Oxford Cambridge and RSA Examinations

ADVANCED GCE A2 7885

ADVANCED SUBSIDIARY GCE AS 3885

SCIENCE

COMBINED MARK SCHEME AND REPORT FOR THE UNITS

JANUARY 2005

AS/A2

3885/7885/MS/R/05J

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Annersley
NOTTINGHAM
NG15 0DL

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Facsimile: 0870 870 6621
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RECOGNISING ACHIEVEMENT

Mark Scheme 2841
January 2005

Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT= answers which are not worthy of credit ( ) = words which are not essential to gain credit __ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument

Question	Expected Answers	Marks
1 (a) (i)	primary consumer / herbivore;	1
(ii)	secondary consumer / carnivore;	1
(b)	water is needed in photosynthesis; to provide nutrients from soil; needed to keep cells turgid; to prevent wilting / water stress; water contained in cell sap / vacuole / cytoplasm; to transport compounds / glucose / sucrose round plant / in solution; (2 points from above list)	2
(c)	temperature / sunlight / light intensity / nutrient availability; (or other acceptable answer)	1
(d)	in a tropical forest, there are more sunlight; hours over a year; ORA **AW** in winter in tropical forest; there are more hours of daylight; ; ORA **AW** tropical forest is nearer equator; therefore there is greater light intensity; **AW** in tropical forest plants are adapted; to make better use of available water; **AW** in tropical forest nutrient cycling; is more efficient; **AW** in tropical forest, temperature; is higher;	2
(e)	(a set of) ecosystems; with similar climate conditions; **AW** large region / area of Earth's surface; dominated by particular ecosystem / other example of biome ;	2
	[Total: 9]	

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Question	**Expected Answers**	**Marks**
2 (a)	correct labels and approximate sizes of segments;	1
(b)	chemical energy in compounds / molecules / bonds / dry organic matter / biomass; fats / lipids / glycogen / starch / carbohydrates / polysaccharides / sugars / example of sugar; (accept protein)	2
(c)	respiration;	1
(d) (i)	energy is required for life / essential processes / example of process; to maintain an internal balance / steady state; shortfall / excess leads to illness / example of illness / death; (2 points from list above)	2
(ii)	more energy is used for movement; but the monkey does not have to travel / move as far; to and from a nest / to and from the young; no energy is used to build / maintain a nest; (2 points from the above list) **AW** young are protected; reducing the energy used for reproduction;	2
(e) (i)	labels: emergent layer, canopy, sub-canopy, forest floor. 2 correct (1 mark); other 2 correct (1 mark);	2
(ii)	macaque is able to swing from tree to tree / grip branches / not fall out of trees / climb better / reach better;	1
	[Total: 11]	

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Question	**Expected Answers**	**Marks**
3 a (i)	weathering / fixation / rainfall / lightning / fertilizer;	1
(ii)	leaching / denitrification / erosion;	1
(iii)	decay / decomposition / death / composting;	1
(iv)	atmosphere / ocean / river / stream / animals / consumers herbivores / carnivores / rocks; (or other acceptable example of these)	1
(b) (i)	inputs and outputs; are equal; **AW** quantities in reservoirs; remain constant;	2
(ii)	negative; feedback;	2
(c) (i)	input is into reservoir 2 / this is an additional input; uptake (from reservoirs) is not required; **AW** nutrient enters plant directly / through leaves; not through roots / from soil	2
(ii)	wheat / bread contains less selenium; because prairie soil is richer in selenium / has higher level of selenium / European soils are poorer in selenium / have lower levels of selenium / uptake is greater from prairie soil / uptake is less from European soil / European soils contain more organic matter / N American soils contain less organic matter;	2
	[Total: 12]	

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Question	Expected Answers	Marks
4 (a)	individuals; that are better adapted to their environment; have a greater chance of survival; and passing on characteristics; to offspring / by reproduction; (3 points from above list)	3
(b)	(good) night vision / being able to see in the dark; strength; (1 mark only for description of behaviour)	2
(c)	a (defined) region / area in which an organism lives; within an ecosystem; and how it is used; (2 points from above list) **AW** the (relevant) physical / abiotic / non-living factors and biotic / living factors; in an organism's environment; (1 mark max for example(s) of physical factors)	2
(d)	cheetahs;	1
(e) (i)	use of three figures 1200, 8 and 24; (1200 x 8 x 24) = 200 000 / 230 000 / 230 400 kJ (per day); ecf if three figures not used	2
(ii)	pride requires 920 000 kJ over 4 days ; 5 days requires more energy than pride has got / they run out of energy on 5th day; some of the energy will be required for hunting next prey; (2 points from above list)	2
	[Total: 12]	

5 (a)	joining (together); of two <u>nuclei</u>; to produce a heavier nucleus / greater mass nucleus / to release energy; (2 points from above list)	2
(b)	nuclei consist of protons and neutrons; total number of protons & neutrons is called mass number / nucleon number / given symbol A; total number of protons is called atomic number / proton number / given symbol Z; atoms of different elements have different atomic numbers / atoms of same element have same atomic number ; example of structures of two different nuclei; isotopes are atoms of same element with different mass numbers; a nucleus occupies a very small part / volume of an atom; at the centre / surrounded by electrons; a nucleus contains almost all the mass of an atom; has a positive charge; hydrogen atom has no neutrons; increasing numbers of protons and neutrons corresponds (mostly) to increased binding energy; unstable nuclei decay radioactively; (6 points max from above list)	6
	QWC **legibility & grammar** 2 marks **A** text is clearly legible **and** **B** spelling, punctuation, grammar are accurate throughout; 1 mark **A** text is untidy but can be read without difficulty **and** **B** spelling, punctuation, grammar show some mistakes; 0 mark **A** text is difficult to read; **and** **B** sp, punct, gram show high proportion of mistakes; (Candidates must satisfy both strands A and B to gain the marks at a particular level. Otherwise the marks for a lower level should be awarded.) (2 marks max)	2
(c) (i)	radiowaves;	1
(ii)	$c = \lambda f$; c is a constant / λf is a constant; **AW** <u>There is inverse proportionality;</u> between λ and f ;	2
(iii)	mega / million / 10^6 / 1 000 000;	1
(iv)	2.2235; x 10^{10}; [Total: 16]	2

Mark Scheme 2842
January 2005

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Question	Expected Answers	Marks
1 (a)	Evaporation; Transpiration; Volcanic activity; AVP	2
(b) (i)	Air is heated (strongly) at the equator; AW air converges at the equator;	1
(ii)	Air cools as it rises;	1
(iii)	Molecules become closer together; Bonds form between molecules ; (heat) energy is released when bonds formed; **(any 2 points**)	2
(c)	Climate may become warmer; Climate may become drier;	2
(d)	Acid deposition / acid rain/ presence of acidic oxides; Causes damage to leaves; AW toxic aluminium released into soil; nutrients leached out of soil; AW tropospheric ozone level increases; Causes damage to leaves; AVP	2 TOTAL : 10

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Question	Expected Answers	Marks
2 (a) (i)	Molecule: several atoms bonded together ; Radical: (a particle) which contains odd number of electrons / unpaired electron(s); Gives example of both: molecule CH_3Br (AW CH_3•) radical CH_3•, Br•;	3
(ii)	sunlight provides the energy to break bonds / provides energy to overcome activation energy barrier;	1
(b) (i)	Speeds up the rate of a chemical reaction; Without being used up / left unchanged at end; Reduces activation energy; Provides alternative mechanism for a reaction; (any 2 points)	2
(ii)	Ozone absorbs (harmful) ultra-violet radiation	1
(c) (i)	Wave-form drawn / reference to a periodic vibration; Electric and magnetic fields shown vibrating at right angles to each other (or referred to in words);	2
(ii)	Rotation; Translation / movement in a straight line / movement of the whole molecule AW ordered kinetic energy;	2
(iii)	Fruit contains water ; The water will heat up;	2
		TOTAL: 13

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Question	Expected Answers	Marks
3 (a)	From chemical (energy); To (gravitational) potential (energy) AW (total) mechanical energy Ignore additional references to kinetic energy in either answer	2
(b)	2000 m; (1 mark working: distance = work / force)	2
(c) (i)	Close to the poles; The field lines are closest together;	2
(ii)	A flow / movement of charge / charged particles / electrons;	1
(d) (i)	Answer = 8×10^{-2} / 0.08 (1 mark working: calculates current^2 =0.0004); W;	3
(ii)	Aluminium + explanation of need for compromise values of resistivity and density; awareness of need for low resistivity in terms of reducing power loss; awareness of need for low density in terms of weight / energy required to get satellite into orbit;;	2 TOTAL: 12

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Question	Expected Answers	Marks
4 (a) (i)	H^+ / H_3O^+;	1
(ii)	Strong acid gives up H^+ ions easily / completely dissociates/ ionises; Weak acid gives up H^+ ions with difficulty / incompletely dissociates / incompletely ionises; AW idea of dissociation ; comparison of ease of dissolciation	2
(b) (i)	Sulphur dioxide / Sulphur oxides/ SO_x / SO_2; Nitrogen dioxide / Nitrogen oxide / NO_x / NO_2 / NO AW sulphur dioxide and sulphur trioxide / nitrogen dioxide and nitrogen monoxide etc.	2
(ii)	Sulphur dioxide: combustion / burning of fossil fuels; Containing sulphur (impurities); AW smelting of ores; Containing sulphur; Nitrogen oxides: reaction of nitrogen and oxygen <u>from air</u>; In car engines / refers to conditions in car engines e.g. high pressure, presence of spark; AW combustion of fossil fuels Containing nitrogen <u>compounds / proteins</u>	2
(c)	Ionic solid: ions are arranged in a regular structure / lattice / bonded to each other / close together Ionic solution: ions are separated / water molecules bonded to ions / arranged randomly / further apart / not bonded to each other AW names property ; explains how the property differs	2
(d)	*Temperature:* <u>Increasing</u> temperature increases rate of reaction ora; Particles have more energy; More frequent collisions / more chance of collision if not mentioned in discussion of concentration; Greater number have energy greater than activation energy Hence can cause bonds to break / result in successful collisions	

	Concentration: Increasing concentration (normally) increases rate of reaction ora; Pattern is described by rate equation Examples of rate equations / different orders Increasing concentration increases rate of collisions / chance of collisions if not mentioned in discussion of temperature ; Because particles are closer together; Rate equation depends on substances present in rate determining step 4 max for each factor QWC: Legibility and grammar 2 marks: A: Text is clearly legible **and** B: Spelling, punctuation and grammar are accurate throughout 1 mark: A: Text is untidy but can be read without difficulty **and** B: Spelling, punctuation and grammar shows some mistakes 0 marks: A: text is difficult to read **and** B: spelling punctuation and grammar show a high proportion of mistakes	6 2 TOTAL: 17

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Question	**Expected Answers**	**Marks**
5 (a)	Proteins; Amino acids; Primary structure; Tertiary structure; Active site; Substrates;	6
(b)	Extraction of metals; Producing sweet syrup; Desizing / biostoning / stonewashing jeans; Tanning leather AVP; NOT production of bread, beer, cheese NOT washing powders	1
(c)	Enzymes operate at <u>lower temperatures</u> hence less fuel / energy used / safer; Fewer waste products produced;	1
		TOTAL: 8 MARKS

RECOGNISING ACHIEVEMENT

Mark Scheme 2844
January 2005

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Question 1	**Expected Answers**	**Marks**
(a)	Phosphates; nitrates; ammonia; NOT nitrogen phosphorous	2
(b) (i)	Excess nutrient; excess growth of plants / excess growth of algae;	2
(b)(ii)	Blocks sunlight; Plants die; Bacteria / detritvores feed on dead plants; Use up all the oxygen / too much competition for oxygen;	3
(c)	Light; pH; temperature; turbidity of water; velocity of water; Any 2 abiotic factors NOT availability of nutrients / just climate	2
(d) (i)	Runoff from farmland / leaching/washed out of soil by rain	1
(d) (ii)	Use less / Only use the minimum amount / don't put on when it is likely to rain /use organic instead / strip of unused land / physical barrier	1
		Total: 11

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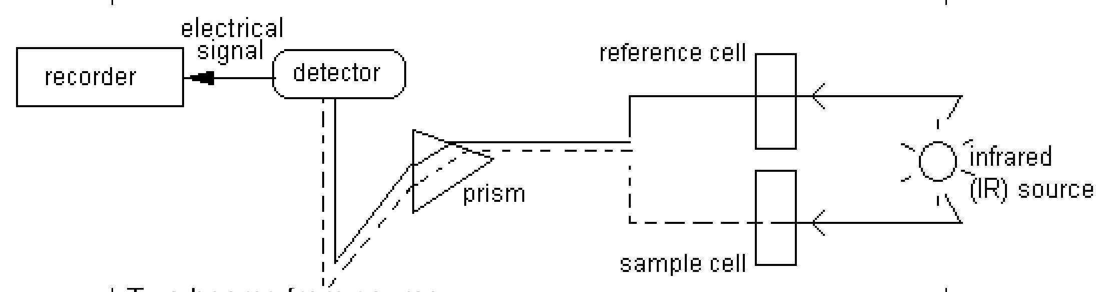
Question 2	Expected Answers	**Marks**
(a)	Distilled water / pure / clean water/ water without peticide	**1**
(b)	Change in vibration; Vibrate with more energy / higher amplitude; Of groups of atoms/ bond in the molecules; Mention of bending/stretching etc;	**3**
(c)		



	Two beams from source; Light from infrared source going through reference cell; and sample cell; IR beams converging; Going through prism / grating; Then to detector; Electrical signal; To recorder; Any 4 points in diagram – labelled correctly	 **4** **Total 8**

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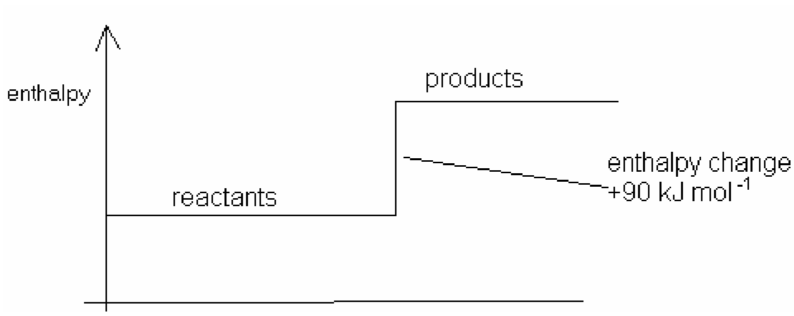
Question 3	Expected Answers	**Marks**
(a)	transferred to thermal /decreases	**1**
(b) (i)	Stays the same / constant	**1**
(ii)	 H / enthalpy axis marked; reactants lower than products; step labelled with positive enthalpy change/ vertically upwards arrow used if enthalpy value not given + sign.	**3**
(b (iii))	Endothermic; bonds are broken and formed; more broken than formed/ stronger bonds broken than formed/ energy needed to break bonds in reactant more than energy released by forming in product	**3**
(c) (i)	Breaking up of lattice; Hydration of ions; Loss of hydrogen bonding between water molecules; 2 points from 3	**2**
(c ii)	Breaking of lattice endothermic; Hydration of ions exothermic; hydration of ions greater; 2 from 3	**2** **Total: 12**

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Question 4	Expected Answers	**Marks**
(a)	Greater yield of grain; Greater disease resistance; Better drought resistance; Longer shelf life; Any two sensible answers	**2**
(b)	Pollen from one variety (which has good characteristics); Placed on stigma of plant with other good characteristics; Select for plants with both properties; Grow and continue to select;	**3**
(c)	Desirable genes found in wild plants; Can combine with domestic varieties to produce new varieties; Increase in hybrid vigour / reduction in inbreeding depression	**2**
(d)	Deep / large root systems; Leaf rolling; Leaf firing; store water in stem; small / waxy leaves; sunken stomata ; shedding of leaves ; leaf hairs; two from above	**2**
(e)	Light of certain frequencies; Absorbed by chlorophyll in leaves; Emits high energy electrons; Some used for synthesis of ATP; Some used for Water break down; To hydrogen ions and oxygen; Oxygen released; Hydrogen ions used to reduce NADP Energy stored as chemical energy; 3 from above	**3**
(f)	Palisade mesophyll cells / palisade /mesophyll	**1**
(g)	In Light independent stage; Reaction between CO_2 and ribulose bisphosphate; Catalysed by RuBisCo; RuBisCo can also bind to O_2; In high light intensity p/s rate high, lots ofO_2; O_2 inhibits the enzyme by competing with CO_2; Results in loss of CO_2 from plant; And less RUBp for glucose synthesis 3 points	**3**

(h)	By keeping RuBP and Rubisco separate; In bundle sheath cells; CO_2 converted to malate / malic acid; Malic acid goes to bundle sheath cells; Where oxygen is not present; Reversible reaction occurs; CO_2 liberated from Malic acid; Delivered to RuBP 3 from above	**3** **Total: 19**

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Question5	**Expected Answers**	**Marks**
(a)	**Gamete** Sex cell / egg and sperm cells; which contains haploid number of chromosomes /1n / half the number of chromosomes of body cell; (2 marks) **Homologous pair** – 2 chromosomes of that carry same genes / genetically identical ;matched chromosomes one from each parent (1 mark) **Independent assortment** homologous pairs are randomly assigned to different cells / gametes; (1 Mark)	4
(b) (i)	Pairs of homologous chromosomes / 4 chromatids pair up; Chromosomes of homologous chromosomes break; Sections of DNA exchanged; Called crossing over	2
(b) (ii)	Increases variation; as all 4 chromatids can have different combinations of genes;	2
(c)	No variation therefore all susceptible to same disease / problems / less desirable characteristics maintained	1 Total: 9

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Question6	Expected Answers	**Marks**
(a) (i)	***Famine*** Varieties that are drought tolerant can be grown in previously unsuitable areas; Better yield in adverse conditions;	**2**
(a) (ii)	***Nutritional value*** Genes for more starch / vitamins (any relevant nutrient) can be engineered into varieties;	**1**
(a) (iii)	***Pesticides*** Genes for natural pest resistance can be engineered into varieties No need for (artificial) pesticides	**2**
(b)	Example such as gene for herbicide resistance getting into weed ; creates superweed ;uncontrolled spread of genetic material or Or Health / ethical hazard with example	**2**
(c)	**Restriction enzymes** (genetic scissors) used to cut gene from host DNA; At specific sites; Same restriction enzyme used to cut plasmid; Sticky ends are the same ; **bacterial plasmids** circle of DNA in bacteria; cut with restriction enzyme; used as vector for transferring gene into another organism **DNA ligase** joins up passenger DNA and vector / joining sticky ends; To make recombinant DNA; Maximum 3 points for each – 6 in all	**6** **Total: 13**

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Question	Expected Answers	**Marks**
7 (a)	Double helix; composed of nucleotides; 2 strands running in opposite directions; sugar phosphate backbone; bases protrude into middle of helix bases pair; by hydrogen bonding; AT (or adenine thymine); GC (or Guanine cytosine; Each strand mirror image of other; Strands can come apart; free nucleotides pair with unzipped chain base pairing can form complementary strand; Semi-conservative replication;	**7**

QWC	**organization & vocabulary** 2 marks **A** answer is clearly and coherently organized throughout **and** **B** appropriate specialist vocabulary is used extensively; 1 mark **A** answer shows a degree of organization **and** **B** some appropriate use of specialist vocabulary is made; 0 mark **A** answer is not organized **and** **B** appropriate specialist vocabulary is not used; **legibility & grammar** 2 marks **A** text is clearly legible **and** **B** spelling, punctuation, grammar are accurate throughout; 1 mark **A** text is untidy but can be read without difficulty **and** **B** spelling, punctuation, grammar show some mistakes; 0 mark **A** text is difficult to read; **and** **B** spelling, punctuation, grammar show extensive mistakes; (Candidates must satisfy both strands A and B to gain the marks at a particular level. Otherwise the marks for a lower level should be awarded.)	**4**
(b)	Single strand; U instead of T	**2**
(c)	4 bases in DNA arranged in triplet code; DNA transcribed into mRNA MRNA goes to ribosome; TRNA brings amino acids; Triplet codes of mRNA (codons) complimentary to triplets of tRNA (anticodons); Peptide bonds formed at ribosome; Polypeptide chain grows; Any 5 from above	**5** **Total: 18**

REPORT ON THE UNITS
January 2005

Chief Examiner's Report

Introduction

Three units were examined this session: 2841, 2842 and 2844. The candidate entries, and the performances on the papers, were similar to other January sessions. The entry for 2842 was, as always in January, very small. In such a situation it is not possible for the Principal Examiner to report on the examination without the risk of Centres recognising themselves or their candidates. It has, therefore, been decided not to write a report on 2842 for this session.

Unit 2841 Science and the Natural Environment

General comments

The entry for this unit was slightly higher than in other January sessions. There was a range of ability, and the paper discriminated well across this range. As in previous January sessions, there was a pleasing number of well-answered, high-scoring scripts. No candidate appeared to have been short of time. All questions were attempted in a serious manner by all candidates.

Attention has been drawn before to the fact that candidates find questions on physical science topics more demanding than those on biological science topics. This was again the case. Thus, it was Q5 that provided the clearest pointer to the higher grade candidates.

Comments on individual questions

Q1

The early parts of this question were intended to be very straightforward; later parts were more testing. Few candidates experienced problems with (a) or (c). However, quite a lot of candidates failed to give two reasons, as asked for, in (b). There were some perceptive answers to (d). In addition to the more obvious explanations in terms of differences in levels of sunlight between the two forests, a number of candidates correctly suggested that trees in a tropical forest are better adapted than those in a temperate forest, to make use of available rainfall. The commonest error in this part was to state that 'there are more hours of sunlight in a tropical forest'. While this is true over the course of a year, it is also true that day lengths (and therefore hours of sunlight) are longer in a temperate forest in summer. This needed to be made clear to gain the second mark in an answer. Some candidates failed to notice that both forests were deciduous. Their answers then explained why a tropical evergreen forest has a greater productivity than a temperate deciduous forest. This would have been a different, and easier, question. The term *biome*, referred to in (e), can be hard to comprehend. This is one point where the experience of this session could be used by Centres to help candidates in the future.

Q2

This was the most straightforward question on the paper. In (a), on the whole, pie charts were accurately sketched. The question in (b) has been set before. Centres have taken note of the points that are expected. Many candidates gave a full and correct answer. Most candidates showed some understanding of the topic of energy balance and its application to the behaviour of the macaque in (d). Part (e), set in a familiar area, produced mainly good answers.

Q3

Parts (a) and (b) involved factual recall of the general principles of nutrient cycling. Part (c) involved application of some of these in the context of a particular element - selenium. The question discriminated well. As expected, part (c) was the most demanding part. Many candidates gave impressive answers to (a) and (b), showing thorough knowledge of the topic in general. It was encouraging to find, in (a)(i) and (ii), that the majority of candidates were aware of the difference between the processes of weathering and leaching. In (c)(i), candidates had to be able to interpret the general model shown in Fig. 3.1. Less able candidates were not able to do this fully, and so their answers were incomplete. Deductions in (c)(ii) were also often incomplete. Selenium levels in the UK population have fallen because there is less selenium in bread/wheat now. This has arisen because there is less selenium uptake from European soils than there was from N. American prairie soils. The second point was usually given. It was the first point that was frequently omitted.

Q4
In (a), explaining the meaning of *natural selection* produced a full range of marks. Most candidates were able to describe a mechanism involving (some of) the steps: survival, reproduction and the passing on of genes/characteristics to offspring. Very few candidates made it clear that natural selection occurs at the level of individuals rather than of whole species. Part (b) asked candidates to use information from Fig. 4.1. Answers sometimes suggested characteristics that were not included in the Fig. Most candidates found it hard to explain the meaning of the term *habitat*. The commonest errors arose from not knowing that the term refers to an organism (or organisms of the same species). Many answered in terms of a community. There was, therefore, confusion in some cases between habitat, environment and ecosystem. The calculation in (e)(i) was done well, on the whole. However, a significant number of candidates worked out the energy required per day by one lion rather than by the pride. These candidates had not read the question carefully. A level of carelessness also crept into (e)(ii) where vague, non-quantitative explanations were common. A correct answer included a simple calculation that 920 000 kJ had been used over 4 days. It was careless to state that all the energy had gone by then.

Q5
Parts (a) and (b) both revealed confusion in candidates' minds with regard to the terms: nucleus and atom. There were many correct answers to (a), but also many that talked about 'joining together of atoms with the release of heat'. This comes close to explaining the meaning of *exothermic reaction* rather than of *nuclear fusion*, as asked. Again, in (b), a surprising number of answers began by stating that 'nuclei contain protons, neutrons and electrons'. This part question was found to be by far the most demanding on the paper, and only the more able candidates were able to gain 5 or 6 marks for scientific content. Some candidates, more probably wanting to set themselves a less demanding task rather than as a result of misunderstanding the one that had been set, wrote about the properties of α, β and γ radiation. Fairly common errors were to state that 'the number of protons equals the number of neutrons' and that nuclei were built up from units of 'two protons plus two neutrons'. The terms *atomic number* and *mass number* were poorly understood. So perhaps it would be useful to stress the meanings of these terms with candidates, and to make it clear that elements with both odd and even atomic numbers exist, which means that half of the elements have an odd number of protons. In (c), nearly all candidates gave the correct answer of 'radiowaves' to (i). Most mentioned both wavelength and frequency in(ii), but few gave a full explanation by stating clearly that these quantities are inversely proportional to one another, or are related by the equation $c = \lambda f$. A significant number of candidates thought that 'M' was an abbreviation for 1000, in (iii). Credit was carried forward where this was then used correctly in (iv), but this was rare. Most candidates had trouble with expressing 22 235 MHz in standard form, in Hz. Clearly many thought that standard form requires some measure of rounding down; it was not uncommon for 22 235 MHz to be changed to 2.2 x 10^n Hz. As already implied, n did not often equal 10.

Unit 2844 – Science and Environmental Management

General Comments

In general, candidates seemed happier answering questions based on biological concepts than they did those based on physics or chemistry, Those questions relying on recall of knowledge of environmental topics were particularly well answered. Most candidates scored highly in question 1, which was about plant nutrients and eutrophication. Few candidates scored well in question 3 (on endothermic and exothermic reactions). This topic has caused difficulties in previous years.

Most candidates were able to make some attempt at answering most of the questions, and there were very few completely blank answers. This suggests that candidates had some knowledge of the topics, but often this was not in enough detail to score all the marks. This was particularly noticeable in questions 4e, 4g and 4h, the questions on photosynthesis. These questions were very variably answered. Some candidates scored full marks, but most were unable to describe the processes in enough detail.

In the extended answer question (question 7), candidates had difficulty in relating the structure of DNA to the way that the genetic material is copied.

In general, candidates who have scored less well in this paper have done so, because they do not have a sufficient depth of knowledge, particularly in the physical sciences and biochemistry, to gain the higher marks.

Q1
In (a), some candidates answered that nitrogen and phosphorous are plant nutrients. Some candidates described the effect of eutrophication on fish in (b)(i), instead of describing the initial effect on plant life, which is an increase in plant growth due to the excess nutrients in the water. In (b)(ii), many candidates showed that they do not appreciate that eutrophication leads to lack of oxygen in the water, and that this is the result of bacterial decomposition of dead algae.

The rest of the question was well answered.

Q2
In (b), few candidates knew that infrared radiation causes changes in vibrational energy, and many described electrons moving to higher energy shells. Most candidates were able to draw reasonable diagrams of how an infrared spectrometer works, and gained most of the marks in (c), but some confused infrared spectrometry with mass spectrometry.

Q3
In general the answers to (a) and (b)(i) were good. It was pleasing to see that candidates were able to draw enthalpy level diagrams, and to know that a positive change in enthalpy results in products at a higher energy level than the reactants. When it came to describing changes in bonding however, candidates were often not aware (or did not describe) that chemical reactions involve both bond breaking and bond forming, and that energy changes are associated with both. In (c), many candidates were able to describe how dissolving involves break up of the ionic lattice and hydration of ions, but few were able to answer part (ii) of this question, which asked them to explain the overall enthalpy change.

Q4
Most candidates gave good answers to parts (a), (b) and (c). In (d), many candidates lost marks because they described ways in which any plant will react to water shortage, rather than describing particular adaptations that drought resistant plants possess. Part (e) was not well answered by many candidates, as they described in general terms why plants need water and light , rather than how light and water are used in the light–dependant stage of photosynthesis. In (f) many candidates answered that chloroplasts were cells. Most candidates were able to gain one or two marks from parts (f) and (g), but few knew enough of the details of photorespiration and the C4 pathway that were needed to gain full marks.

Q5
In (a) most candidates knew that gametes are sex cells, but failed to pick up an extra mark by not stating that the chromosome number is half that of somatic cells (1n).
Most candidates were able to explain the meaning of homologous pair, but many were unable to explain the meaning of independent assortment. Parts (b) and (c) were generally well answered.

Q6

Parts (a) and (b) were generally well answered. In (c) most candidates had a general idea of what genetic engineering is about, and were able to pick up 2 or 3 marks in this question. Few candidates knew enough of the biochemical detail needed to gain all the marks.

Q7

Some candidates scored highly in part (a), being able to describe clearly and accurately the structure of DNA, and how the genetic material is copied. Many candidates however became confused when attempting to describe DNA replication, getting mixed up between replication and transcription. In (b) most candidates were aware of the differences between DNA and RNA. Few candidates knew about the synthesis of proteins in enough detail to score all the marks in part (c). Again they became confused between protein synthesis and DNA replication.

Advanced GCE Science (7885/3885)

January 2005 Assessment Session

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2841	Raw	60	45	39	34	29	24	0
	UMS	90	72	63	54	45	36	0
2842	Raw	60	48	42	36	30	25	0
	UMS	90	72	63	54	45	36	0
2844	Raw	90	70	60	51	42	33	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3855	300	240	210	180	150	120	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
3855	0.0	20.0	40.0	60.0	100.0	100.0	5

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Information Bureau

(General Qualifications)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: helpdesk@ocr.org.uk

www.ocr.org.uk

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Telephone: 01223 552552
Facsimile: 01223 552553

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