RECOGNISING ACHIEVEMENT

GCE

Science

Advanced GCE **A2 7885**

Advanced Subsidiary GCE **AS 3885**

Combined Mark Schemes And Report on the Units

January 2006

3885/7885/MS/R/06J

Oxford Cambridge and RSA Examinations

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Mark Scheme 2841
January 2006

Mark Scheme	Unit Code 2841	Session Jan	Year 2006	Version final

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)	from top predatory birds Great Tits caterpillars oak tree / oak 2 marks for all 4 correct 1 mark for 3 or 2 correct 0 otherwise	2
(ii)	(level 1 is) producers (level 2 is) primary consumers / herbivores (level 3 is) secondary consumers (level 4 is) tertiary consumers 2 marks for all 4 correct 1 mark for 3 or 2 correct 0 otherwise	2
(b)	population all the organisms of one species; eg. caterpillar / Great Tit; community the collection of populations/ total number of organisms of all species; eg. tree + caterpillars + Great Tits;	4
(c) (i)	Adaptation can take place when **individuals** are present with a characteristic that gives them an increased chance of **survival**. When they **reproduce** , the characteristic can be passed on to their **offspring**. The process can go on through successive **generations**. Gradually, an increasing proportion of the **population** will possess this advantageous characteristic. This process is called **cumulative** natural **selection**. 4 marks for all 8 correct 3 marks for 7 or 6 correct 2 marks for 5 or 4 correct 1 mark for 3 or 2 correct 0 otherwise	4
(ii)	caterpillars arrive earlier; parents that breed early find more food; rear more chicks; leading to an increased number of early breeders; (3 points from the above list)	3
		Total: 15

2(a)	same atomic number / same proton number / <u>atoms</u> of same element ; NOT different forms of the same element different number of neutrons / nucleons / different mass number;	**2**
(b) (i)	1;	**1**
(ii)	1;	**1**
(c)	diagram showing central nucleus / can be implied by positions of protons & neutrons; containing proton and neutron; with electron around nucleus in ring / band / shell / cloud;	**3**
(d) (i)	bombardment / or equivalent wording / knocking out of an electron; by electrons / γ rays / UV / X-rays / ionizing radiation;	**2**
(ii)	by a magnetic field / by (electro)magnet; NOT by an electromagnetic field	**1**
(iii)	two peaks / two signals (are recorded) / two deflected beams; strength / height / area (of each) is / bar chart shows measure of amount;	**2**
(e)	**one bullet point from the list below** 3 points max from list given ● radioactive decay / radioactivity; α particles; carry a positive / 2+ charge; and have a mass of a helium atom / 4 amu / comparable to mass of atom; ● radioactive decay / radioactivity; β particles / cathode rays ; carry a negative / 1– charge; mass is much smaller than mass of atoms; ● Rutherford's experiment; (some) α particles (in a beam); are scattered by / some pass through & some stopped by (thin sheet of) metal / gold; showing atoms have dense / positively charged centre; ● mass spectrometer; isotopes; show existence of neutrons; (give credit for answers about evidence for electronic structure also)	**3** **Total: 15**

3 (a)	prokaryotic cell / eukaryotic cell • encased in capsule / no capsule; • no nucleus/DNA is free/has plasmids / (membrane-bound) nucleus; • no (membrane-bound) organelles / (membrane-bound) organelles; (allow example of organelle once only) (2 bullet points from the list above)	**2**
(b) (i)	top left label: phosphate / hydrophilic (head) / ionic group / polar group / charged group; bottom left label: lipid / fatty acid (group) / hydrophobic (tail) / non-polar group / uncharged group; centre label: protein; right label: bilayer / bimolecular leaflet / 5 nm - 7 nm size quoted / phospholipids (if terms phosphate & lipid not already used);	**4**
(ii)	by passive transport / move unassisted through channels / by osmosis / by diffusion / along (falling) concentration gradient; by active transport / movement is assisted by proteins / against concentration gradient;	**2**
(c) (i)	anaerobic action occurs on part of disc while it is immersed in sewage, aerobic action occurs on part of disc while it is in air;	**2**
(ii)	nutrients; nitrates; phosphates; carbon dioxide; water; dinitrogen oxide / N_2O / nitrous oxide; methane; ammonia; hydrogen sulphide;	**2**
(d) (i)	(2 points from above list)	**1**
(ii)	uv lies to higher frequency / shorter wavelength; uv radiation is (capable of transferring) higher energy (than visible light) / can be ionizing radiation; NOT uv is more penetrating causes breakdown of / damage to cells / example of damage / stops cells functioning;	**2** **Total: 15**

4 (a) (i)	15 (trees);	**1**
(ii)	6 000 000 / 6 x 10^6 trees used / 8000 km of cable laid per year (average); 120 000 trees used per year;	**2**
(iii)	destruction of tropical rain forest / reduction in biodiversity / leads to deforestation / very large number of trees lost / non-renewable resource;	**1**
(b)	buttress roots provide stability; pointed leaves drain water away; leaves contain toxins to kill grazing insects; leaves waterproofed by waxy coating; branches spread out to catch more sunlight; large leaves catch more sunlight/ maximize or allow more photosynthesis; long roots/shallow root mat collects more nutrients / water; concave leaves catch more water; (2 points from above list)	**2**
(c)	**scientific content** forest has a layered structure; most trees are tall / have tall trunks / only have leaves at the top; emergent layer; (trees are) about 60 m high; umbrella-like shape / stick out of top of forest; canopy layer; (trees are) about 45 m high; spreading tops / form flat top to forest; sub-canopy layer; (trees are) about 25 m high; spindly / bushy shape / needing low levels of light; forest floor; ground level / 0 m height; where decomposition occurs / location of root mat; (7 points max from above list)	**7**
	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** **Total: 15**

Mark Scheme 2842
January 2006

Mark Scheme	Unit Code 2842	Session Jan	Year 2006	Version 5 (post-standardisation)
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)	Points plotted correctly; Smooth curve drawn;	2
(b) (i)	Ozone absorbs ultra-violet radiation; From the Sun; Converted into heat / thermal energy Any 2 points from 3 above	2
(ii)	50 km; 20 km ($\pm$ 5km); ecf from graph	2
(c)	nitrogen; oxygen;	2
		Total: 8

2 (a) (i)	Nitrogen and oxygen AW nitrogen is oxidised; Both substances provided by air; <u>React</u> at high temperature / pressure;	3
(ii)	Acid deposition / acid raid; react / dissolve in water to produce (nitric) acid; Kill fish in lakes / kill trees /corrode stonework ovp AW (Photochemical) smog; react with hydrocarbons; To produce toxic compounds / ozone / VOCs / causes breathing difficulties	3
(b)	porous: allows named substance (oxygen, nitrogen oxides, water) to reach catalyst; AW allows nitric acid to reach calcium carbonate;	1
(c) (i)	2 (H_2O) 4 (HNO_3)	2
(ii)	H^+ / H_3O^+	1
(iii)	Acid will be neutralized / pH increases / become (closer to) 7	1

(d)	Surface area increased; so rate of reaction / colliisions is faster;	2
(e)	(No) only likely to remove a small proportion of nitrogen oxides; would need a huge amount of paint AW too much NO_x; paint would need replacing frequently AW costly <u>with justification</u> cannot remove nitrogen oxides already in lakes; only works in urban areas; ovp	2
(f)	Added to acidic lakes / rivers AW added to soil which has become acidic AW used in scrubbers to remove acidic flue gases	1
		Total: 16

3 (a)	To reduce power loss / heat loss / energy loss; AW to reduce size of current;	**1**
(b) (i)	Power = current x voltage (or rearranged);	**1**
(ii)	200,000,000 W and 375,000 V (both needed) AW appropriate use of scientific notation e.g. 2×10^8, $200 \times 10^{6,}$, 3.75×10^8, 375×10^6	**1**
(iii)	533 A (no penalty for >3 s.f.) ecf from (ii) (2 marks) working e.g. rearranges current = power / voltage ; (1 mark) *If incorrect formula given in (i) award 1 mark for appropriate rearranging of equation if done* *+ 1 for correct substitution of values from (ii)*	**2**
(c)	idea of current diverting into other lines (accept also power, energy, electricity); increased <u>current</u> causes heating;	**2**
(d)	power / energy losses greater over long distances AW greater resistance; ovp e.g. greater environmental effect of pylons / security issues / capital outlay / maintenance / safety issues	**1**
		Total: 8

4 (a) (i)	No other molecule is lost / only one product formed;	**1**
(ii)	Double (covalent) bond	**1**
(b) (i)	Contains odd number of electrons / unpaired electron(s)	**1**
(ii)	Circles drawn around both R• and $R\text{-}CH_2\text{-}CH_2\bullet$	**1**
(iii)	Initiators /radicals are (very) reactive; Causes bonds to break / less energy required to break bond	

	AW activation energy is lowered; Causes a chain reaction to occur (any 2 points from 3 above)	**2**
(c) (i)	Molecules further apart **ora**; So less mass in a given volume	**2**
(ii)	Strength / Melting point / flexibility / rigidity / elasticity	**1**
		Total: 9

5 (a)	Catalyst reduces activation energy; Collision between molecules provides energy for reaction / to break bonds Only collisions with energy > activation energy will have enough energy to react; More successful collisions in presence of a catalyst / more collisions lead to a reaction AW Greater number of molecules will have E > Ea in presence of a catalyst	**4**
(b)	**Compares conditions:** Hd uses lower pressures; uses lower temperatures; Catalyst and/or solvent recycled / re-used; ora in each case 2 max for comparing conditions / **Explains advantage of these conditions** Low pressure reduces chance of leaks / explosions Requires less energy hence less fuel use Low temperature requires les energy hence less fuel (if not mentioned above) Less fuel used = fewer emissions / less CO_2 / less $SO_{x;}$ Recycling solvent / catalyst means no toxic substances to be disposed of; Reusing solvent / catalyst means less energy / raw materials used to replace them	**4**
	QWC: Organization and vocabulary **2 marks** A: answer is clearly and coherently organized throughout **and** B: appropriate specialist vocabulary is used (e.g. toxic, emissions, energy, fuel , and *catalyst, solvent, temperature or pressure* are used in correct way) **1 mark** A: answer shows a degree of organization **and** B: some appropriate use of specialist vocabulary is made *(e.g. just catalyst, solvent etc. used in correct way)* **0 mark** A: answer is not organized B: appropriate specialist vocabulary is not used or is used inappropriately	**2** **Total: 10**

6 (a)	Starch: energy storage / storage of glucose Cellulose: component of cell wall / gives cells rigidity	**2**
(b)	X = 5 Y = 5	**1**
(c) (i)	Aerobic; respiration;	**2**
(ii)	chemical energy to electrical energy;	**1**
(d)	(enzymes) have an active site; with a specific shape; will only fit / bond to one specific sugar molecule	**3**
		Total: 9

Mark Scheme 2844
January 2006

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
   <u>You are advised to destroy all draft versions.</u>

2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.

3. The following annotations may be used when marking. <u>No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.</u>

   x = incorrect response (errors may also be underlined)
   ^ = omission mark
   bod = benefit of the doubt (where professional judgement has been used)
   ecf = error carried forward (in consequential marking)
   con = contradiction (in cases where candidates contradict themselves in the same response)
   sf = error in the number of significant figures

4. The marks awarded for each <u>part</u> question should be indicated in the margin provided on the right hand side of the page. The mark <u>total</u> for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct <u>and</u> answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Mark Scheme	Unit Code 2844	Session Jan	Year 2006	Version
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)	I mark for each correct label;	**4**
(ii)	2 cells from mitotic division circled;	**1**
(b) (i)	Copy of each chromosome randomly assigned to each cell; Leads to large number of different combinations;	**2**
(ii)	Sections of DNA swapped between homologous chromosomes; Can lead to 4 different chromatids / recombinant DNA;	**2**
(c) (i)	Correct calculation of frequencies; Correct labelling of axes; Correct drawing of histogram);	**3**
(ii)	normal	**1**
(iii)	35 mm (no mark without unit)	**1**
(iv)	Drier / less sunny / less nutrients or similar	**1**
		Total: 15

<table>
<tr><th>Question</th><th>Expected Answers</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>Alternative version of a gene</td><td>1</td></tr>
<tr><td>(b) (i)</td><td>1 mark for correct red parent bb;
1 mark for heterozygous parent Bb;
1 mark for correct offspring
<table><tr><td></td><td>b</td><td>b</td></tr><tr><td>B</td><td>Bb</td><td>Bb</td></tr><tr><td>b</td><td>bb</td><td>Bb</td></tr></table></td><td>3</td></tr>
<tr><td>(b) (ii)</td><td>50%</td><td>1</td></tr>
<tr><td>(c)</td><td>Ladybirds eat insects lower down food chain;
Which have eaten the sprayed crops /ingested insecticide;</td><td>2</td></tr>
<tr><td>(d) (i)</td><td>mRNA transcribed / produced from DNA/gene;
mRNA passes from nucleus to ribosome;
mRNA has codon;
codon pairs with anticodon on tRNA;
tRNA brings amino acids to mRNA;
There is a specific transfer RNA for each amino acid;
protein assembled at ribosome;

4 from above</td><td>4</td></tr>
<tr><td>(ii)</td><td>Genes for pest resistance or good growth may spread from crops to weeds;
Weeds may then grow much faster;

Allow alternative problem + consequence</td><td>2

Total: 13</td></tr>
</table>

Question	Expected Answers	Marks
3 (a)	Phosphorous; nitrogen; calcium; potassium ; 2 from above(maximum one mark if not element e.g. phosphate / nitrate).	2
(b)	Crops grown and removed/ Same crop grown every year;	1
(c)	Eutrophication; Nutrients for algae; Increased growth of algae; Algae die/light blocked and plants die; Bacteria feed off algae; Use up all oxygen; Fish die from lack of oxygen; 4 from above	4
(d) (i)	Reaction goes back to formation of reactants/ as product made, goes back to reactants; So less product;	2
(ii)	Increased heat causes reaction to move in direction to reduce change; Reaction favours reverse reaction / reformation of products from ammonia; Reaction slows down.	3
(iii)	Formation of ammonia leads to decreased pressure; As less molecules of product than reactants; Raising pressure drives equilibrium to right/production of ammonia;	3
		Total: 15

Question	Expected Answers	Marks
4 (a)	Graph shows absorbance of red wavelengths; Transmittance of blue, so colour is blue;	**2**
(b) (i)	A correct label for detector B filter labelled correctly C incident before sample D sample labelled correctly E transmitted – after sample 2 correct = 1 4 correct = 2 5 correct = 3	**3**
(b) (ii)	Absorbs the wavelengths; that will not be absorbed by the copper ions;	**2**
(b) (iii)	Known standards of copper ions prepared; standard curve; blank with water / reference cell; transmittance / absorbance of sample measured; concentration calculated from standards; concentration is proportional to absorbance (ora); 4 from above	**4**
(c)	Sample different locations; Different times of day; Before / after rainfall; Different seasons of the year; Repeat samples; 2 from above	**2**
(d)	In visible spectroscopy absorbance of energy promotes electrons; to higher energy levels; In infrared, absorbance of energy increases vibrational energy; Of molecules;	**4**
		Total: 17

Question	Expected Answers	Marks
5 (a)	Water; sugar / glucose	2
(b) (i)	Solar energy absorbed; Water broken down / photolysis; Energy stored as ATP; Oxygen released; Hydrogen atoms produced; Photoexcitation / electron promoted to higher energy ; 3 from above	3
(b) (ii)	Reaction between CO_2 and RuBP; Catalysed by RuBisCo; Production of NADPH To produce 3C / PGA; Then glucose/sugar; 3 from above	3
(c)	High concentration of oxygen builds up in mesophyll cells; oxygen competes with CO_2 for binding to RuBisCo	2
(d) (i)	Carbon dioxide converted to 4C / malic acid; Shunted to bundle sheath cells; Deeper in the leaf / away from oxygen; Carbon dioxide released from 4C / malic acid; Carbon dioxide enters chloroplasts of bundle sheath cells; Then into C3 / calvin cycle 4 from above	4
(ii)	C4 pathway wastes some of the energy / less energy produced; fixation or transport of CO_2 requires energy / ATP; energy requirement may exceed energy production (AW); Further distance to transport CO_2 to bundle sheath cells; One of the answers above	1

Question	Expected Answers	Marks
(e) (i)	High temp and high Carbon dioxide; Allow figures	1
(ii)	At 20 °C photosynthesis is slow as temp is limiting factor; so increasing Carbon dioxide has no effect; At higher temp, photosynthesis is faster, until Carbon dioxide becomes limiting factor; Then increasing Carbon dioxide will have an effect;	4
		Total: 20

Question	Expected Answers	Marks
6	Water and salt molecules in motion; Continually strike the membrane; Water molecules can pass through in both directions; Salt molecules too big; There are more molecules on the water side; So there will be more water molecules colliding with the membrane from that side; So net / faster flow of water from water side to salt / net flow from high concentration of water to low / net flow from less negative water potential to more negative ; Applying pressure to the salt side; Increases number of collisions on salt side; Increases the number of water molecules that will pass through membrane from salt side; Net flow from salt to water. 6 marks from above	6
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;	4

Question	Expected Answers	Marks
	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.)	**Total: 10**

Report on the Units
January 2006

Chief Examiner's Report

Three units were examined this session: 2841, 2842 and 2844. The numbers of candidates entered for the units were similar to those in other January sessions. The ability of candidates entered for the AS papers, 2841 and 2842, was on average higher than before. These papers performed well; they were of very similar demand and grade thresholds were close to design values. The A2 paper, for unit 2844, discriminated well between candidates. It was slightly more demanding than papers in previous sessions and slightly lower grade thresholds were set accordingly.

GCE AS SCIENCE: Unit 2841 Science and the Natural Environment

January 2006

Principal Examiner's Report

General comments

The entry for this Unit was of similar size to that in previous years. Its overall quality was higher. There was an increase in the proportion of the more able Year 11 students who take this AS course after completion of their GCSE in Science, and in the number of candidates from 6th Form Colleges where courses based on this specification are well established. All scripts bar one represented a worthy attempt at the paper. This performed very well. All questions were of comparable demand and discriminated between candidates of different ability. All parts of all questions proved accessible to candidates. No candidate appeared to have been short of time.

Comments on individual questions

Question 1

The question divided into two sections: one on ecology, the other on adaptation. Both sections moved from parts testing basic knowledge to parts requiring some application to the context in which the question was set. Almost all candidates scored well on (a) and (c)(i), the knowledge parts. The application parts, (b) and (c)(ii), discriminated between candidates of higher and lower ability. Thus, in (b), lower ability candidates failed to provide examples from the text supplied and, in (c)(ii), they repeated the general points about adaptation that had been supplied in (c)(i).

Question 2

This question was again based on two topics. In both cases, knowledge and understanding were tested. Parts (a), (b), (c), and (e) tested the topic of atomic structure. The first three parts were at a basic standard and were done well by most candidates. Part (e) was harder but was capable of being learned. A very similar question had been set in an earlier paper and had been poorly done. It was pleasing to find that several Centres had taken note of this earlier situation and had made sure that candidates were prepared on this area. Part (d) tested the topic of mass spectrometry. The quality of response was very Centre dependent. It was clear that some Centres had not prepared candidates on this topic. Candidates who had been prepared did well on the first two parts. Part (d)(iii) was harder and discriminated in favour of the most able candidates.

Question 3

Parts (a) and (b) tested general points about cells and the plasma membrane. Parts (c) and (d) were applied to the context of the rotating biological contactor. Although candidates tend to find application harder than recall, the plasma membrane is a difficult topic and, overall, the two sections of the question proved equally demanding. Some candidates, in fact, did not attempt (b)(i), suggesting that they had not learned about the plasma membrane. Failure to attempt this part was not Centre dependent. Perhaps some Centres had relied on all candidates being able to bring forward knowledge of this topic from their earlier science course, when some of their candidates had not previously studied the topic.

Question 4

This question required candidates to perform two simple calculations, and then tested knowledge of tree and forest structure in a tropical rain forest. The calculation in (a)(i) was a straightforward, one-step process, and was done correctly by almost everyone. Part (a)(ii) had two steps. Many candidates were unable to make more than one step, and this was seldom explained. Thus it was not clear if a calculated value referred to the total number of trees used over the 50 year period, or to the total mass of gutta-percha used, or to the average length of cable laid per year. The lack of explanation probably reflects candidates' confusion about how to proceed but, as a matter of general practice, candidates should be encouraged to explain their working in a calculation. Parts (b) and (c), on tropical rain forests, were done well. Most candidates showed impressive knowledge of tree adaptation and forest structure in a tropical rain forest.

Principal Examiners Report

2842: Science and Human Activity
January 2006

General Comments

The total entry for this unit is generally very small in the January session. However this session saw a fairly significant rise in the number of candidates sitting the unit, following a similar increase last January. The cohort taking this unit in January is unusual since the majority are resitting the unit having first taken it in the previous June session

Several scripts of very high quality were seen; there were however a rather larger number of noticeably weak scripts, although very few really weak scripts were seen. There was no evidence of candidates being short of time.

Comments on individual questions

Question 1

The unfamiliar graph-plotting exercise was handled well by most candidates. Some tried to start their curve at the (false) origin and others found the slightly jerky pattern in the data disconcerting.

In (b), many candidates were able to give good explanations of the heating effect caused by ozone and consequently identified the height of maximum concentration correctly. Fewer were familiar with the idea of the tropopause as the height at which temperature begins to increase with altitude.

Oxygen (or dioxygen) was often not mentioned as one of the two abundant gases in the stratosphere for part (c), suggesting that candidates believe that it is present mostly in the form of ozone. Some candidates insisted on giving formulas or chemical symbols rather than names. At best this is a dangerous gamble – the mark can only be awarded if the formula is completely correct. Even then there will be situations in which only the name will do.

Question 2

The descriptions of nitrogen oxide formation and its role in acid deposition appear with great regularity in these papers and it was a surprise to find that most candidates were unable to score maximum marks for part (a)

The unusual context in the remaining parts of the question was generally handled well by candidates. It was pleasing to find that the tricky equation-balancing in (c) was done correctly by many candidates.

The evaluation of this new technique in part (e) produced several interesting responses. Candidates should be aware that in questions such as this there is unlikely to be a mark for simply stating “yes” or “no”. With two marks allocated for the question a candidate should be making two distinct evaluative points to score full marks.

Question 3

Candidates seem familiar now with the use of high voltage in power lines to reduce power loss and the majority knew the relationship between power, voltage and current in (b). Many candidates had problems with the MW and kV conversions in (b) (ii) and with the rearrangement of the equation.

Some leeway was allowed in the idea of current being diverted into other lines in (c), but the common statement that *voltage* was diverted was not allowed. Despite some good answers in this question there is still a sense that candidates remain hazy about the distinction between terms such as current and voltage.

Numerical answer:
(b) (iii) 533A

Question 4
Candidates seemed familiar enough with the representations of bonding and structure shown in this question. However it was rare to find a confident explanation of addition processes in (a) (i), and definitions of the term radical remain quite loose – many candidates discuss ideas of losing or gaining electrons.

The very best candidates provided an excellent explanation of radical chain reactions in (b), going well beyond what was expected.

Most candidates realised that the branching in part (c) increased the separation of the molecules, but few could make the full leap to explain that this would produce less mass in a given volume and hence reduce density. It has been noticed in previous sessions that candidates seem unaware that density has a precise meaning and few can quote it correctly.

There was a pleasing range of suggestions for properties which would differ between the two types of polymer.

Question 5
Part (a) required a fairly sophisticated understanding of collision theory and only the very best candidates scored full marks. Few were able to link the reduction in activation energy to the proportion of successful collisions; a very common misconception was that catalysts somehow provided energy for the reaction. There is still a belief in some candidates' minds that "activation energy" is a distinct *type* of energy rather than simply a label used to describe the height of the energy barrier in the reaction profile.

Conversely, part (b) proved straightforward for most. Weaker candidates simply identified the key features from the table, but the best candidates were able to discuss in detail how the environmental burdens arise and consequently how these features reduce them.

Question 6
Most of this question was on familiar material and candidates scored well on these areas. Some candidates are still too willing to give one-word answers and responses such as "energy" or "structure" when required to state a role clearly will not do at this level. Deducing the molecular formula in (b) proved surprisingly challenging.

Only the very best candidates spotted that the two marks allocated for (c) (i) meant that they needed to specify aerobic respiration rather than the more general respiration

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General Comments

As is usually found in this paper, candidates seemed happier answering questions based on biological concepts, rather than those based on physics or chemistry. Those questions relying on recall of knowledge of plant breeding topics and genetic crosses were particularly well answered. Most candidates scored highly in the first part of question 2, which was based on Mendel's laws of inheritance, however the second part of the question, which required a fairly detailed knowledge of protein synthesis was less well answered. Few candidates scored well in the second part of question 3 (on the effect of changing pressure and temperature in the Haber process), but it was pleasing to see that most candidates have a good knowledge of eutrophication, and are able to answer questions on this fully and accurately.

Most candidates were able to make some attempt at answering most of the questions, and there were very few completely blank answers. The exception to this was question 4d, which asked for an explanation of the difference between infrared spectroscopy and visible spectroscopy, in terms of the interaction of molecules and atom with electromagnetic radiation.

Generally, candidates had some knowledge of the topics, but often the answers given were too vague and general, with insufficient scientific detail being given to score all the marks. This was particularly noticeable in question 6, the extended answer question. Here it was clear that many candidates had a good general idea about the processes of osmosis and reverse osmosis, but many candidates were unable to describe the processes in enough detail. Others did not really address the question, which was about the movement of molecules.

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

Question 1

Question 1 (a) (i)
Good labelling of cells in the processes of mitosis and meiosis

Question 1(a) (ii)
Not so well answered, many candidates labelled the 4 cells from the second meiotic division as identical.

Question 1(b) (i)
Candidates often just repeated the question, without explaining how independent assortment occurred, or its effect on variation.

Question 1 (b) (ii) Candidates were not clear between which chromosomes crossing over occurred.

Question 1 (c) Most candidates were able to draw a histogram, but many were unable to calculate the median length of the leaves. Units were often missing from the graphs and the median length.

Question 2 Question 2 (a)
Many candidates were unable to state the meaning of the term *allele*.

2(b)
Some good answers, but too many candidates did not know the terminology used in the question, and so were unable to draw a correct genetic cross diagram.

2(d)
This was a straightforward question about protein synthesis, but many candidates did not know this process in sufficient detail.

Question 3 Question 3 (a)

When asked to name **two elements** which plants need to grow successfully, many candidates gave nitrates and phosphates as the answer, despite the fact that **two elements** was emboldened. This suggests that many candidates are not clear about what elements are, or that they do not read questions carefully.

Question 3(c)
Good answers on the topic of eutrophication by most candidates, suggesting that this is a topic which is taught well.

Question 3 (d)
Although most candidates can understand that the production of ammonia from nitrogen and hydrogen is a reversible process, they do not appreciate how this fact affects the production of ammonia when temperature and pressure change. Many candidates answered these questions in terms of greater kinetic energy of molecules, leading to more collisions etc. and disregarded the reverse reaction

Question 4 Question 4
The answers given to this question, suggested that many candidates had never used a colorimeter to measure the concentration of a substance.

Question 4 (a)
Many candidates confused between absorbance and transmission.

Question 4 (b) (i)
Some candidates confused between incident and transmitted light beams.

Question 4 (b) (ii)
Many candidates could not explain the function of the filter in colorimetry.

Question 4(b) (iii)
Many candidates did not know how a colorimeter could be used to measure concentration of a substance.

Question 4 (d)
Only a very few candidates understood how molecules and atoms interact with electromagnetic radiation in infrared spectroscopy and visible spectroscopy.

Question 5 Question 5 (a) and (b) and (c)
Some good answers given to descriptions of the light dependent and light independent stages of photosynthesis.

Question 5 (d)
Again some good answers explaining the C4 pathway.

Question 5 (e)
Many candidates could not explain the effects of changing carbon dioxide concentration and temperature in terms of limiting factors.

Question 6 Question 6
Some very good answers explaining osmosis and reverse osmosis in terms of the passage of molecules across a semi-permeable membrane. Many candidates however were not able to describe the processes in sufficient detail to gain high marks.

Advanced GCE Science (3885/7885)
January 2006

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2841	Raw	60	46	41	36	31	26	0
	UMS	90	72	63	54	45	36	0
2842	Raw	60	46	40	34	28	23	0
	UMS	90	72	63	54	45	36	0
2844	Raw	90	62	54	47	40	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)

Unit	Maximum Mark	A	B	C	D	E	U
3885	300	240	210	180	150	120	0
7885	600	480	420	360	300	240	0

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

Unit	A	B	C	D	E	U	Total Number of Candidates
3885	0.0	14.3	42.9	71.4	92.9	100	14
7885	0	0	0	0	0	0	0

For a description of how UMS marks are calculated see;
www.ocr.org.uk/OCR/WebSite/docroot/understand/ums.jsp

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