investigatory. The candidate must find the data/information for himself/herself by direct observation and/or measurement. Reference may be made to texts for background information, but all sources must be quoted.
- b) The teacher should guide the candidate and, where required, select questions to guide the candidate's investigation and suggest methods of investigation.
- c) The question to be investigated should be stated and discussed by the candidate in the introduction to the work.
- d) It is not expected that candidates will necessarily solve all the problems they encounter, but they should demonstrate an attempt to do so. When problems fail to yield positive results, the candidates should be encouraged to discuss their actual findings and comment on the implications.

Examples of possible investigative work

Project work can be based on a variety of topics. The following examples are intended as a guide, but teachers should assist candidates to devise projects of their own.

Experimental Work

- thinning of root crops; no thinning and thinning to various spacing: effects on total yield and size of roots produced;
- plant population in relation to yield; spacing of plant stations and rows: comparison to find optimum spacing;
- spraying versus not spraying; infestation with disease or pest organisms: effects on yield, cost-effectiveness;
- top-dressing versus not top-dressing; various treatments and effects: comparison of costs and yields;
- fertiliser trials; organic versus inorganic, differing application rates: effects on yields and diminishing returns;
- rationing of animal feed versus ad-lib feeding; effects on production: cost-effectiveness;
- effects of different levels of nutrition on young animals; measurement of live weight gain under different rationing regimes: effects on health, cost-effectiveness.

For field trials, it is useful to have a group of candidates involved, in order to make possible replication of treatments on plots in different parts of the garden or field. This improves the

statistical accuracy of the trial. However, each candidate's contribution must be assessed and individual reports must be written.

When different treatments are tried, the effect upon yield of produce is a factor to be measured. The cost-effectiveness of alternative treatments should also be considered.

Attention should be paid to the presentation of results in a clear and concise form, including tabulation or graphical representation.

Reasons should always be given for treatments carried out, methods tried, or conclusions reached.

Ecological Work

- effects of moorland burning; effects on species distribution and population: by comparing adjacent areas, burned and not burned;
- shoreline ecology; distribution of species: effects of abiotic and/or biotic factors;
- sand dune ecology; distribution of species: effects of abiotic and/or biotic factors;
- pond or stream studies; distribution of species: effects of abiotic and/or biotic factors;
- pollution related to biological indicators;
- land use survey linked to soils or geology.

In field surveys, the aim is to carry out an information-gathering exercise using questionnaires, random sampling etc. and to evaluate the findings. Conclusions must be included.

The layout of the Investigative Project report

Title - The report should bear a clear title. This should appear on the first page, together with the name of the candidate and the name of the school.

Contents - A list of contents should be included, showing clearly the main sections of the report and the numbers of pages where they appear. Lists of tables, graphs and photographs can also be included, if appropriate.

Introduction - This should state the objective(s) of the project, the questions to be answered or hypotheses to be tested and describe briefly the plans for carrying it out.

Sources of material, such as reference texts or people interviewed, should be acknowledged. Details of the time (with dates) and the place where the project was carried out should be given.

Background study - This should provide information about the subject of the study and describe any scientific principles that are involved.

The main report - The main body of the project report should be clearly divided into appropriate sections, with clear headings. It should give a detailed account, in logical sequence, of the practical work carried out. Data recorded should be compiled in tables and appropriate graphs plotted.

Conclusions and assessments - The conclusions of the report should be summarised in a few paragraphs. The findings should be compared to the original plan set out in the introduction. Limitations of the data should be noted and suggestions made for improvements.

Assistance received from other people must be acknowledged.

Criteria for awarding marks for the Investigative Project

The award of marks is based on the professional judgement of the science teacher, working within a framework of descriptions of performance. Within each skill, each line in the marking grid represents a description of performance illustrating what might be expected for a candidate working at a particular level.

Marking decisions should be recorded on marking grids. A master copy is provided in the coursework guidance booklet. The completed grid should accompany the work if it is required for moderation.

Candidates may not always report their work in a particular order. So, evidence of achievement in a skill may be located almost anywhere in the report. Thus, it is necessary to look at the whole report for evidence of each skill in turn.

Intermediate marks 1, 3, 5, 7 or 9 can be used where performance exceeds that required by one statement, but does not adequately match that required by the next higher statement (e.g. if the work significantly exceeds what is required for 4 marks, but does not reach the standard for 6, then a mark of 5 may be awarded).

Where a decision is based partly on the teacher's observation of the candidate at work, a record of this should be retained.

SKILL P

Planning using appropriate background information

Does not select relevant questions (they are provided) and does not use background information.	0
Selects relevant questions with considerable guidance and uses some background information within the plan.	2
Selects relevant questions with guidance; expresses outline information only; plans an appropriate investigation using some relevant information to inform the plan.	4
Selects relevant questions with some guidance; expresses information in general terms; plans an appropriate investigation incorporating some background research.	6
Selects relevant questions without guidance; expresses information in general terms; plans an appropriate investigation using a range of appropriate information to inform the plan.	8
Selects relevant questions without guidance; clearly expresses information; plans an appropriate investigation using detailed scientific information to inform the plan and identifies a suitable procedure.	10

SKILL A**Analysis and presentation of data**

Does not provide any deductions.	0
Provides one valid deduction, chart or simple line graph.	2
Provides deductions that are based on the evidence and uses simple bar charts or line graphs to identify patterns in the data.	4
Provides an analysis which is generally related to the evidence and uses graphs and charts to support the analysis.	6
Provides an analysis based on the evidence; gives conclusions with reasons; presents a range of data in an appropriate form and links application of scientific data to the investigation well.	8
Provides a comprehensive analysis based on the evidence and gives conclusions with reasons.	10

SKILL Q**The quality of the practical part of the study, collecting and obtaining information**

No work presented or recorded.	0
Carries out tasks with considerable help; provides some inaccurate observations and records outline information only.	2
Carries out tasks with help; provides some inaccurate observations and records, provides limited observations and presents information in a simple format.	4
Carries out tasks collecting a range of information with only an occasional error; records information with few inaccuracies.	6
Carries out tasks collecting a good range of accurate information and records information clearly.	8
Carries out systematically, with due regard for safety, accurate and detailed observations with appropriate precision, and records information clearly.	10

SKILL E**Evaluating the evidence, use of secondary information and possible procedures for improvement**

Makes no comment about the procedures used or the evidence obtained.	0
Makes a simple comment about the procedures used or the evidence obtained.	2
Makes a relevant comment about procedures used or the evidence obtained and suggests some improvements.	4
Makes relevant comments about procedures used and evidence obtained, comments on the suitability of the procedures and suggests changes to that will improve the reliability of the investigation.	6
Considers critically the reliability of evidence and whether it is sufficient to support conclusions, accounting for any anomalies; describes in detail further work to provide additional relevant evidence and information which will support conclusions.	8

SKILL W

The quality of the written report and presentation of data and supporting information

Poorly presented report lacking any format with numerous gaps and omissions.	0
Report reasonably well presented, but lacking logical format; some gaps and omissions.	2
Report well set out and a range of visual information used, with sections labelled; sub-headings, contents and bibliography present.	4
Report neat, detailed and well presented; appropriate terminology used, and good use of visual information; sub-headings used, contents and bibliography accurate and detailed, and pages numbered and cross referenced where appropriate.	6

SKILL D

Determination, initiative and independence

Failed to complete any parts of the task.	0
Completed some parts of the task but needed guidance. Kept to a simple study.	2
Completed tasks and responded well to any difficulties when given guidance.	4
Completed tasks and dealt well with any difficulties without direct support.	6

Arrival at the Final Mark Submitted

The marks achieved in all three elements should be added together to give a total mark for the Portfolio.

Element	Number of assessments	Total marks per assessment	Total marks for Element
Practical Skills	9	3	27
Work-Related Report	1	32	32
Investigative Project	1	50	50
Total for Portfolio (for form MS1)			Total mark out of 109

Coursework Assessment Forms will be provided for centres to summarise the marks for each candidate's portfolio. The final total marks out of 109 should be submitted to OCR on Form MS1 by 15 May in the year of entry for Unit B496. These forms are produced and despatched at the relevant time based on entry information provided by the centre.

All assessed work which has contributed to candidates' final totals must be available for moderation.

5.3 Regulations for Internally Assessed Work

Supervision and Authentication of Work

OCR expects teachers to supervise and guide candidates who are undertaking work that is internally assessed. The degree of teacher guidance will vary according to the kind of work being undertaken. It should be remembered, however, that candidates are required to reach their own judgements and conclusions.

When supervising internally assessed tasks, teachers are expected to:

- offer candidates advice about how best to approach such tasks;
- exercise supervision of work in order to monitor progress and to prevent plagiarism;
- ensure that the work is completed in accordance with the specification requirement and can be assessed in accordance with the specified mark descriptions and procedures.

Coursework should, wherever possible, be carried out under supervision. However, it is accepted that some tasks may require candidates to undertake work outside the centre. Where this is the case, the centre must ensure that sufficient supervised work takes place to allow the teachers concerned to authenticate each candidate's work with confidence.

Candidates will require guidance in their choice of topics areas for their coursework, and some of the work is likely to be carried out individually and independently without direct supervision. Teachers will need to take steps to ensure that the work presented for assessment accurately reflects each candidate's individual attainment.

Legal and Ethical Working Practices

This specification covers topics involving legal and ethical considerations, for example in the care of animals. It is important that the teacher should be aware of these considerations, and give clear guidance where such issues arise in coursework. Where candidates are planning their own coursework tasks, the teacher has a duty to check the plans before work starts and to monitor the activity as it proceeds. Candidates should understand that ethical and legal guidelines are based on respect and care for the living organisms concerned.

Candidates must not:

- cause or risk any stress, distress, or suffering to any animals;
- engage in or be a party to any illegal activity.

The attention of teachers is drawn to the following sections in the CLEAPSS Laboratory Handbook:

14.1 Animals in school

14.2 Animals in the wild

14.11 Greenhouses

15.4 Pesticides

15.5 Plants and seeds

15.6 Ponds

17.1 Fieldwork

Health and Safety

The attention of teachers is drawn to Appendix C of this specification.

Candidate Authentication Statement

Candidates will fill in candidate authentication statements, and these will be held at centres in the usual way.

Centre Authentication Form for Coursework

Centres should complete the 'Centre Authentication Form for Coursework'. Changes to the form will not be accepted after the coursework submission date.

Production and Presentation of Internally Assessed Work

Candidates must observe certain procedures in the production of internally assessed work.

Any copied material must be suitably acknowledged.

Where work is based on the use of secondary data, the original sources must be clearly identified.

Each candidate's assessed work submitted for moderation should be organised within electronic files as required by OCR.

Annotation of Candidates' Work

Teachers must provide references to indicate where in the portfolio candidates' work meets the assessment criteria. Further information is provided in the teacher guide for this specification.

Moderation

All internally assessed work is marked by the teacher and internally standardised by the centre. Marks are then submitted to OCR, after which moderation takes place in accordance with OCR procedures. The purpose of moderation is to ensure that the standard of the award of marks is the same for each centre and that each teacher has applied the standards appropriately across the range of candidates within the centre.

It is the responsibility of the centre to carry out effective internal standardisation to ensure that similar standards are applied by each teacher involved in the assessment. The portfolio must be completed and marks submitted by the 15th May in the year of entry.

The sample seen by the moderator will represent performance across the whole ability range from the centre. The sample of work must show how the marks have been awarded in relation to the mark descriptions (see Section 4.5).

The moderator will require a written statement, describing how internal standardisation has been carried out within the centre.

Minimum Requirements for Internally Assessed Work

If a candidate submits no work for this internally assessed unit, then the candidate should be indicated as being absent from that unit on the mark sheets submitted to OCR. If a candidate completes any work at all for an internally assessed unit, then the work should be assessed according to the criteria and mark descriptions and the appropriate mark awarded, which may be zero.

6 Technical Information

6.1 Making Unit Entries

Centres must be registered with OCR in order to make any entries, including estimated entries. It is recommended that centres apply to OCR to become a registered centre well in advance of making their first entries. Centres should be aware that a minimum of ten candidates for summer examinations is normally required.

Unit Entry Options

Within each of the optional Units B491 – B495, candidates must be entered for either the Foundation Tier or the Higher Tier option. It is not necessary for candidates to enter at the same tier in every unit. Candidates may, if they wish, attempt examinations at both tiers, but not in the same examination session, since the examinations will be timetabled simultaneously.

Unit Entry Code	Option Code	Component to be taken
B491	F	01 Unit 1: Plant Cultivation Foundation Tier
	H	02 Unit 1: Plant Cultivation Higher Tier
B492	F	01 Unit 2: Amenity Horticulture Foundation Tier
	H	02 Unit 2: Amenity Horticulture Higher Tier
B493	F	01 Unit 3: Management of the Natural Environment Foundation Tier
	H	02 Unit 3: Management of the Natural Environment Higher Tier
B494	F	01 Unit 4: Care of Animals Foundation Tier
	H	02 Unit 4: Care of Animals Higher Tier
B495	F	01 Unit 5: Livestock Husbandry Foundation Tier
	H	02 Unit 5: Livestock Husbandry Higher Tier
B496	-	- ELBS Portfolio: Practical Skills, Work-Related Report, Investigative Project

Recommended Entry Policy

Predicted GCSE Grade	Recommended Tier of Entry
A*-B	Higher
C	Higher/Foundation
D-G	Foundation

Entry Deadlines

Final candidate entries must be made by 21 October for the January session and by 21 February for the June session.

6.2 Making Qualification Entries

Candidates **must** be entered for certification code **J650** to claim their overall GCSE grade.

If a certification entry is not made, no overall grade can be awarded.

A candidate who has completed all the units required for the qualification may enter for certification either in the same examination session (within a specified period after publication of results) or at a later session.

First certification will be available in June 2008 and every January and June thereafter.

6.3 Grading

GCSE results are awarded on the scale A*-G. Units are awarded a* to g. Grades are awarded on certificates. Results for candidates who fail to achieve the minimum grade (G or g) will be recorded as unclassified (U or u).

Uniform Marks

In unitised schemes candidates can take units across several different sessions. They can also re-sit units or choose from optional units available. When working out candidates' overall grades OCR needs to be able to compare performance on the same unit in different sessions when different grade boundaries have been set, and between different units. OCR uses uniform marks to enable this to be done.

A candidate's uniform mark is calculated from the candidate's raw mark. The raw grade boundary marks are converted to the equivalent uniform mark boundary. Marks between grade boundaries are converted on a pro rata basis.

When unit results are issued, the candidate's unit grade and uniform mark are given. The uniform mark is shown out of the maximum uniform mark for the unit.

Results for each unit will be published in the form of uniform marks according to the following scales.

Grade	a*	a	b	c	d	e	f	g	u
Units B491, B492, B493, B494, B495	50-45	44-40	39-35	34-30	29-25	24-20	19-15	14-10	9-0
Unit B496	150-135	134-120	119-105	104-90	89-75	74-60	59-45	44-30	29-0

Higher tier candidates may achieve an "allowed e" if their raw mark is less than but close to the minimum mark required for a 'd' grade. Higher tier candidates who miss a grade 'e' will be given a uniform mark in the range 'f-u' but will be graded as 'u'.

Candidates' uniform marks for each module are aggregated and grades for the specification are generated on the following scale:

Grade	A*	A	B	C	D	E	F	G	U
	300-270	269-240	239-210	209-180	179-150	149-120	119-90	89-60	59-0

The candidate's grade will be determined by this total mark. Thus, the grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of the assessment may be balanced by better performance in others. Candidates achieving less than the minimum mark for grade G will be unclassified.

6.4 Result Enquiries and Appeals

Under certain circumstances, a centre may wish to query the grade available to one or more candidates or to submit an appeal against an outcome of such an enquiry. Enquiries about unit results must be made immediately following the series in which the relevant unit was taken.

For procedures relating to enquiries on results and appeals, centres should consult the *Handbook for Centres* and the document *Enquiries about Results and Appeals - Information and Guidance for Centres* produced by the Joint Council. Further copies of the most recent edition of this paper can be obtained from OCR.

6.5 Shelf-Life of Units

Individual unit results, prior to certification of the qualification, have a shelf-life limited only by that of the qualification.

6.6 Unit and Qualification Re-sits

Candidates may re-sit any unit an **unlimited** number of times.

For each unit the best score will be used towards the final overall grade.

Candidates may enter for the full qualification an unlimited number of times.

6.7 Guided Learning Hours

GCSE Environmental and Land-Based Science requires 120 guided learning hours in total.

6.8 Code of Practice/Subject Criteria/Common Criteria Requirements

These specifications comply in all respects with the revised *GCSE, GCE, VCE, GNVQ and AEA Code of Practice 2005/6*, the subject criteria for GCSE Additional Applied Science and *The Statutory Regulation of External Qualifications 2004*.

6.9 Arrangements for Candidates with Particular Requirements

For candidates who are unable to complete the full assessment or whose performance may be adversely affected through no fault of their own, teachers should consult the *Access Arrangements and Special Consideration Regulations* and *Guidance Relating to Candidates who are Eligible for Adjustments in Examinations*. In such cases advice should be sought from OCR as early as possible during the course.

6.10 Prohibited Qualifications and Classification Code

Every specification is assigned to a national classification code indicating the subject area to which it belongs.

Centres should be aware that candidates who enter for more than one GCSE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Performance Tables.

The classification code for this specification is 1750.

7 Other Specification Issues

7.1 Overlap with other Qualifications

This specification has been developed as an alternative to GCSE Additional Applied Science A.

7.2 Progression from these Qualifications

GCSE qualifications are general qualifications which enable candidates to progress either directly to employment, or to proceed to further qualifications.

Many candidates who enter employment with one or more GCSEs would undertake training or further part-time study with the support of their employers.

Progression to further study from GCSE will depend upon the number and nature of the grades achieved. Broadly, candidates who are awarded mainly grades G to D at GCSE could either strengthen their base through further study of qualifications at Level 1 within the National Qualifications Framework or could proceed to Level 2. Candidates who are awarded mainly grades C to A* at GCSE would be well prepared to broaden their base through further study of qualifications at Level 2 or to proceed to appropriate qualifications at Level 3 within the National Qualifications Framework.

Candidates achieving Level 1 awards in Environmental and Land-Based Science could progress to further qualifications at Levels 1 and 2 within the National Qualifications Framework, for example to vocational qualifications within the Land and Environment sector.

Candidates achieving Level 2 awards in Science and in Environmental and Land-based Science will be well prepared for further study in GCE Applied Science at Level 3 within the National Qualifications Framework, or for progress to vocational qualifications in the Land and Environment sector.

7.3 ICT

In order to play a full part in modern society, candidates need to be confident and effective users of ICT and understand the importance of ICT to life and work.

This specification provides candidates with a wide range of appropriate opportunities to use ICT in order to further their study of science in the Land and Environment sector:

- gathering information from the internet and CD-ROMs;
- gathering data using sensors linked to data-loggers or directly to computers;
- using spreadsheets and other software to process data;
- using animations and simulations to visualise scientific ideas;
- using software to present ideas and information;
- recording evidence of practical skills using video clips or photographs
- organising reports and evidence of investigations in a coursework portfolio, stored electronically.

The examples listed in the table show some points in the specification where opportunities might more easily be found.

ICT	Possible Opportunities
Gathering information from Internet CD-Rom	B496: Information for the Investigative Project B496: Information for the Work-Related Report B493: Information on conversion ratios
Data logging	Environmental monitoring for plant growth (B491), control of pollution (B493) and animal care (B494, B495)
Processing data	B492: Control of environmental conditions in glasshouses Record keeping for plant care (B493) and animal care (B494, B495)
Visualisation	B496: Use of digital photographs and video-clips in evidencing practical skills
Making presentations	There are opportunities for candidates to make presentations as part of their portfolio work for B496

Further details of the opportunities provided by this specification for the development of candidates' ICT skills are given in the Key Skills Section of this specification.

7.4 Citizenship

From September 2002, the National Curriculum for England at Key Stage 4 includes a mandatory programme of study for Citizenship.

Citizenship Programme of Study	Opportunities for Teaching the Issues during the course
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Section 1: Knowledge and understanding about becoming informed citizens

The work of parliament, the government and the courts in making and shaping the law	There are opportunities throughout the course to discuss the way in which the law is concerned with animal welfare, health and safety, conservation and pollution.
How the economy functions, including the role of business and financial services	The Work-Related Report requires candidates to undertake research on a business/enterprise. The course as a whole is vocationally oriented.
The opportunities for individuals and voluntary groups to bring about social change locally, nationally, in Europe and internationally	The role of voluntary groups in conservation (Unit B493) is critical. Such groups have also been important in the development of organic food production (Unit B493), sustainable development and free-range animal husbandry (B495).
The media's role in society, including the internet, in providing information and affecting opinion	The role of the media has been important in the promotion of organic food production, the campaign against GM foods and extensive farming (B493, B495).
The rights and responsibilities of consumers, employers and employees	These issues can be explored within the Work-Related Report (Unit B496).
The issues and challenges of global interdependence and responsibility, including sustainable development and Local Agenda 21	There are many opportunities throughout the course to discuss issues of sustainable development. Local conservation and Agenda 21 issues are particularly relevant in Unit B493.

Section 2 : Enquiry and communication

Researching a topical scientific issue by analysing information from different sources, including ICT-based sources, showing an awareness of the use and abuse of statistics	B496: Researching a science-related issue for the Investigative Project B493: Exploring topical issues related to food and agriculture
Expressing, justifying and defending orally and in writing a personal opinion about a topical scientific issue	B493: Exploring topical issues related to food and agriculture B495: Studying the animal welfare arguments for different production systems
Contributing to group and class discussions	B493: Exploring topical issues related to food and agriculture B495: Discussing the issues of embryo transfer and cloning
Consider and evaluate views that are not their own	B493: Reflecting on different points of view with regard to organic or GM food
Participating in science-based school and community activities	B491 Maintaining glasshouses B495: Looking after livestock

7.5 Key Skills

These specifications provide opportunities for the development of the Key Skills of *Communication*, *Application of Number*, *Information Technology*, *Working with Others*, *Improving Own Learning and Performance* and *Problem Solving* at Levels 1 and/or 2. However, the extent to which this evidence fulfils the Key Skills criteria at these levels will be totally dependent on the style of teaching and learning adopted for each unit.

The following table indicates where opportunities *may* exist for at least some coverage of the various Key Skills criteria at Levels 1 and/or 2 for each unit.

Level	Communication	Application of Number	IT	Working with Others	Improving Own Learning and Performance	Problem Solving
1	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓

7.6 Spiritual, Moral, Ethical, Social, Legislative, Economic and Cultural Issues

There are many opportunities throughout the course to discuss issues which affect people's lives, for example in areas of food production, animal welfare, and the environment.

Issue	Opportunities for Teaching the Issues during the Course
The ethical implications of selected scientific issues	B492: Ethical issues related to genetic engineering and cloning B494: Ethical issues related to agriculture and food production
The range of factors which have to be considered when weighing the costs and benefits of scientific activity	B496: work-Related report of a science-related issue B493: Social and economic issues arising from farming and food processing B492: Long and short term economic and environmental costs and benefits related to the use of glasshouses
Scientific explanations which give insight into the local and global environment	B493: The origins of pollutants and what happens to them in the atmosphere B493: The cycle of elements such as nitrogen in the environment
Scientific explanations which give insight into human nature	B491: Genes and inheritance

7.7 Sustainable Development, Health and Safety Considerations and European Developments

OCR has taken account of the 1988 Resolution of the Council of the European Community and the Report *Environmental Responsibility: An Agenda for Further and Higher Education*, 1993 in preparing this specification and associated specimen assessments.

Issue	Opportunities for Teaching the Issues during the Course
Environmental Issues	
Air pollution	B493: Noise and smell as pollutants
Habitat destruction	B493: Loss of hedgerows and common land to demands of farming and urbanization
Food and agriculture	B495: Intensive versus organic approaches to food production B493: The issues of GM crops in food production
Management of weeds and pests	B493: Effects of herbicides and pesticides on the environment
Energy resources	B493: The environmental advantages and disadvantages of different energy sources for generating electricity
Health and Safety Issues	
Safe practice in laboratory	B496: Carrying out coursework: skills and evaluation of risk
Safe practice in the workplace	B495: Working with farm machinery
Food and nutrition	B493: Food safety and the risks and benefits associated with new agricultural technologies
Health and disease	B495: The danger to humans of using antibiotics in animal production B493: The dangers of transferring herbicides and pesticides to humans on food

OCR has taken account of the 1988 Resolution of the Council of the European Community in preparing this specification and associated specimen assessments. European examples should be used where appropriate in the delivery of the subject content.

Although this specification does not make specific reference to the European dimension it may be drawn into the course of study in a number of ways. The table below provides some appropriate opportunities.

Issue	Opportunities for Teaching the Issues during the Course
The importance of agriculture, horticulture and related industry to European economies	There are many opportunities throughout the course to develop these ideas
Environmental issues which extend over a larger area than the UK	B493: Study of how human activities change balance of ecosystems e.g. fishing quotas
Differences in attitudes to key issues in different parts of Europe	B493: Comparing attitudes to GM crops in different countries B493: European policies for the use and disposal of materials B495: Contrasting attitudes across Europe to health issues including routine use of antibiotics in animal production

7.8 Work-Related Learning

There are many opportunities throughout the course to use work-related learning in developing skills, knowledge and understanding. In particular there will be opportunities to:

- develop awareness of the extent and diversity of local and national employment opportunities;
- relate candidates' abilities, attributes and achievements to career intentions and make informed choices based on an understanding of the alternatives;
- learn from contact with personnel from different employment sectors;
- have experience (direct or indirect) of working practices and environments.

The following relate specifically to Unit B496, element 2, the Work-Related Report.

Recognise, develop and apply skills for enterprise and employability Performance Area B: Jobs and tasks in the enterprise

Use experience of work, including work experience and part-time jobs, to extend understanding of work Performance Area A: The nature of the enterprise
Performance Area B: Jobs and tasks in the enterprise

Learn about the way business enterprises operate, working roles and conditions, and rights and responsibilities in the workplace Performance Area A: The nature of the enterprise
Performance Area B: Jobs and tasks in the enterprise

Undertake tasks and activities set in work contexts Performance Area B: Jobs and tasks in the enterprise
Performance Area C: The application of science within the enterprise

Engage with ideas, challenges and applications from the business world Performance Area A: The nature of the enterprise
Performance Area B: Jobs and tasks in the enterprise
Performance Area C: The application of science within the enterprise (especially in the context of a school-based mini-enterprise)

7.9 Avoidance of Bias

OCR has taken great care in preparation of these specifications and assessment materials to avoid bias of any kind.

7.10 Language

These specifications and associated assessment materials are in English only.

7.11 Support and Resources

Support is available from the OCR GCSE science website www.gcse-science.com where centres should register their intention to offer this qualification. Registering on this site provides access to a teachers' forum and local support networks.

Appendix A: Grade Descriptions

Grade F

Candidates demonstrate a limited knowledge and understanding of science content and how science works. They use a limited range of the concepts, techniques and facts from the specification, and demonstrate basic communication and numerical skills, with some limited use of technical terms and techniques.

They show some awareness of how scientific information is collected and that science can explain many phenomena.

They use and apply their knowledge and understanding of simple principles and concepts in some specific contexts. With help they plan a scientific task, such as a practical procedure, testing an idea, answering a question, or solving a problem, using a limited range of information in an uncritical manner. They are aware that decisions have to be made about uses of science and technology and, in simple situations familiar to them, identify some of those responsible for the decisions. They describe some benefits and drawbacks of scientific developments with which they are familiar and issues related to these.

They follow simple instructions for carrying out a practical task and work safely as they do so.

Candidates identify simple patterns in data they gather from first-hand and secondary sources. They present evidence as simple tables, charts and graphs, and draw simple conclusions consistent with the evidence they have collected.

Grade C

Candidates demonstrate a good overall knowledge and understanding of science content and how science works, and of the concepts, techniques, and facts across most of the specification. They demonstrate knowledge of technical vocabulary and techniques, and use these appropriately. They demonstrate communication and numerical skills appropriate to most situations.

They demonstrate an awareness of how scientific evidence is collected and are aware that scientific knowledge and theories can be changed by new evidence.

Candidates use and apply scientific knowledge and understanding in some general situations. They use this knowledge, together with information from other sources, to help plan a scientific task, such as a practical procedure, testing an idea, answering a question, or solving a problem.

They describe how, and why, decisions about uses of science are made in some familiar contexts. They demonstrate good understanding of the benefits and risks of scientific advances, and identify ethical issues related to these.

They carry out practical tasks safely and competently, using equipment appropriately and making relevant observations, appropriate to the task. They use appropriate methods for collecting first-hand and secondary data, interpret the data appropriately, and undertake some evaluation of their methods.

Candidates present data in ways appropriate to the context. They draw conclusions consistent with the evidence they have collected and evaluate how strongly their evidence supports these conclusions.

Grade A

Candidates demonstrate a detailed knowledge and understanding of science content and how science works, encompassing the principal concepts, techniques, and facts across all areas of the specification. They use technical vocabulary and techniques with fluency, clearly demonstrating communication and numerical skills appropriate to a range of situations.

They demonstrate a good understanding of the relationships between data, evidence and scientific explanations and theories. They are aware of areas of uncertainty in scientific knowledge and explain how scientific theories can be changed by new evidence.

Candidates use and apply their knowledge and understanding in a range of tasks and situations. They use this knowledge, together with information from other sources, effectively in planning a scientific task, such as a practical procedure, testing an idea, answering a question, or solving a problem.

Candidates describe how, and why, decisions about uses of science are made in contexts familiar to them, and apply this knowledge to unfamiliar situations. They demonstrate good understanding of the benefits and risks of scientific advances, and identify ethical issues related to these.

They choose appropriate methods for collecting first-hand and secondary data, interpret and question data skilfully, and evaluate the methods they use. They carry out a range of practical tasks safely and skilfully, selecting and using equipment appropriately to make relevant and precise observations.

Candidates select a method of presenting data appropriate to the task. They draw and justify conclusions consistent with the evidence they have collected and suggest improvements to the methods used that would enable them to collect more valid and reliable evidence.

Appendix B: Requirements Relating to Mathematics

During the course of study for this specification, many opportunities will arise for quantitative work, including appropriate calculations. The mathematical requirements which form part of the specification are listed below. Items in the first table may be examined in written papers covering both Tiers. Items in the second table may be examined only in written papers covering the Higher Tier.

Both Tiers

add, subtract, multiply and divide whole numbers

recognise and use expressions in decimal form

make approximations and estimates to obtain reasonable answers

use simple formulae expressed in words

understand and use averages

read, interpret, and draw simple inferences from tables and statistical diagrams

find fractions or percentages of quantities

construct and interpret pie-charts

calculate with fractions, decimals, percentage or ratio

solve simple equations

substitute numbers in simple equations

interpret and use graphs

plot graphs from data provided, given the axes and scales

choose by simple inspection and then draw the best smooth curve through a set of points on a graph

Higher Tier only

recognise and use expressions in standard form

manipulate equations

select appropriate axes and scales for graph plotting

determine the intercept of a linear graph

understand and use inverse proportion

calculate the gradient of a graph

Statistical methods e.g. cumulative frequency, box plots, histograms

Appendix C: Physical Quantities and Units

It is expected that candidates will show an understanding of the physical quantities and corresponding SI units listed below and will be able to use them in quantitative work and calculations. Whenever they are required for such questions, units will be provided and, where necessary, explained.

Fundamental physical quantities

Fundamental Physical Quantities	
Physical quantity	Unit(s)
length	metre (m); kilometre (km); centimetre (cm); millimetre (mm)
mass	kilogram (kg); gram (g); milligram (mg)
time	second (s); millisecond (ms) year (a); million years (Ma); billion years (Ga)
temperature	degree Celsius ($^{\circ}\text{C}$)
current	ampere (A); milliampere (mA)

Derived Quantities and Units	
Physical quantity	Unit(s)
area	cm^2 ; m^2
volume	cm^3 ; dm^3 ; m^3 ; litre (l); millilitre (ml)
density	kg/m^3 ; g/cm^3
force	newton (N)
speed, velocity	m/s; km/h
energy	joule (J) ; kilojoule (kJ); megajoule (MJ)
radioactivity	Becquerel (Bq)
radiation dose	Sievert (Sv)

Appendix D: Health and Safety

In UK law, health and safety is the responsibility of the employer. For most centres entering candidates for GCSE examinations this is likely to be the Local Education Authority or the Governing Body. Teachers have a duty to co-operate with their employer on health and safety matters. Various regulations, but especially the COSHH Regulations 1996 and the Management of Health and Safety at Work Regulations 1992, require that before any activity involving a hazardous procedure or harmful microorganisms is carried out, or hazardous chemicals are used or made, the employer must provide a risk assessment.

A useful summary of the requirements for risk assessment in school or college science can be found in Chapter 4 of Safety in Science Education. For members, the CLEAPSS guide, Managing Risk Assessment in Science offers detailed advice.

Most education employers have adopted a range of nationally available publications as the basis for their Model Risk Assessments. Those commonly used include:

- Safety in Science Education, DfEE, 1996, HMSO, ISBN 0 11 270915 X;
- Topics in Safety 3rd edition, 2001, ASE ISBN 0 86357 316 9;
- Safeguards in the School Laboratory, 10th edition, 1996, ASE ISBN 0 86357 250 2;
- Hazcards, 1995 with 2004 updates, CLEAPSS School Science Service*;
- CLEAPSS Laboratory Handbook, 1997 with 2004 update, CLEAPSS School Science Service*;
- CLEAPSS Shorter Handbook (CLEAPSS 2000) CLEAPSS School Science Service*;
- Hazardous Chemicals, A manual for Science Education, (SSERC, 1997) ISBN 0 9531776 0 2.

*Note that CLEAPSS publications are only available to members or associates.

Where an employer has adopted these or other publications as the basis of their model risk assessments, an individual centre then has to review them, to see if there is a need to modify or adapt them in some way to suit the particular conditions of the establishment. Such adaptations might include a reduced scale of working, deciding that the fume cupboard provision was inadequate or the skills of the candidates were insufficient to attempt particular activities safely.

The significant findings of such risk assessment should then be recorded, for example on schemes of work, published teachers guides, work sheets, etc.

There is no specific legal requirement that detailed risk assessment forms should be completed, although a few employers require this.

When candidates are planning their own investigative work the teacher has a duty to check the plans before the practical work starts and to monitor the activity as it proceeds.

Appendix E: Explanation of Terms Used in this Specification

In the specification learning outcomes are prefixed by '*Candidates should be able to demonstrate*' which is followed by statement prefixed by the words, 'knowledge' or 'understanding'.

This appendix, which is not intended to be exhaustive or prescriptive, provides some guidance about how these statements may be interpreted in the computer-based tests, and the use of 'command' words in questions.

It must be stressed that the use of a command word depends on the context in which it is set, and consequently it is not possible to provide precise definitions of these words which can be rigidly applied in all circumstances. Nevertheless, it is hoped that this general guidance will be of use in helping to interpret both the specification content and the assessment of this content in written papers.

Command words associated with scientific knowledge and understanding (AO1)

Candidates are expected to remember the facts, concepts, laws and principles which they have been taught. Command words in this category include:

State...; Recognise...; Name...; Draw...; Describe...; List...; Give...; Write...; What?...; How?...; What is meant by...?

e.g. '*What is meant by the term 'GM' ?*'

 '*Name parts A, B and C on the diagram.*'

Command words associated with interpretation, evaluation, calculation and communication (AO2)

The command words include:

Explain...; Discuss...; Suggest...; Calculate...; Why...? Complete...; Work out...; How would you know that...?

The use of these words involves the ability to recall the appropriate material from the specification content and to apply this knowledge and understanding.

e.g. '*Use the graph to calculate the concentration of the fertiliser.*'

 '*Explain why it is important for these materials to be recycled.*'

 '*Suggest two reasons why some people are concerned about the use of pesticides on foods.*'

Appendix F: Centre Audit for Running Computer-Based Tests

Please use this information to ensure that the centre has the technical capability to administer the computer-based tests required for this specification. **Please note it is the responsibility of the Head of Centre to ensure that the centre is appropriately equipped to administer the tests in terms of system requirements and venue requirements.** The Examinations Officer within the centre is responsible for the conduct of the computer-based tests within the bounds of the Instructions for the Conduct of Examinations issued by the Joint Council for Qualifications.

If there are any difficulties in completing the audit, please contact general.qualifications@ocr.org.uk.

Requirements for OCR Computer-based Tests for General Qualifications

What is needed to run OCR General Qualifications using the Cambridge Assessment Connect System?

- *Ensure that the Head of Centre, Examinations Officer, Systems Manager/Technician and subject teacher are clear about what is involved.*
- *Check that the centre can meet the technical and venue requirements.*

Before starting teaching the specification – planning and approval

1. Agree who is to be the Test Administrator, responsible for making sure that the tests are conducted properly. The Examinations Officer may fulfil this role or may delegate it to a colleague.
2. Complete the Connect Centre Audit check list. This checks that the centre is able to meet the technical eligibility requirements. The school or college Systems Manager/Technician must be part of this process.
3. The Connect Installation software and a copy of the Connect Technical Guide should be downloaded from the OCR website. This should be done by the member of staff responsible for the Centre Network. This person is referred to in this document as the Technician but may have a different title within the centre. Entries for Computer-based Tests can only be made if the centre has installed the Connect software.

Before entries are made for a Computer-based Test – setting up

1. The Technician installs the Connect Control software on a workstation in the room where the examination will take place (the test room); this workstation will be used to administer the test.
2. The Technician installs the Connect Station software on **one** candidate workstation in the test room.
3. The Technician runs a diagnostic test to check that the programs are running correctly and communicating properly with each other and the outside world.

4. The Technician then installs the Connect Station software on all the machines to be used in the test room.
5. The Test Administrator runs a dummy test, which models the steps involved in running a real test, to ensure that the Test Administrator is confident of the procedure.
6. Entries are made following the usual procedure, ahead of the entries deadline.

At least one month before the test date

The subject teacher and Test Administrator run a practice test for candidates so that they are familiar with the format and look of Computer-based Tests.

48 Hours before the test

1. The Test Administrator downloads the test material 48 hours before the day of the test.
2. The Test Administrator checks the mouse, keyboard, screen and headphones (if required) on each candidate workstation.

On the day of the test

1. The Test Administrator uses the Connect Control software to run the tests.
2. The Test Administrator uploads candidates' responses back to OCR.

CENTRE CHECKLIST FOR RUNNING COMPUTER-BASED TESTS

Technical Requirements
Minimum Requirements for each Candidate Computer
Pentium II 400Mhz, Pentium III 800Mhz (recommended) or above workstation hardware
128MB RAM (256 MB recommended)
At least 250Mb of available hard disk space
Windows XP/2000/2003
Internet Explorer 5 (or above)
High colour 32 bit display or better
A screen resolution of 800x600 or higher
Mouse
Soundcard and headphones for candidates requiring a reader or taking a test involving sound
Protocols supported: TCP/IP
Flash Player version 8 installed on each workstation
Minimum Requirements for Test Administrator Computer
Pentium IV, 800Mhz (or equivalent/better)
512MB RAM
At least 1.5Gb of available hard disk space
Windows XP/2000/2003 (2000 & XP)
Internet connection at a minimum speed of 56kbps
Adobe Acrobat reader installed
PC/Network Administration rights for installation
Connection to a printer
Minimum Requirements for the Network
A 32 bit network server installed with a supported server operating system; Windows 2000 Server or Windows 2003 Server
Minimum 100 mbps network speed
If redundant storage is to be used then a minimum of 1Gb per test should be allocated on the networked disk space
If auto-discovery of the Candidate Workstations is to be used as opposed to manual configuration of each workstation then a network that supports Multicasting must be used.
Technical Support Personnel
Appropriate technical support personnel who will be available during all OCR CBT live sessions.

Administration Requirements
Workstation Requirements
Capacity for a minimum of seven candidates (8 PCs)
A spare capacity of one workstation for every seven
1 workstation within the same room as the candidate workstations to run Connect Control
Test Room Requirements
A quiet room or rooms, free from distractions and interruptions
A room or rooms and equipment dedicated to the test during the session
Good lighting, without disruptive glare on screens
Proper ventilation and heating (where necessary)
Walls free from display material
Appropriate furnishing to give candidates maximum comfort
Adjustable chairs
Adequate space at each workstation to allow candidates to take notes
Secure workstations. Seating arrangements should prevent candidates from being able to see a fellow candidate's screen. The minimum distance between the outer edge of one screen and the next should be 1.25 metres, unless the monitors are positioned back to back or separated by dividers high enough to prevent other candidates from overlooking the work of others. In this case, the minimum distance need not apply. However, if the screens are diagonally opposite and not separated by dividers, 1.25 metres may not be sufficient. The principal objective is to ensure that no candidate's work can be overseen by others, and Examinations Officers must take appropriate steps to ensure that this can be achieved.
A clock or clocks in the room visible to all candidates, or the provision of alternative arrangements
A means of summoning assistance (e.g. phone) and support contact details available in the test room for emergencies
Disabled access to the test room and to workstations, or the provision of alternative arrangements, e.g. a ground floor room.
Facilities for registration and ID checking
Requirements Outside the Test Room
None
Administrative Personnel
An Examinations Officer who will be available during all OCR CBT live sessions.
A minimum of one invigilator per room for each session. If there are more than 25 candidates in a room, there should be a further ratio of 1 invigilator to every 25 candidates.
The Examinations Officer and invigilator must be familiar with the emergency procedures for the test venue.

OCR computer-based tests will normally be administered at the centre, providing the centre has a venue which meets the following technical criteria, **or can be run at an external test venue** where authorisation has been given by OCR, for example where a candidate is in hospital on the day of the examination. An external test venue may be an appropriate multimedia room at a school or college or other venue suitable for computer-based testing but must meet the same technical criteria. The venue must have technical support personnel who will be available for during all OCR Computer-based Tests live sessions.

Appendix G: Guidance for the Production of Electronic Coursework

The coursework assessment in Unit B496 comprises three elements. For each candidate, the three elements together form a coursework portfolio, stored electronically.

Structure for evidence

A coursework portfolio is a collection of folders and files containing the candidate's evidence. Folders should be organised in a structured way so that the evidence can be accessed easily by a teacher or moderator. This structure is commonly known as a folder tree. It would be helpful if the location of particular evidence is made clear by naming each file and folder appropriately and by use of an index, called 'Home Page.'

There should be a top level folder detailing the candidate's centre number, candidate number, surname and forename, together with the Unit code B496, so that the portfolio is clearly identified as the work of one candidate.

Each candidate produces evidence for the three coursework elements; practical skills, work-related report and investigative project. The evidence for each element should be contained within a separate folder within the portfolio. Each of these folders is likely to contain separate files.

Each candidate's coursework portfolio should be stored in a secure area on the centre network. Prior to submitting the coursework portfolio to OCR, the centre should add a folder to the folder tree containing coursework assessment and summary forms.

Data formats for evidence

In order to minimise software and hardware compatibility issues it will be necessary to save candidates' work using an appropriate file format. (Further information on this topic is provided in the separate OCR guidance on digital coursework submissions).

Candidates must use formats appropriate to the evidence that they are providing and appropriate to viewing for assessment and moderation. Open file formats or proprietary formats for which a downloadable reader or player is available are acceptable. Where this is not available, the file format is not acceptable.

Electronic coursework is designed to give candidates an opportunity to demonstrate what they know, understand and can do using current technology. Candidates do not gain marks for using more sophisticated formats or for using a range of formats. A candidate who chooses to use only digital photographs (as required by the specification) and word documents will not be disadvantaged by that choice.

Evidence submitted is likely to be in the form of word processed documents, PowerPoint presentations, digital photos and digital video.

To ensure compatibility, all files submitted must be in the formats listed below. Word processed documents or PowerPoint presentations must be converted to HTML or PDF formats before submission. OCR will not accept compressed (zipped) file formats. Where new formats become available that might be acceptable, OCR will provide further guidance.

It is the centre's responsibility to ensure that the electronic portfolios submitted for moderation are accessible to the moderator and fully represent the evidence available for each candidate.

Accepted File Formats

Movie formats for digital video evidence

MPEG (*.mpg)

QuickTime movie (*.mov)

Macromedia Shockwave (*.aam)

Macromedia Shockwave (*.dcr)

Flash (*.swf)

Windows Media File (*.wmf)

MPEG Video Layer 4 (*.mp4)

Audio or sound formats

MPEG Audio Layer 3 (*.mp3)

Graphics formats including photographic evidence

JPEG (*.jpg)

Graphics file (*.pcx)

MS bitmap (*.bmp)

GIF images (*.gif)

Animation formats

Macromedia Flash (*.fla)

Structured markup formats

HTML (*.html, *.htm)

XML (*.xml)

CSS (*.css)

XSL (*.xsl/*.xslt)

Text formats

PDF (.pdf)

Please consult OCR guidance on digital coursework submissions for advice on compatibility of versions of these file formats.

