OCR
RECOGNISING ACHIEVEMENT

GCE

Science

Advanced GCE **A2 7885**

Advanced Subsidiary GCE **AS 3885**

Report on the Units

June 2006

3885/7885/MS/R/06

Oxford Cambridge and RSA Examinations

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Advanced Subsidiary GCE Science (3885)

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Unit 2841/01

General Comments:

The paper was slightly less demanding than last year's paper, but generally followed the same style. The paper assessed more Physics and Biology concepts than Chemistry. This year's paper did not require as many extended answers but the questions were broken down into many more parts.
Questions 1, 3 and 4 required candidates to bring together information from different parts of the specification and use it to explain the scientific background to a variety of context. Question 2 tested candidates' numeracy skills. This question required candidates to convert tabulated data into either a bar chart or a graph. The calculation involved simply working out a percentage.

Generally candidates' performance fell within the expected standard for most questions. Responses ranged from very good to blanks. Generally the marks scored on 1(d), 2(c), 3(iii), and 4(b) were generally low for able and less able candidates. This was due to either lack of understanding or misunderstanding of the concept.

Detailed explanations are given in the comments on individual questions.

Comments on individual questions

Question 1:
Most candidates did not gain the mark for a (ii) on what term is used to describe all organisms that depend on producers in a food web. Most candidates wrote primary consumers even though the word **all** was in bold. Candidates must be encouraged to pay attention to bold text in a question. Part d (i) showed a lack of understanding of the concept of productivity. Poor answers stated 'productivity is the rate at which something is produced' and stopped there. Good answers went on to use key words related to this concept by stating 'rate at which **biomass** is produced **per unit area'**
Many candidates wrote '**gas'** in response to what form does disordered energy take.

Question 2:
It was surprise how many candidates did not gain the full 3 marks to parts 2 (a) and 2(b) even though this question came in a different form in June 2005 paper. Candidates still seem not to be able to differentiate between **atomic number** and **atomic mass number**. Answers such as 'isotopes are elements with the same number of protons and electrons but different atomic number' testify to the lack of understanding of the concept of isotopes.

Reponses to the meaning of the term nuclear fission (2c) lacked detail. Good answers explained the term using words such as **bombardmen**t with **neutrons, splitting** of **nuclei** and used the example given in the question. Less able candidates recognized nuclear fission involved **splitting** of an **atom** but did not give any more detail.
Part 2f (ii) asked for an explanation of the term '**half life'.** Good answers stated 'it is the time taken for the radioactivity to fall to half its original value'. Poor answers showed a misunderstanding and confusion of the concept; these answers stated it is 'half the time taken for radioactivity to fall to half its mass'

Many concepts reoccur in papers year on year. It may be helpful for centres to use past papers to get candidates familiar with the different styles used in questions to test their knowledge of concepts.

Question 3:
Generally answers to this question fell within the expected standard with the exception of parts a(iii) and c(iii). There seems to be a general misunderstanding that a beam of light can change

from white to red or blue when it strikes a pigment because **the light is absorb by the pigment and change to the colour of the pigment.** The less able students did not seem to grasp the concept of white light being made up of all the colours and the colour we see is the colour that is **reflected.** Remote sensing imaging still seems to be a concept that candidates need to revisit.. Candidates' answers lacked detail.

Question 4
A common misconception was candidates interpreted **natural selection** as '**selective breeding.'** Most students could build up the concept of natural selection using the accepted scientific terms such as '**overproduction', 'mutation', 'adaptation', 'survival of the fittest'.** Less able candidates either left the question blank or explained selective breeding.

Candidates were able to pick up communication marks for answers which clearly used accepted terminology in the right context.

Unit 2842 Science and Human Activity

General comments:

The paper was of a similar style to previous sessions. Overall the performance of candidates was broadly similar to that in June 2005 although there were fewer really poor scripts; the vast majority of candidates were able to display some knowledge and understanding across the range of subject areas tested in the paper.

Marks were spread fairly evenly across questions 1,2,3 and 5; question 4 proved demanding for many candidates however. It was pleasing to see many candidates producing an excellent standard of extended writing in question 2. There were a range of calculations encountered in the paper – generally candidates seemed confident, but there were still difficulties with rearranging equations and handling standard form.

There was no evidence of candidates being short of time in answering this paper.

Comments on individual questions:

Q1: Although most candidates picked up several marks on this question even the best candidates rarely scored full marks. The distribution of pressure zones at different latitudes on the Earth was not well known even with the clear hint of descending and ascending air shown in the diagram. More surprisingly a majority of candidates suggested that the climate at 30^o N or S is predominantly wet.

Some candidates had trouble with the calculation; even if the equation was rearranged correctly they found difficulty handling the numbers. As with last year coping with standard form proved a problem for some; one surprisingly common error was to multiply the pressure by 20^2. A significant number of candidates incorrectly rearranged force as pressure/area*.*

Numerical answer: (b) (iii) 2.06×10^6 N

Q2: Acid rain is a familiar context for questions in this unit and candidates seemed to welcome the opportunity to display their knowledge. Some candidates seemed unfamiliar with the use of the term *deposition* in (a) but most understood how oxides of sulphur are produced by power stations.

There were some outstanding answers to part (c), providing a detailed and wide-ranging discussion of approaches to solving the problem of acid deposition. Some answers, however, did not progress beyond a general discussion of energy efficiency and by the end of the answer appeared to be focussing more on tackling global warming than acid deposition. Others provided great detail about the various political initiatives and (sometime fanciful) legislation without explaining how the targets for lower emissions are actually met. It was also too common to find candidates giving detailed descriptions of the harmful effects of pollution, which did not gain credit

Q3: Candidates often feel less confident with questions on the physics-based topics in the course; however this was generally not the case with this question and scores were frequently high. The term *epidemiology* is being used by many more candidates than when similar questions have been asked in the past. However, centres should be aware that spelling of technical terms may be important when there is a danger of confusion with other scientific vocabulary – here, for example the commonly seen "epid<u>erm</u>ology" was not given credit. Some candidates missed an easy mark by failing to indicate one cycle in b (ii).

Most candidates associated power with energy although few could give an accurate definition in terms of the <u>rate</u> of energy transfer.

Candidates seemed happy with the idea in part (b) of showing that a set of given data satisfies an equation and setting the question in this way allowed a sequence of calculations to be set in part (c). It was pleasing to see that many candidates were able to use the unfamiliar data about battery capacity in (c) (ii) but sadly not all were able to also cope with the conversion from mA to A. Calculating percentages is a mathematical skill which is frequently tested in this specification and it remains concerning that many candidates were unable to manipulate their previous answers to calculate percentage in c (iii).

Some well thought-out suggestions were made about the relative risks from power lines and mobile phones. For full marks candidates needed to clearly make a comparison between the two types of fields - a significant number of answers attempted to explain how power lines and mobile phones both harmed health rather than comparing risk between the two.

Numerical answers

(c) (i) 14 C (ii) 2412 C (iii) 0.58 %

Q4: This question featured some difficult chemical ideas and as a result was found to be the most challenging by candidates. However some centres have clearly taught these ideas, particularly those relating to the shapes of molecules, very well and some excellent answers were seen.

A majority of candidates were able to identify the substrate of the enzyme in (a). The following part, explaining the increased rate of reaction of enzyme catalysed processes has been poorly understood in the past. In this paper there was a significant increase in candidates knowing, and understanding the significance of, the lower activation energy of this process

Part (b), explaining how a covalent bond holds atoms together, rarely produced more than one mark for candidates. Almost all were aware that atoms shared electrons but then most believed that the it is simply the formation of full shells which is the factor holding the atoms together. Very few were able to explain the process in terms of electrostatic attraction

As mentioned above, there were many good answers seen to (b) (ii). Some candidates still believe it is the atoms in the molecule which repel each other and made no reference to electron pairs

Q5: This question followed on from q4 and explored the kinetics of the enzyme catalysed reaction in more detail. Candidates assume that graph plotting questions are straightforward but some would be well advised to take a little more care ensuring that they understand how to interpret the scale. Here some candidates plotted some points rather carelessly, losing marks on the graph and often making it more difficult to gain full credit for the analysis which followed.

A few candidates, no doubt thinking of coursework activities, tried to plot tangents to calculate the rate in (b). A pleasing fraction of students were able to correctly use the term *proportiona*l and to appreciate the connection with first order equations.

The straightforward mark for suggesting a change which could be made to increase the rate of reaction in (v) was thrown away by some candidates by simply writing one word answers such as "temperature" – which clearly does not describe a change at all!

Even candidates who otherwise performed well on this question seemed unfamiliar with the vocabulary of "*rate equation*" and "*rate constant*" (these terms have been used widely in several past questions.

Few candidates were able to fully explain the levelling out of the graph in terms of the saturation of the active sites. Ideas such as the "enzymes being used up" do not quite explain the situation adequately. Some candidates interpreted a levelling off of the graph as an indication that the reaction had stopped.

An interesting range of applications of enzymes were discussed in the final part of the question, although non-food applications of enzymes were not well known.

Unit 2843/01 Interpreting Scientific Information June 2006

General comments

This paper, set on a well-written article on a topic that should be familiar to students of the course, nevertheless proved demanding. However, many candidates who had been well-prepared for this type of paper performed creditably. Unfortunately, significant numbers of candidates seemed less than well-prepared for this component; many clearly harboured misconceptions about the topic in hand; many had a poor grasp of the meaning of the article and, in some cases, candidates left many blanks in their answers. Centres are reminded that the best way to prepare candidates for this component is to include interpretation of scientific information of this type throughout the course of study, as well as giving them past papers as practice towards the end of the course.

Comments on individual part questions

1(a) Most, but by no means all, candidates answered this extremely simple, first question correctly.

1(b) The information needed to draw the graph was given in the text of the article, and those candidates who drew an inverted, symmetrical bell-shaped curve peaking at 3 ^{o}C gained full marks.

1(c) Most well-prepared candidates drew from the text the information that Murphy and Stainforth's graphs are skewed, or that they have long tails at higher temperatures.

1(d) As expected, fewer of the candidates could sketch correctly the shapes of the graphs representing this new work, though many made creditable attempts at doing so. Candidates should remember to add labels where these are specifically asked for.

1(e) Many candidates realized that the factor missing from conventional climate models is clouds, although many were confused by the term 'Achilles heel', taking this to be a type of cloud.

2(a)(i) To answer this question, candidates needed to be able to interpret what the author of the article had written, and so it proved taxing for many. However, many of the better candidates realized that the direct greenhouse effect refers to the warming produced as a result of carbon dioxide alone, excluding any feedbacks.

2(a)(ii) This question, requiring the most basic of knowledge about the greenhouse effect, revealed a good deal of confusion among candidates. Some stated correctly that greenhouse gases 'let through' short wave solar radiation, though it was disappointing that they did not use the scientific term 'transmit' to describe this. Very few candidates realize that the long wave radiation re-emitted by the Earth is absorbed by the greenhouse gases; most believe, incorrectly, that it is reflected back to Earth by the greenhouse gases; many hedged their bets by stating that the greenhouse gases 'trap' this radiation. Significant numbers of candidates confused the greenhouse effect with problems with the ozone layer, and in many such cases the spelling o-zone was used; this is to be discouraged.

2(b)(i) Similarly, disappointingly few candidates realized that snow and ice reflect solar radiation because they are light in colour, whereas open water, bare rock etc, absorb radiation because they are dark in colour. A few candidates used the term albedo, but not always correctly.

2(b)(ii) Candidates were either familiar with the concept of feedback, in which case they gained marks either from giving a general explanation or in terms of the specific example, or they were not. A disappointing number of candidates seem to think that positive feedback means a good report: ie they are familiar only with the general meaning of this term and not the scientific one.

2(b)(iii) Since the correct answer could be taken directly from the text more candidates were able to answer this question correctly.

2(c) Most students gained part marks for identifying directly from the text the fact that the current predictions for global warming include the effects of water vapour formation and of ice melting. However, many candidates simply copied out the short paragraph which was relevant to this question; this practice is often not helpful to candidates, who would do better to spend a moment thinking about what the paragraph means, and it should be discouraged. The more able candidates deduced from the text that current predictions involve the direct effect of the increase of carbon dioxide in the atmosphere, plus the two feedback mechanisms they had been asked about in previous parts of this question: formation of water vapour and the melting of ice.

2(d)(ii) Oddly enough, since the question about positive feedback had been answered in general rather badly, a good number of candidates realized that the reflection of solar radiation away from the Earth by clouds in daytime is an example of negative feedback.

2(d)(ii) This question was also answered reasonably well.

3(a) Despite the clear statement in the text that storm clouds form and air currents rise in the inter-tropical convergence zone, not all candidates answered correctly and many gave the answer 'equator'.

3(b) Answers from candidates who are familiar with the format of past papers shone out from those of candidates who had been less well prepared for this component. Many of the former gained full marks for this question, though a common omission was either to label the air current as rising more strongly than 20 years ago, or indicating by the size of arrows that this is the case. Candidates should be aware that where labels are specifically asked for they should be included if full marks are to be gained.

3(c)(i) This question placed a high demand on candidates because it required them to generalize from their interpretation of the text. A pleasing number of the more able candidates were able to do this.

3(c)(ii) This was a less demanding question and was thus accessible to a greater proportion of candidates. Many, however, failed to answer the question and instead described what Wielicki thinks about the interpretation that other scientists place on their result rather than what he thinks about his own results. This is an example of candidates failing to score marks because of their tendency to identify the relevant section of the text and then to quote blindly from it rather than thinking about the meaning of what they are reading.

3(d) Despite being asked to summarize in their own words, too many candidates simply quoted from the relevant paragraph of the article.

4(a) A pleasing number of candidates answered this question correctly.

4(b) Most candidates correctly listed 'volcanic eruptions' as a naturally occurring event that can produce changes in temperature on a global scale. Some, however, failed to gain the second mark because they wrote down 'solar radiation' as opposed to the correct answer, 'changes in solar radiation'.

4(c)(i) This question produced confusion among many candidates, for whom the term 'aerosol', despite the cue given at the beginning of 4(c), means aerosol sprays in general use. Many of these candidates are under the mistaken impression that ozone-depleting chlorofluorocarbons are still used in such sprays. The aerosols referred to in the article arise as a result of the burning of forests, crop waste and fossil fuels, and thus a correct answer to this question should have involved one of the solid products of incomplete combustion of these materials: soot, ash, carbon etc. Some candidates did interpret this question correctly.

(c)(ii) Few candidates managed to stand back from the flow of the article to reflect that eliminating the above particles would improve air quality, or decrease pollution, or that burning of such organic material produces more carbon dioxide to add to the greenhouse effect and produce further global warming. This was a very tough question in that the counter-argument receives much more prominent treatment from the author.

4(c)(iii) Not surprisingly, therefore, this question, which is about the positive effect of such aerosols in shading the planet, was answered much better.

4(c)(iv) This was another tough question, although some of the more able candidates gave good answers. Many of the less able candidates found it impossible to comment on what the author had concluded about Crutzen's and Murphy's work, or even to comment on that work, as presented in the article, instead giving their own opinions about the likelihood of global warming.

Coursework components - 2843/2 and 2846/2

Approximately 482 candidates were entered for AS Science; and 129 candidates for A2 Science. This represented 30 AS Centres (2843/2) and 18 A2 Centres (2846/2). It is pleasing to report that very few Centres had to be scaled. This was far fewer than in previous years. It is clear that most Centres are interpreting the criteria fairly. Most of the Centres scaled had been scaled in previous years. Only one Centre was scaled at both AS and A2.

Centres were generally very prompt in sending coursework for moderation. The administration of Centres was generally good with most Centres correctly using Coursework form GCW048 and counting the best mark in each of Skill Areas P, I, A and E. This year there was the additional requirement to send CSS160 (Certificate of). It would help is Centres sent separate forms for each specification.

Quality of the work submitted for moderation

There was some excellent work submitted for moderation this year where candidates clearly demonstrated high levels of performance in all Skill areas. Some of the work, however, was little better than that produced at GCSE and it was hard to see progression from GCSE to AS and A2.

Choosing appropriate tasks

Centres used a number of different coursework tasks. In some Centres, candidates only used whole investigations. Candidates then only had one mark in each Skill Area and so had no opportunity to count the best mark or to improve. It may be better to use a whole investigation for AS as this can lead more naturally to a good evaluation in Skill Area E. For A2, it is probably better to design tasks that assess one or two skill areas each.

A good coursework task for AS or A2 level should:

- include content from some part of the AS specification for AS and from both AS and A2 units for A2. In A it is vital that the Centre identifies the area of the specification used;
- enable candidates to do some scientific research at an appropriate level to inform their planning;
- enable the candidates to collect ample data with suitable precision and accuracy;
- usually allow candidates to plot one or more line graphs (bar charts and similar are not appropriate at this level);
- enable candidates to do some detailed processing (calculating the average values for three readings is *not* detailed processing);
- allow opportunities for candidates to evaluate their experiments.

Some of the coursework tasks chosen did not meet these criteria.

Suitable tasks used by Centres

The tasks used this year were generally the same as those seen in previous years.

AS

Factors affecting rate of reaction (from Coursework booklet)
Radioactivity of household dust (from Coursework booklet)
Effect of surface area on the rate of decomposition of hydrogen peroxide
Measuring reaction rates of calcium carbonate and hydrochloric acid using a pressure gauge

linked to a computer
Finding the order of reaction for the decomposition of hydrogen peroxide
Investigating the effect of temperature on the decomposition of hydrogen peroxide with enzymes in potato
Investigating the amount of oxygen used by respiring seeds
Investigating how temperature affects beetroot stability using a colorimeter
Finding the order of reaction for the reaction of calcium carbonate and dilute hydrochloric acid using loss of mass

A2

Different methods of analyzing for Cu^{2+} ions
(This involved colorimetry and titration. It gave a good comparison of the methods).
Factors affecting enzyme activity incorporating pH
Effects of light intensity on the growth of *Chlorella*

Interpretation of criteria and work of candidates

Some Centres applied the criteria with generosity. It should be remembered that these criteria are hierarchical. For example, to award 1 mark in any Skill Area, 1a and 1b *must* be scored. Some Centres awarded 2 marks, for example, when only 1a and 1b had been scored. Also, in some Centres, if a candidate had achieved 1a, 1b, 3a and had made some progress in 5a, candidates were awarded 4 marks. This should only be 2, as 3b had not been achieved.

Skill Area P - Planning

The guidance on length given in the Coursework manual for Planning is about 800-1000 words and this remains a good guide. Very much less than this probably means that the report does not contain enough background science. Much more than this probably indicates that too much irrelevant material is being included. Many of the reports resembled a list of instructions with little or no science

P.1a The candidate must give a question to be studied, plan a fair test and, if relevant, make a prediction.

P.1b The candidate must choose appropriate equipment.

P.3a The candidate must introduce some scientific knowledge and understanding. For example, in a rate of reaction experiment, they may list factors which affect the rate of reaction and then identify which factor is to be varied and which are to be kept constant.

P.3b The candidate must choose a suitable number and range of observations/measurements to be made..

P.5a At this level the candidate must use a secondary source to inform the plan. It is not enough to list a book. A reference, e.g. a page number or web address, must be given so that it can be checked. The science used should be at AS or A2 level. Often the reports seen lacked science altogether or included science at below Grade C GCSE level. Some reports contained completely wrong science, for example the rate of enzyme reaction increasing with temperature up to 90^{o}C. They should not be given credit for wrong science. A reference to safety, e.g. 'wear a lab. coat' or 'use eye protection', is not enough to award P.5a where clearly P.3a and P.3b were not merited. Perhaps for P5a candidates might use Hazcards for information.

P.7a To be awarded this, the candidate must use and evaluate information from a variety of sources. Again, these must be identified and references given. Very few candidates realised this and some teachers gave P.7a when P.5a was clearly the maximum.

P.7b The candidate must now justify the strategy used, i.e. that it will provide precision and reliability.

Eight marks are available only for exceptional performance in P.7a and P.7b or both.

Skill Area I - Implementing

In Skill Area I, much of the evidence remains in the Centre, and the Moderator can only act on the annotation provided. Although annotation can assist the Moderator throughout in confirming the decisions of the Centre, it is essential here.

I.1a Evidence provided by the Centre.

I.1b The candidate makes some observations or measurements. However, if they are not adequate for the activity, I.1b cannot be given. At this level, they do not have to be recorded in a formal table.

I.3a Evidence provided by the Centre. The candidate is confident in practised techniques, e.g. weighing.

1.3b The observations and/or measurements are recorded in a table devised by the candidate. Correct units are given in the table headings.

1.5a Evidence provided by the Centre. A higher level of competence is seen. For example, a candidate can dilute a given solution accurately to produce five different solutions of different concentrations.

1.5b The candidate must now show precision in the observations and measurements taken. In many cases candidates had three very different results (e.g. 17s, 34s and 51s and they took an average. This does not suggest precision in the results collected.

1.7a Evidence provided by the Centre. The candidate must be fully proficient in all techniques and with all equipment.

1.7b Here the candidate must ensure that the degree of precision is the maximum permitted by the equipment. For example, a thermometer should be used to measure temperature to the nearest 0.5 ^{o}C and a burette consistently to 0.05 cm^{3}.

Skill Area A - Analysing Evidence and Drawing Conclusions

A.1a The candidate carries out some simple processing of evidence, e.g. averaging results.

A.1b The candidate can report a simple trend or pattern, e.g. increasing the concentration of hydrogen peroxide increases the rate of reaction.

A.3a Here the candidate draws an appropriate line graph with a line of best fit when appropriate. If this is not possible, the candidate carries out some numerical calculations at a higher level than for A.1a. Candidates can use computer packages to draw graphs. However, in many cases candidates could not use them properly.

Candidates often cannot draw lines of best fit using a computer package. If there is any doubt graph paper should be used. In some Centres it is pleasing to report that good computer generated graphs were produced.

A.3b The candidate links the conclusion with associated scientific knowledge and understanding. As a guide, it should be linked back to the science given in P.3a.

A. 5a It is here that many candidates fell down. For rate of reaction experiments, they tried to calculate the initial rate by working out a gradient. For this a tangent must be drawn to the curve at 0 and a large triangle drawn. Too often candidates did not draw a tangent but tried to calculate the gradient of the curve or they drew a very small triangle.

A. 5b The link made now is with science at a higher level.

A. 7a For a rate of reaction experiment, the candidate now might use evidence from A.5a to devise a rate equation and write:

$$\text{Rate of reaction} = k[A]^x[B]^y$$

A.7b Now the link is with science at the highest level.
A mark of 8 is available.

Skill Area E - Evaluating Evidence and Procedures

Evaluation is the most difficult Skill Area for candidates. It is perhaps easier here to separate the two strands.

The 'a' strand is about improvements in the investigation. Often an experiment that works very well gives fewer opportunities for evaluation than one that is more open-ended. A candidate who suggests studying a different variable is not meeting the requirements of this strand. Too often candidates are given credit for suggesting the investigation of another variable.

E.1a The candidate makes a relevant comment on the suitability of the experimental procedure.

E.3a The candidate recognises the limitations in the experimental procedure. For example, in a rate of reaction experiment, some gas is lost before the cork attached to the gas syringe can be put into the flask.

E.5a The candidate indicates an improvement. In the above example, perhaps the solid reagent could be put into a small test tube separate from the acid. The reaction is started by shaking the flask.

E. 7a The candidate justifies the improvements in terms of increasing the reliability. In the example given, will the acid enter the small tube sufficiently quickly or will the rate be limited?

The 'b' strand is about the *quality* of the evidence collected and this strand is overlooked by many candidates, a candidate failing to score E.1b cannot be awarded even 1 mark despite reaching 7 marks in the ‘a’ strand.

E.1b The candidate recognises anomalous results. In practice, many candidates either highlighted them in the results table or circled them on graphs. If there are no anomalous results, candidates should state this. Where there are anomalous results, and the candidate ignores their existence, E1.b cannot be given.

E.3b The candidate comments on the accuracy of observations suggesting reasons for anomalous results. For example, when measuring photosynthesis of a plant, the temperature of the water may change. This could account for any anomalous results.

E.5b Candidates may notice from their results that when they take three readings there are differences between them.

E.7b The candidate assesses the significance of the uncertainties. In the above example, perhaps looking at 19 and 25 (ignoring 43) and averaging the value as 22, they could look at the graph and decide whether this point would now be closer to the graph.

The individual reports to Centres are intended to provide positive support to Centres to help them get the Coursework right. Where significant scaling has taken place the work will have been seen by at least two Moderators.

Science 2844 June 2006

General Comments

As is usually found in this paper, candidates seemed happier answering questions based on biological concepts, rather than those based on physical or chemical concepts. Questions requiring candidates to recall knowledge of the causes and effects of environmental pollution were particularly well answered. Most candidates scored well in the first two questions, which were on these topics. 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. This has not always been the case in the past.

Questions that required answers containing more technical detail (questions 4 and 5) were not so well answered. Most candidates had a basic idea of how genetic engineering is carried out and also know some of the details of chromatography, but few knew enough science to gain high marks. There were some candidates who appeared to know nothing at all about chromatography, and the second part of question 3, which required a fairly detailed knowledge of protein synthesis, was not well answered.

Answers to question 6, the extended writing question (which was about breaking and forming bonds when substances dissolve) were very variable. Some candidates gave excellent well organised and well explained answers, gaining all the marks. Many candidates though, explained what endothermic and exothermic reactions are in terms of temperature changes, but failed to relate this to bonding, which was what the question was really about.

This session, there were too many papers with parts of questions left completely blank, and on several papers, whole questions not attempted. This suggests that some candidates had not covered the whole of the specifications.

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 5. In other cases, the candidates had written answers which did not relate to the question (especially in question 6) and so lost most of the marks for that question

In general, candidates who have scored less well in this paper have done so, because their knowledge and understanding is too superficial to gain the higher marks.

Question 1

Question 1 (a)
Good knowledge of sources of water pollution.

Question 1(b)
Not so well answered, many candidates failed to connect nitrate ion concentration with changing rainfall throughout the year, or seasonal use of fertilisers, or to mention leaching.

Question 1(c)
Mostly well answered with candidates knowing methods for reducing nutrients entering streams.

Question 1 (d)
Candidates were able to describe in some detail how to sample streams in order to make accurate comparisons.

Question 1 (e)
Many excellent answers with candidates being able to describe the causes and effects of eutrophication. There are still some candidates whoever who think that the fish die because "the algae take up all the oxygen"

Question 2

Question 2 (a) and 2(c)(ii)
Some candidates were not able to give definitions for the terms haploid and diploid.

2(b)
Some very good answers. Most candidates were able to describe in detail the process of mitosis.

2(c)
Again good answers. Candidates are knowledgeable about the effects on variation of sexual and asexual reproduction.

2(d)
Most candidates lost one of the marks here by not explaining that sexual reproduction enables organisms to survive better when there are <u>changes</u> in the environment or <u>new</u> diseases.

Question 3

Question 3 (a)

Most candidates drew good accurate diagrams of DNA structure.

Question 3(b)
About half of candidates did not know that strands of DNA are held together with hydrogen bonds.

Question 3 (c)
Few candidates were able to explain how 4 bases can code for all the amino acids, in terms of 20 amino acids and 64 different arrangements.

Question 3 (d)
In part one of this question, good knowledge was demonstrated of the differences between RNA and DNA. In contrast however, part two of this question which asked candidates to describe the functions of mRNA and tRNA was very poorly answered. Most candidates do not know how these molecules are involved in protein synthesis.

Question 3 (e)
Most candidates were not able to relate the sequence of DNA to the primary structure of a protein, and then relate its tertiary structure and shape to function.

Question 4

Question 4 (a)
Good knowledge of the benefits of GM crops.

Question 4 (b)
Most candidates gave correct answers as to the function of restriction enzymes as tools to cut DNA, but did not mention that the DNA is cut at specific base sequences rather than randomly.

Question 4 (c)
Most candidates referred to DNA ligase to "glue" DNA into vector, but did not mention the role of restriction enzymes to cut the vector open.
Some candidates gave bacteria as a vector rather than bacterial plasmid.

Question 4(d)
Many candidates did not know enough scientific detail about the process of genetic manipulation, to be able to describe how the transformed bacteria are selected for and how recombinant DNA might be inserted into cells.

Question 4 (e)
Mostly good answers about the possible dangers of GM and the precautions.

Question 5

Question 5
Quite a few blank or nearly blank pages, suggesting that some candidates had not covered this topic. Other candidates who had attempted the question gained 0 marks.

Question 5 (a) and (b)
Most candidates recognised that the pesticide had broken down into different components in the second diagram, and that after 2 months, all or most of it would have broken down.

Question 5 (c) (i)
Some good answers in terms of polar and non-polar molecules being attracted to charged grains on the plate. There were a significant number of candidates however who while they knew that some molecules "stick" to the plate while others do not, were not able to give a mechanism for the "sticking".

Question 5 (c) (ii)
Most candidates realised that some components "stick to the plate" more than others, but many were not able to relate this to differences in speed of movement up the plate.

Question 5 (d)
Good answers on use of different solvents or rotating plate to separate components that are close together.

Question 5(e)
Many candidates did not seem to be familiar with g.l.c.

Question 6

Question 6 (a)
This question was about breaking of bonds in ionic compounds, and reforming of bonds with water. The answers were very variable. Some candidates gave excellent well organised and well explained answers, gaining all the marks. Many candidates though, explained what endothermic and exothermic reactions are in terms of temperature changes, but failed to relate this to bonding, which was what the question was really about.

Question 6 (b)
Most candidates were able to explain that “the molecules are closer together” when dissolved in water for 1 mark, but were not able to explain why.

Question 6 (c)
Most candidates were able to explain that there is an increase in disorder in dissolving, and that this is related to an increase in entropy. Most were unable to go on and explain that entropy can change in both system and surroundings, and that it is the overall entropy change that is positive in dissolving.

Unit 2845 Synthesis of Scientific Concepts

General comments

The paper had the well-established style of two structured questions (Q1&Q2), two moderately long answer questions (Q3 & Q4) and two long answer questions (Q5 & Q6). All questions produced a good range of marks. Full marks were gained by some candidates on all questions except Q5. There was no evidence that any candidate was short of time. However, a significant proportion of candidates seemed to be short of preparation. About 60% of candidates were of similar performance to those who have entered for this Unit in the past. Their marks were widely spread, centred on about half-marks. But there was a second population, making up about 40% of candidates, whose marks were quite tightly bunched below 30%. This group may have been present in the past, but to a lesser and unnoticeable extent.

Comments on individual questions

Q1 This question focused on different ways of presenting data: by table of numerical values, pie chart and triangular graph. It was not intended to be difficult. Most candidates did well. Many, however, could not present 20μm in standard form in (a). At first this was surprising since most candidates were able to handle standard form values well enough in Q2. Data was, however, provided in this form in Q2. Presumably, after the data had been fed in, a calculator displayed an appropriate result in standard form. In Q1, however, the candidate was required to produce a standard form value. A few candidates could not calculate a percentage in (b); they failed to divide each separate mass by the total mass of all the samples. Use of the triangular graph in (c), to show one particular point, was straightforward. Using the graph to show a range of soil compositions in (d) was, as intended, more demanding.

Q2 A question of this kind is deliberately set each year to test mathematical skills appropriate to a course in Science at this level. It is important to include a question of this kind in a paper which, otherwise, places a heavy emphasis on long, written answers. A pleasing number of candidates did well on Q2.

Q3 There were some poor answers to this undemanding question. Providing the three labels should have been very straightforward. And there were any number of points to make about other aspects of the diagram that should have been obvious. Poor preparation is the most likely explanation.

Q4 It has sometimes been thought that candidates do better on biological science topics than on physical science topics. This does not seem to be the case here. Answers to Q4 (biological science) were at least as poor as those to Q3 (physical science). Most candidates were inclined to write more on the biological science topic. But what came out from many was ill-informed, arm-waving, opinion rather than relevant scientific principles and concepts. One particular example of incorrect factual knowledge was that plants were often classified as "processors" or "providers" rather than as " producers". An example of vagueness was that many answers referred to "the food chain" as if there was only one food chain for the whole Earth.

Q5 The same comments about vague, arm-waving opinion on biological science can also be made about this question. Many candidates rewrote, more discursively, the content of the question as if it were their own opinion. There were lots of good, mainstream specification points that could have been made.

Q6 On a more cheerful note, there were some attempts at this question. Most candidates covered all three, required areas of science in their answers. Not surprisingly, nearly all did better on aspects of the molecular structure of carbon dioxide, and on ocean circulation, than they did on the more demanding topic of reversible processes. By and large, those candidates who displayed competence on the scientific topics also presented their answers well and gained high marks for the quality of their written communication.

Report to Centres 2846/01

General Comments

The average mark is somewhat lower than last year. Performance across questions is more consistent. However, despite the paper being a little easier than last year's, there is a sharp increase in really weak scripts.

Basic mathematics is generally improved this year, but, as last year, poor spelling (particularly of technical terms) and grammar is still a feature of many scripts. Candidates did, however, appear to have read the question stems with more attention than previously.

Comments on individual questions:

1 (a) (i) Many students failed to convert kilometres to metres.
(b) (i) Only a minority gained this mark.
(c) (i) A fair number of candidates did little more than repeat the generalities of the stem. Specifically, the waves travel through the vacuum of space, then enter the (variable density) atmosphere.
(d) Generally quite well done – could be answered generically, or specifically with respect to RADAR, SONAR or LIDAR. Some mistakenly tried to describe a GPS system. Some think that radar can be used under water.

2 (a) Most candidates gained some marks for (i) and (ii). Most frequent mistakes were to make 12 ½ hours a half or quarter cycle rather than a whole cycle and specifying a displacement swing of $\pm$ 50mm.
(iv) Some interesting valid suggestions here, including the nutation of the earth's axis.
(b) (ii) Some strange spellings (e.g. 'anesosphere') here.

3 (a) More strange spellings (e.g. 'Corriolous') of Coriolis (a distinguished French applied mathematician of the nineteenth century).
(c) Many candidates confuse specific heat with latent heat and discuss boiling evaporation etc. This misconception carries over into (iv) where the breaking, rather than the stretching of bonds is deemed, incorrectly, to be the issue.

4 (a) Most candidates made a reasonable attempt at the drawing, though a number showed the shaft as a sort of chimney out at sea. Full marks required careful attention to water levels external to, and within, the tunnel/shaft system.
(d) 'Cheaper' was an acceptable suggestion.
(e) Candidates divided sharply into those who took the right track by comparing proportions or percentages, and those who, superficially, compared absolute values. Few candidates troubled to comment on nuclear energy.

Advanced GCE Science 3885/7885
June 2006 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2841	Raw	60	46	41	36	31	27	0
	UMS	90	72	63	54	45	36	0
2842	Raw	60	40	35	30	26	22	0
	UMS	90	72	63	54	45	36	0
2843A	Raw	120	83	73	63	54	45	0
	UMS	120	96	84	72	60	48	0
2843B	Raw	120	83	73	63	54	45	0
	UMS	120	96	84	72	60	48	0
2844	Raw	90	64	56	48	40	33	0
	UMS	90	72	63	54	45	36	0
2845	Raw	90	49	43	37	31	25	0
	UMS	90	72	63	54	45	36	0
2846A	Raw	120	88	79	70	62	54	0
	UMS	120	96	84	72	60	48	0
2846B	Raw	120	88	79	70	62	54	0
	UMS	120	96	84	72	60	48	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
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:

	A	B	C	D	E	U	Total Number of Candidates
3885	10.2	20.5	39.3	59.4	79.0	100.0	466
7885	7.2	19.2	33.6	56.8	89.6	100.0	128

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

Statistics are correct at the time of publication

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