

Applied Science

Advanced GCE A2 H575/H775

Advanced Subsidiary GCE AS H175/H375

Report on the Units

January 2007

H175/H375/MS/R/07J

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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.

The reports on the Examinations provide information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

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G622: Monitoring the Activity of the Human Body

General Comments

All questions were attempted by the majority of the candidates. Time does not appear to have been an issue in terms of completing the paper.

Comments on Individual Questions

Question

- 1 (a) Many candidates appear not to have learnt the 'normal' values and were unable to recall the values required here. Tidal volume values did not always relate to 'dm³'.
- (b) Most candidates gave the correct answer with some evidence of an improvement in spelling. Phonetic spellings were accepted.
- (c) (i) Answers were often too general to credit. Common errors included reference to blowing as long as possible rather than as forcefully as possible. Also three readings are taken and the best recorded not the average.
- (ii) Candidates need to be reminded that where a question asks for data to be used marks will be allocated to reward appropriate data responses. Only the more able candidates noticed the reduction in the am/pm range.
- (d) (i) Majority gained the marks on offer here.
- (ii) A surprising number of candidates failed to answer this section. Some gave a quantity rather than a name.
- (e) (i) Answered well.
- (ii) Many candidates failed to recognise the change in frequency in the ECG chart. Suitable alternative wording was allowed, eg the different distances between similar peaks. Many answers included 'irregular' which was rejected.
- (iii) Answered well.
- 2 (a) This was well answered by most candidates with many gaining 5 out of the 7 marks available.
- (b) (i) Poorly done by a large number of candidates. A common misunderstanding was to interpret 'burning' as 'the burning off of food stores' and 'respiration' as 'breathing' or 'ventilation'.
- (ii) Few related their answers to functions at cellular level.

Report on the Units taken in January 2007

- 3** (a) Often answered well.
- (b) Often a vague description which was not credited.
- (c) Answered particularly badly with candidates describing the treatment and not the principles involved here. Answers were often imprecise and not credit worthy.
- (d) Answered well.
- (e) Answered well.
- (f) Answered well.
- 4** (a) (i) Answered well.
- (ii) Whilst trends were well described by many, most failed to gain the second mark available for an appropriate data value.
- (b) Generally well done – candidates were very aware of risk assessments.
- (c) Very poor response to this question by the vast majority of candidates. Many candidates left boxes blank instead of using ✓ or ✗.
- 5** (a) Very poorly answered. Most of those who attempted the calculation gained the 1 mark on offer for the difference value. Few candidates could carry the calculation through to find the percentage change.
- (b) Many candidates could provide the statements but fewer followed this up with satisfactory explanations.
- 6** (a) This was well done by many with many candidates scoring 3 or 4 marks. Some candidates failed to read the question carefully enough and provided irrelevant information. Statements and numerical data relating to Joe were ignored.
- (b) Some candidates did not refer to insulin and glucagon as the hormones involved and there is some confusion between their roles in the body. Inappropriate use of the terms glycogen and glucagon is still a problem for many but appeared to be less so this session than in the recent past. Liver involvement was rarely mentioned.
- (c) Many simply quoted statements about Joe. Few made their statements comparative or offered comparable statements about Andrew.
- (d) Many stated that Joe was diabetic but failed to explain why they thought that this was the case.
- (e) Many candidates were confused by the graphs. Few candidates provided a completely correct response.

G623 Cells and Molecules

General Comments

Plan: The majority of student plans investigated the water potential in potato and sugar beet tissue using a range of saline solutions and measured percentage change in mass or length of tissue samples. Centres are asked to ensure that candidates read the instructions brief carefully to avoid misinterpretation, eg use of sucrose solutions instead of saline, or beetroot instead of sugar beet.

Test: All questions were attempted by the majority of the candidates. Time does not appear to have been an issue in terms of completing the paper.

Comments on Individual Questions

Planning Exercise

- A** This needs to be a working document relevant to the intended practical work. An appreciation of electrical (top-pan balance); glassware and sharps hazards which are of low risk.
- B** Prediction needs to be comparative and related to water potential differences in both tissues.
- C** Justification of the prediction using existing knowledge of water potential and information on the accompanying OCR resource sheet.
- D, E, F, G** Many candidates did not consider preliminary work. Those that did assumed that observations from previous investigations using potato and sucrose solutions were acceptable here. In many cases, the preliminary work was not justified or related to the main method of the investigation. Candidates must realise that preliminary work has to inform the main method.
- H, I** Many candidates listed at least two secondary sources. Candidates must ensure however that full reference details are given, ie full website address and or title, author, publisher for texts. They must state how these references have helped in the investigation to be awarded I.
- J, K** Many candidates achieved marking point J. However a lack of detail in the method or confusion of techniques within a single method meant that many candidates did not achieve K. Some candidates failed to appreciate that their method should have been comparative.
- L, M** Candidates need to provide qualified names for equipment and quantities to be awarded M.
- N** Candidates need to appreciate the importance of repeats and the need for experimental data to be comparative in this investigation.
- O, P** Whilst the majority of candidates stated a minimum of 5 saline concentrations, the range stated did not always relate to the information in the insert and/or their prediction.

- Q, R** Whilst many candidates stated a minimum of 3 variables as dependent, independent and controlled variables, very few candidates explained how the controlled variables were to be controlled.
- S** Many candidates planned to tabulate their data in a suitable format. However, units of measurement must always be included in the headers.
- T** Many candidates planned to display their results graphically. Some went as far as calculating water potential in kPa using calibration curves.
- U** Means and % change in mass were the most common calculations seen in scripts.
- V** A large number of candidates indicated possible conclusions graphically. Many highlighted the expected concentration of saline which gave no increase or decrease in mass or length as being equivalent to the water potential of the tissue. Graphical display allowed a comparison in the expected water potential in both tissues.
- W** Some candidates were able to recognise one possible source of error in their equipment. At least two sources are needed to award this marking criterion ('recognises sources of error').
- X** Many candidates were able to suggest at least one possible method to improve the accuracy or validity of their data.
- Y** Very few candidates failed to use scientific terminology appropriately.

Test

- 1** (a) Most candidates gained 3 out of the 4 marks. Some candidates failed to use the terms 'resolution' or 'magnification' and resorted to 'can see things more clearly'.
- (b) (i) Generally well answered but candidates must be encouraged to ensure that the label lines are drawn to touch the object they are labelling and not 'just in the general direction'.
- (ii) Well answered by the majority.
- (iii) Whilst many candidates scored the mark for correct measurement in mm, many failed to gain the mark for calculation and conversion to μm .
- (iv) Not answered well. Candidates did not know what monoclonal antibodies were or how they could be used to identify genetic diseases. This area of the specification needs to be covered more thoroughly and students need to appreciate the difference between antibodies and antigens. More able candidates did mention the ELISA test.
- (v) This section was attempted by many candidates and most scored the two QWC marks. It is pleasing to note that candidates are now referring to a range of moral and ethical issues in their answers and not simply stating 'for religious reasons'.

Report on the Units taken in January 2007

- 2 (a) (i) Many candidates could define monosaccharide and hexose.
(ii) Very few candidates gained marks here. Many candidates did not appreciate the formation of water in the formation of a dipeptide. Many could not draw the structural formula of either product correctly.
- (b) Whilst many candidates are now capable of describing the test for starch, there are still many who cannot. Many did not appreciate the need for boiling sucrose with acid and then neutralising the solution before heating with Benedict's reagent. The colour change from blue to brick red or orange red is still causing problems for weaker candidates. Only the more able candidates appreciated that enzymes are proteins and can therefore be tested for using Biuret reagent.
- 3 (a) Most candidates scored maximum marks in this section although some need to ensure that they are familiar with the counting procedure when using a haemocytometer.
- (b) Generally well answered.
- (c) Very few candidates gained maximum marks. Many scored 2 out of the 4 marks. Many failed to appreciate the conversion factor of mm^3 to cm^3 .
- (d) This section was answered correctly by many candidates. The most popular answers in section (i) were cells dead or only one square counted. In section (ii) many candidates stated the Coulter Counter or count more squares in their answers.

GCE Applied Science Portfolio Units AS

General Comments

This is the second January assessment session for this qualification with many more Centres now offering their candidates portfolios for assessment. It is notable that many Centres have applied the assessment criteria very accurately and have assessed their candidates' work at the correct level.

The portfolio units available for this session were as follows:

- Unit 1 (G620) Science at Work
- Unit 2 (G621) Analysis at Work
- Unit 5 (G624) Chemicals for a Purpose
- Unit 6 (G625) Forensic Evidence
- Unit 7 (G626) Physics of Sport

The majority of Centres were very responsive in returning scripts for moderation and where there was low entry it was appreciated that Centres sent all scripts directly to the moderator; this saved time and led to an efficient moderation exchange, some Centres however did not include the Centre Authentication form with the candidates' work and additional letters needed to be sent to ensure this was included. Work from many Centres was well organised and clearly annotated with the assessment criteria codes. This helped moderators locate assessment requirements over a wide range of candidates' work that was presented. Appropriate page numbers on portfolios is really appreciated as this helps moderators locate work. It is also very useful to the moderators when Centres include the tasks sheets set for the portfolio work; this helps to support the moderation process.

It was good to see that many candidates had been on industrial visits or speakers had been into schools and colleges, this really supports this qualification and hopefully will continue. Some high quality and interesting up to date science was seen and where Centres had given candidates clear well structured assignments linked to the assessment criteria, the work produced reflected the standard required for an AS level qualification. Risk assessments should be included with practical work as evidence of safe working is a requirement of the specification.

In the majority of Centres, candidates' work was at an acceptable standard for AS level with several Centres now being accredited. Some scaling of Centres did occur but this was where the work submitted did not fit the requirements of the assessment criteria. Centres need to watch that the candidates are directed to these requirements and do not include additional class work they have completed. Scaling also occurred at the higher mark bands where work did not reflect the requirements, ie work was not sufficiently detailed and accurate and evaluations not at a high enough level for A grade work.

Work selected for moderation reflected coverage of all the Units offered by this AS specification. A range of marks was seen. Candidates need more guidance and support in the use and selection of research material obtained from the internet

Unit 1 Science at Work

This is a mandatory unit and was completed by all candidates taking both the AS single award and the AS double award. A number of Centres had resubmitted upgraded work for this assessment session.

AO1a

Evidence of work from a wide variety of organisations was seen, eg airports, Rolls Royce, schools and colleges, incinerators, power stations, health & fitness clubs, zoos, safari parks, the NHS, pharmacies, dentists and opticians, food and drink producers, metrological office etc.. Many candidates used research work from a range of sources, ie they had been to visit, had a speaker and used leaflets or the internet. It was good to see a lot of active involvement for these strands of the unit.

The survey requires evidence of information on the products made or service offered, the type of work, information on the science involved and some information regarding health and safety. Many Centres have encouraged candidates to include information on these points and record them in a range of ways – presentations, leaflets, posters and reports. Where candidates have used work from the internet they must be encouraged to select the suitable material and reference it. Some irrelevant work was seen occasionally but also a lot of good, precise high quality surveys were also produced.

The text of the survey should use candidates' own words. Information cut-and-pasted from internet sites is insufficient. If fewer than five surveys are included in the portfolio, then credit should still be given for those organisations that were surveyed. The mark allocated then needs to be averaged. Work seen this session tended to mostly include five surveys, which was good to see.

AO1b

The in-depth study should reflect coverage of all the bullet points given in the specifications. Candidates should choose **one** of the organisations studied in the survey for their in-depth study and where this was the case, good clear reports were seen focused on the requirements given in the specification and some excellent work was seen. It was still noted that many candidates did not focus on **one** of their surveyed organisations but wrote a little extra over a number of organisations from their survey and with no real indication of what should be marked. For this strand all the marks should be focussed on one organisation not from a number. Again, for mark band 3, the additional guidelines indicate a comprehensive study is required and information should be selected and clearly and logically presented. Some evaluation and justification of the use of the material needs also to be included for the higher mark bands. Comments on the validity of the sources used must be included if mark band 3 is to be reached. There was minimum evidence of evaluation and justification of the research material. However some excellent work was seen with precise informative research.

AO1c

Even for mark band 1 candidates need to show an awareness and a basic knowledge of Health and Safety laws and regulations. Some work still had no evidence of this, even though marks for this strand can be picked up throughout the work studied for Unit 1. Higher marks were seen where candidates linked Health and Safety with their surveys and also made suitable links in their main study. Contributions to this strand can come from evidence included throughout the unit, however risk assessments alone are insufficient for even mark band 1.

AO2a

Work for this strand generally did not reflect the requirements of the assessment criteria for mark band 2. Work should demonstrate suitable detailed knowledge of the impact the organization has on society and candidates should be directed to the specifications for the points required. The work for this strand, in the majority of scripts seen, was included as part of the in-depth study. It would however be useful for moderators if an indication was given on the URS form of where this evidence could be located within the unit. Best practice was seen in Centres where candidates had clearly extracted the evidence and related their knowledge to each of the bullet points in the specification and used their own words in the reports.

AO2b

It should be noted that mathematical guidelines of straightforward and complex calculations are given in the appendix of the specification. A wide range of suitable calculations were seen linked to practical work offered. Calculations submitted tended to be assessed correctly at mark band 1 and 2 but, for mark band 3, work should be correct and answers given to the appropriate degree of accuracy, and correct significant figures. Centres are now submitting a range of calculations rather than just one example and evidence of additional tasks to cover a range of mathematical work was also seen to support mark band 3.

AO3a

Most Centres are now submitting two practical activities at the correct AS standard for this part of the assessment. Many Centres used the suggestions given in the teacher's guide but a wide range of interesting work is now being submitted. Work is also being supported by interesting information linked to vocational contexts, this is good to see. Basic titration work is often linked to food/water analysis and various physical testing has been seen. A range of AS level practical work covering physics, chemistry and biology has been submitted this session.

It may be useful in the future to include a brief statement from the assessors that the practical work had been safely completed. Risk assessments should be included, with evidence to show that they have been used during the practical work.

AO3b

It should be noted that AO3b is assessed for recording only. Accuracy of recording has increased this session. However, it needs to be noted that the recording of titration results should be at least to one decimal place and set out in a suitable format if mark band 3 is to be awarded. Measurements need to show the required precision and include the relevant units. Omission of units was still widespread. Candidates can not reach mark band 3 if they have been provided with the format to record their results.

AO3c

Generally work seen is now being assessed appropriately for processing with interpretation even for mark band 1. Candidates are now showing the methods of processing their results for higher mark bands, and, in some cases, evaluation of accuracy of apparatus and method is being included for mark band 3. Processing skills in graphs and calculations were clearly evident in work seen. However interpretation of results should include reasons.

Unit 2 Analysis at Work

Work moderated for this unit was much better this session. A range of energy policies were seen and a variety of practical exercises were submitted. It is hoped that minor amendments will be made to the assessment criteria to enable more accessibility for this unit. It is hoped that the amended assessment criteria will be introduced for use from September 2007.

AO1

The work produced on energy policies was wide-ranging. An excellent source of energy policies can be found from websites of universities. Many sites gave well structured information which could be used for the assessment criteria. Tesco also seems to have suitable work on their website. There was some generous marking for this strand but generally candidates were giving Energy policies now and not environmental ones.

Work for AO1b on energy efficiency was still weak and needs to include what measures are put in to place by companies and colleges/universities in order to become efficient. A definition of energy efficiency was often seen without any reference to anything else. Centres should focus on Section 2.2.5 'Efficiency' in the specification and link it to the requirements of AO1b.

Environmental issues are very topical and a great deal of good research has been produced here. However candidates need to ensure that they extract relevant information and relate it to their chosen organization. Although this has been difficult to cover by many Centres it is a both a very important and topical issue and a much higher level of work has certainly been seen this session.

AO2

Although much better, work for this strand is still rather brief. A vague mention of heat from a fuel is insufficient. It is important that candidates describe the different types of energy transfers that might be present in the generation of electricity. More relevant data is now being seen but candidates need to make a comparison of the relative benefits and problems of large-scale and small-scale electrical generation, not just give basic information. Accuracy and correct solutions are needed to fulfil the mathematical requirements of mark band 3.

AO3

A wide range of practical work was again seen which reflected all the mark bands. Work seen generally reflected mark bands 1 and 2 but it still needs to be noted that work for mark band 3 needs to be suitably detailed, with evidence of vocational links and with evidence from the assessor that risk assessments have been produced and used and equipment has been safely used. Results need to be suitably presented, processed and interpreted. Suitable evaluation is needed and this needs to be focused on the method and outcomes of the specific experimental work completed, not just a generic statement of the success of the work. The requirements of the assessment criteria for each practical include production of a suitable report. This does not necessarily mean rewrite a method followed a reference to the standard procedure followed is sufficient.

Centres need to be aware that the requirements of the practical work in this unit include two physical analyses both chromatography and colorimetry, one qualitative chemical analysis examples can include investigative work on unknowns, forensic investigation, 'mummion', water, pollution analysis and one quantitative analysis examples seen included analysis, of water vinegar, iron tablets, bleach, ear drops, metallic solutions etc. Good practice was seen where practical work had a vocational link. It is hoped that Centres in the future will link the practical work to a suitable vocational context.

Unit 5 Chemicals for a Purpose

This AS level unit is an optional part of the double award and it is hoped that this unit will offer candidates the opportunity to extend their chemistry knowledge and study the properties and actions of examples of chemical products used in consumer goods. There is a lot of guidance given in the specification under 5.4 'Guidance for Teachers' and in 'Guidance on Delivery'. This section gives additional guidance for each section of 'What You Need to Learn' from the specification with examples of compounds, processes, catalysts and practical work. Centres are advised to use this when preparing for this unit.

AO1

Work was again seen which did not link to the requirements of the assessment grids, although it clearly states in the assessment criteria, to give four examples of chemical compounds (two organic and two inorganic). Some Centres still allowed candidates to submit lists and tables of many examples, without even focusing on the requirements for mark band 2. However Centres that guided their candidates correctly produced good work as those candidates chose suitable examples which allowed them to link properties to uses and structures and continue through AO1. AO1c also requires that one of the examples should be either a polymer or a detergent. The requirement for this strand is that the chemistry of the example chosen is researched and studied, so it is important that the polymer (eg) chosen has suitable reactions that candidates can understand. It is hoped that for higher mark bands evidence will be shown of understanding the chemistry of the chemical chosen.

AO2

A range of both organic and inorganic industrial processes were included, eg Haber process, Contact process, fractional distillation/cracking, reforming. Some presentation work was seen which clearly demonstrated understanding that was supported by comments from those listening. Work on catalysis was suitably discussed; however advantages and disadvantages of the processes were not given enough detail for mark band 2 or 3. Again, it is suggested that Centres refer to the teacher's guidance given in the specification.

AO3

Evidence was seen from good candidates of their research in workable methods for preparations with good records of all observations, weighings, melting points etc.. Risk assessments need to be included for all mark bands. Aspirin was generally the compound chosen. Candidates need to check that all observations and results are recorded and diagrams are drawn wherever possible; even diagrams from higher level candidates could be better.

Results need to include the yield and, for AO3b mark band 2, the yield should be calculated correctly and for mark band 3, how the theoretical yield is calculated needs to be included to reflect suitable knowledge at this level. For AO3b candidates need to record all mass results to the same number of decimal places for mark band 3. AO3c needs to show an awareness that the yield can be increased by changing conditions just for mark band 1. This strand was generally not well done and candidates need to work on improvements for this section.

Unit 6 Forensic Science

A limited amount of work was presented for this session. The work moderated however was appropriately assessed, and the task sheets which were seen, logically covered the requirements of the specification.

AO1

Centres whose candidates used scenarios to assess AO1a again produced some good evidence on the need to record and preserve a crime scene. However reports focused on the topics from the specification on this section were also satisfactorily assessed. Crimes in the school laboratories were quite popular. Candidates gave interesting and informative work on methods of recording the crime scene through the use of photography, video methods and sketches. Centres need to note the mark allocation for this section, AO1b (12 marks), and consequently, allocate an appropriate time for candidates to work on this section. This session the AO1b work was linked with AO3a and these seemed to work well together. Work on ethics was again varied but generally candidates were not gaining the higher mark bands. For mark band 3 a range of relevant information on ethical issues in forensic work is needed. Work on an ethical code for forensic scientists was seen this time.

AO2

Case study work generally this session was not as good as previously seen. More discussion of strengths and weaknesses of analytical techniques used and an understanding of the probability of guilt with a review of the evidence needs to be worked on with candidates. A range of Rf values for mark band 1, refractive index calculations for mark band 2 and, for higher mark bands, data sheets of qualitative data with appropriate problems.

AO3

Experimental work was wide-ranging and again included work on fingerprinting and taking footprints, measuring and the use of photographs, a range of microscopic techniques, use of artificial blood for testing and analysis, chemical tests, both inorganic and organic analysis of unknown substances. Chromatographic work included analysis of inks, dyes, amino acids, lipsticks, with the use of IR spectroscopy for identification. Refractive Index of glass was seen from most Centres. Mark band 3 candidates need to process and interpret their results in more detail.

Unit 7 The Physics of Sport

This AS level unit again was the most popular of the optional units. It was good to see work which showed candidates' enthusiasm in their work. Some Centres included a wide range of practical work linked to the appropriate topics to support understanding, which was good to see. Some excellent high quality work was seen from candidates for this unit.

AO1 & AO2

Six leaflets were expected and candidates are expected to extract relevant information on measurement, seeing, movement, choice of ball material, equipment and techniques in sport. Some candidates produced lengthy reports, very often including a lot of information directly taken from websites; this was not what was expected. Centres need to spend time with candidates teaching them how to extract the required research material obtained from the internet for their leaflets. For mark band 3, although the assessment criteria stated 'demonstrate a comprehensive and detailed knowledge and understanding' this should still be shown in a leaflet with evidence of suitable selection of the correct material. This demonstrates a higher level skill. Most work this session showed that the five different quantities that were moderated did show both work on the structure of the eye and a link to a chosen sport. This included archery, tennis, winter sporting activities such as skiing, snowboarding, etc. Rugby, football, tennis, basketball, snowboarding and skiing were popular sports chosen for the movement leaflet and, again, for mark band 1, candidates just gave evidence of musculo-skeletal systems with no particular link to the chosen sport. Evidence was seen of practical activities based on movement generated data which covered AO2 and AO3. Centres should refer to Section 7.2.2 'Physics of the Body'.

Care needs to be taken to ensure work on choice of ball material and equipment in sport did link to properties and did not solely focus on historical information. Research into materials and how new technology has improved performance was seen. Candidates did give evidence and reasons for selection of a particular material for its chosen use which allowed mark band 3 to be accessed. Work on sports techniques should allow candidates opportunity to complete practical work on momentum. This was seen in several Centres and candidates used results and data collected to support mathematical evidence for AO2b. This was good to see.

AO3

It again should be noted that 19 marks are focused on the practical requirements for this unit and consequently the time spent on practical work should be allocated accordingly. A range of practical work was seen this session which can be submitted for AO3. Evidence of planning is needed and a range of techniques must be included with a range of tests carried out and evidence of the need to repeat. Risk assessments should be included with suitable interpretation of data. The practical work can be included as an additional piece of work and not just included within a leaflet considered for the measurement criteria and, both units and devices for measuring should be included.

G628 Sampling, Testing and Processing General Comments

This is the first time that this paper has been set and the number of candidates taking the examination totalled 256. Some centres had previously entered candidates for the AVCE (Science) qualification, but there were also a number of new centres.

The specification content for this module is broadly similar to module 7446 in the AVCE (Science) and there was evidence of many candidates being prepared for this examination by using the previous 7446 material as well as the sample material provided by OCR.

The paper total was 90 and there were many papers that showed a score of between 30 and 50. Relatively few candidates scored in the fifties and sixties but sadly, there were a number of candidates who scored less than twenty and a few who scored only in single figures. A number of the candidates with low scores produced papers showing that they had not really used the case study material adequately in their preparation. Too often answers were given that had no relevance to the case study material, and where use of this would have led them to the required answers.

As expected, most candidates scored more marks on the first two questions; these were based on the two articles.

In general, there were two main weaknesses with many candidates' responses. The first was that the questions did not seem to have been read carefully enough. This paper is of A2 standard and the question stems reflect the higher level of understanding required. Very often the answer, although in itself a correct statement, did not answer the question posed. The other weakness concerns the use of mathematics. Changing the subject of equations causes problems for a number of candidates, and too often candidates did not look at their answers to see if the number produced was at all realistic.

A few papers showed evidence that the paper was a little long. All too often, this was due to candidates not dividing their time adequately between questions. Certainly, the better candidates showed that the paper could be finished in time, if care was taken with time allocation.

On balance the examiners felt that this first paper had worked well and had been discriminating and that all candidates had been allowed to show what they knew and had learnt.

Comments on Individual Questions

- Q1** This question was based on the article 'Osteoporosis – A challenge to modern medicine'
- a i** Many candidates gained the correct answer, 6.2 million, but there were a worrying number who gave the answer 6 200 000 million, this is rather larger than the entire population of the United States and candidates should have inspected this (wrong) answer to see if it was realistic in the light of the question.

- a ii Almost all candidates gained a mark here by dividing the answer to (ii) by five.
- b Oestrogen is a controlling hormone for the dissolving of existing bone and for bone formation. Some candidates could not make the distinction between 'controlling' and 'forming/removing' although this was seen in the article.
- c Few candidates commented that the body is designed to adjust to gradually falling hormone levels as we grow older and that interference with this process may cause problems.
- d Only a few candidates correctly showed the part of the pyrophosphate molecule that would be attacked by the controlling enzymes.
- e i The term 'placebo', commonly in medical testing, was not well known.
ii Many candidates realised that treatment for osteoporosis could not be affected by psychological factors.
iii It was pleasing to see that many candidates read the question correctly and gave correct responses related to **this** trial.
iv Almost all candidates stated, correctly, that the long term effects were unknown.
- f There are many factors to be considered when a new drug is to be trialled and candidates scored freely from the large number of acceptable choices provided in the mark scheme.
- g i Most candidates gave an acceptable response for possible problems with the use of fluoride as a treatment for the reduction in bone mineral density.
ii The stem of the question showed a graph which provided the answer to this question. Sadly, a great number of candidates chose to ignore this and lost marks as a result.
iii Here, too, many candidates did not use the graph provided.
- h The case study provided details leading to the answer and better candidates used the article correctly.
- i i The correct answer was 126 mg and many candidates gained a mark here.
ii Nearly all papers showed that candidates were able to use the mathematical expression provided. Surprisingly, however, few were then able to use their answer to demonstrate how the mass of calcium in the tablet was 119 mg.
iii Most candidates commented about poor calcium absorption and this gained credit. There were fewer responses which showed that candidates had deduced that there was no suggestion that calcium supplements prevented or cured osteoporosis.

Q2 This question was based on the article 'Bituminous materials'.

- a**
- i** It was very worrying that a significant number of candidates had little idea about representative sampling. This is an important feature that should be clearly understood.
 - ii** Some candidates did not read the question correctly. However, most candidates agreed with the examiners and stated that the geologist should tell his colleagues where he is going and for how long.
 - iii** Most candidates gained some credit for stating from where samples should be taken but too often, the reasons were unclear.
 - iv** The risks from falling rocks were the commonest acceptable response.
 - v** The examiners expected that 'where the sample was found' should be written on the label. This was often done.
 - vi** Few candidates commented that the finer the limestone particles then the greater the surface area and the more bitumen they could absorb.
 - vii** Almost all students were aware of the use of suitable resources to find a suitable solvent.
 - viii** Many candidates used a pestle and mortar to crush the rock. This was an acceptable response but the spelling was often poor! The use of a grinder or a crushing machine posed more problems, however, for the examiners. In contrast, relatively few candidates realised that mass was lost in crushing, for example, by sticking to the sides of the mortar. The reason why the solvent and the crushed mixture were stirred was to remove soluble material. Few gave this response. Similarly, even fewer realised that washing with fresh solvent will remove any traces of solution adhering to the insoluble material in the filter paper. Sadly, many candidates did not read this question correctly and did not see that the solvent was very flammable. As a result they heated directly using a Bunsen burner! Most, however, mentioned the use of a fume cupboard.
 - ix** There are still some candidates who cannot manipulate percentages correctly. This is a very important part of any analytical procedure.
 - x** The mean value for the percentage was usually given correctly.
- b**
- i** The need for the results to be comparable was commonly seen.
 - ii** Most candidates realised that, as the temperature increased, the bitumen became softer and penetration would therefore increase. A surprising number did not clearly understand the term 'viscosity' and thought that an increase in viscosity made the liquid 'thinner'.
- c** If the tar has a low viscosity, it will run through an orifice quicker and therefore a smaller hole will make the liquid flow more slowly, making measurements more accurate. This was a discriminating question.
- d** Candidates should have chosen a temperature between the boiling points of decane and bitumen. Few could express this clearly in their answers.

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- e** Most candidates realised that the smaller the sample the less reliable the weighing will be. A number stated, wrongly, that if the mass taken was ten times smaller, then the percentage would also be ten times smaller.
- f**
 - i** The idea of risk assessment was well understood.
 - ii** Relatively few candidates could devise a practical method, in a logical order. Some used the wrong experiment entirely.
- g**
 - i** Some candidates could not describe an emulsion and simply said that it was two insoluble liquids, one on top of the other.
 - ii** Most candidates used the article to provide an acceptable answer.
 - iii** The answer to this question could also be deduced from the article and many candidates were able to do this.
 - iv** Nearly all candidates stated, correctly, that 'Orimulsion' was not suitable for outside storage as it had a minimum storage temperature and that winter temperatures would be below this figure.
 - v** The article provided clues to the advantages and disadvantages of 'Orimulsion' and many candidates gained both marks.

Q3

- a** Almost all candidates were able to suggest an alternative supplier, another method, or 'make it yourself'.
- b** This was a question that asked candidates to devise a procedure, given an outline. It was uncommon to see a response with sensible answers presented in an ordered fashion, and this is an area that needs attention.
- c** Most candidates correctly gave heat/stir, filter or use stronger acid.
- d** This question too, asked candidates to complete a practical procedure. Most candidates stirred and filtered but few then went on to dry the cadmium, as requested in the question.
- e** The examiners expected **toxic** or a warning label indicating this to be on the bottle. This was usually done correctly.
- f**
 - i** This was done poorly by many candidates. Some could not identify the correct electrode and the method of oxygen collection suggested that many candidates had never seen a gas collected over water.
 - ii** The examiners were expecting the cathode to be weighed before and after. Too many candidates decided to scrape the zinc off the cathode and then weigh it.
- g**
 - i** The toxic nature of sulphur dioxide was generally recognised.
 - ii** This was a discriminating question. The usual correct response was to release the oxygen or to keep acid spray from exiting the vessel.

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- iii Most candidates correctly stated that a continuous process would be quicker/more economical.
- h
 - i The plots were usually correct, as was a line of best fit.
 - ii The density of brass, 8.4 g cm^{-3} was an easy mark gained by most candidates.
 - iii Most candidates gained the two marks but a few did not draw lines on the graph as requested.
 - iv Few candidates commented that the volume was measured to two significant figures but the density had been quoted to three significant figures.

G635 Working Waves

General Comments

Candidates demonstrated a contrasting amount of preparation for different sections of the syllabus. In addition to variation between candidates within centres, candidates from some centres were markedly better prepared for some sections than others.

Comments on Individual Questions

- 1 (a) (i) Most candidates correctly gave correct basic definitions but would have achieved more marks by specifying 1 at a point, or 2 at a time, or alternatively giving the units.
(ii) Only a minority of candidates answered correctly. Wrong answers included 1.5:1, 3:2 1:2.5, 1:1, 1.5:0, 0:1.5.
- (b) & (c) Only a minority of candidates demonstrated that they understood this use of the term coherence by correctly answering part (i). However a greater number were able to score one or two marks by sensible guesses at part ii and knowledge of an application (commonly Christmas lights) in part c.
- (d) (i) A large number of candidates were unable to give the correct answer. In addition to those who reversed the ratio or thought the refractive indices were the same, a number gave answers such as "thicker".
(ii) The best candidates were able to demonstrate that they had thoroughly understood the science in the specification.
- (e) Most candidates were able to score at least one or two marks (eg cheaper).
- (f) (i) & (ii) A number of correct responses.
(iii) 1 & 3 Few correct answers.
- (g) The mathematical requirements of this paper were few and the evidence of this section suggests that it is not the strength of most candidates.
- 2 (a) (i) Many confused this with the production of X-rays. Others thought they are produced by various detectors.
(ii) Many evidently had little knowledge of this application.
(iii) Correct answers were usually film badge, Geiger counter and Gamma camera. Some candidates appear to have some distance to travel before meeting the requirements of this specification, giving answers such as "X rays" and "Infra-red scanners".
- (b) (i) The majority of candidates knew that electromagnetic waves are the only waves that travel in a vacuum. The other two answers discriminated well according to their knowledge.
(ii) & (iii) Generally a well applied understanding of the basics of the electromagnetic spectrum.
- (c), (d) & (e) (i) Evidence of sound, basic knowledge.
- (e) (ii) Well answered by the best candidates.

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- 3** (a) (i) Although very hot was in bold, many answered red rather than white. Many thought infra-red was the main component. Very few described the spectrum in terms of the relative contributions of different colours/frequencies. Many ignored the word immediately and described the subsequent effect of cooling.
(ii) Few answers indicated a scientific understanding of the shift in the contributions of different frequencies.
- (b) (i) Many good examples. Some were too vague eg helicopters, but this mark was given if an answer found under b ii.
(ii) Most candidates obtained some credit and the question discriminated well between the better and less informed candidates.
- 4** (a) Well answered by a substantial number of candidates. Common errors included (ii) confused with biological cell sizes, or answers in MHz.
(v) Many answers relating to frequency bands.
- (b) Responses clearly indicated whether candidates had learnt about digital signals or not. (iii) required more advanced knowledge.
- (c) Correctly answered by most candidates.
- 5** (a) (i) Most candidates demonstrated at least some knowledge, many recognising that it is the ionising effect that initiates damage. Weaker candidates referred to rays emitting radiation.
(ii) Generally well answered. Some candidates justified radiotherapy rather than diagnosis.
- (b) (ii) A minority of candidates demonstrated that they had studied this device.
(iii) Most candidates gave reasonable answers. Confusion by a minority of candidates between diagnosis and therapy was condoned in this section. Some weaker candidates suggested standing behind intensifying screens.

GCE Applied Science Portfolio Units A2

General Comments

This is the first assessment session for this A2 qualification. Entry was limited with the following portfolio units submitted for moderation:

- Unit 8 (G627) Investigating the Scientist's Work
- Unit 10 (G629) Synthesising Organic Chemicals (Limited Entry)
- Unit 13 (G632) The Mind and the Brain (Limited Entry)
- Unit 14 (G633) Ecology and Managing the Environment
- Unit 15 (G634) Applications of biotechnology

Centres were very responsive in returning scripts for moderation and where there was low entry it was appreciated when centres sent all scripts directly to the moderator; this saved time and led to an efficient moderation exchange. Work from most Centres was well organised and clearly annotated with the assessment criteria codes, and indicated that staff and candidates were experienced in portfolio assessment, following on from AS in previous sessions. Centres are again asked to include the tasks sheets given to the candidates as this helps to support the moderation process.

In the majority of Centres, candidates' work was at an acceptable standard for A2 level. Limited scaling of Centres did occur but this was where the work submitted was not at an appropriate level for the A2 requirements of the assessment criteria.

Unit 8 Investigating the Scientist's Work

This is a mandatory unit and forms part of the synoptic assessment for both the single and double A level qualification. Some interesting work was submitted although entry was limited. Food investigative work, vitamin C, iron with both biological and chemical links, health and fitness, electrical and physical properties of materials, effects of stimulants, energy drinks, caffeine etc. on performance was all seen. Candidates can base their experimental investigative work on any topic, however, in order for the assessment criteria to be covered, candidates need to build on the skills and knowledge from the AS qualification.

Centres need to be aware that the requirements for AO1 strand should include a full holistic plan, which is not just the aims of a series of experiments; it needs to include a detailed log of the full investigation with the appropriate monitoring for AO3. The plan should not be 'written up' after the work has been completed. It is hoped that this unit will test both organisational skills as well as the use of experimental techniques. Centres are advised to look at the exemplar work on the OCR Website for the GCE Applied Science A2 if they are unsure of the requirements. AO1 should include evidence of both scientific principles and details of a range of experimental techniques. Some candidates tended to be quite repetitive in their chosen experimental work. A variety of different techniques is preferred.

Risk assessments need to be included with all experimental work to fulfil the health and safety requirements. For mark band 2, AO1b needs to show evidence of a range of relevant research with information on why this has been chosen with statements to support its validity. Mark band 3 needs to also include constraints that the candidates are working to with suitable contingency plans.

Centres need to ensure that when the investigative work has been decided upon candidates will be able to gather sufficient data to cover the requirements of AO2. Not only data for calculations but also there needs to be a suitable vocational link. Candidates should not just be doing volumetric analysis or physical testing in isolation.

It is useful if Centres can include with this unit evidence that candidates had actually carried out the practical work and evidence that they had completed or used risk assessments. A statement written on the candidates' work is sufficient or alternatively a certificate of completion of the practical. A write up of the method etc. is not evidence that the candidates have completed the practical requirements.

Evaluation was quite weak and Centres need to work on this strand with their candidates.

Unit 14 Ecology and Managing the Environment

Candidates' work for this unit showed much evidence of a wide variety of fieldwork and visits undertaken. Work moderated consistently reflected candidates' enthusiasm and interest in this topic. Several candidates produced high quality work which reflected suitable coverage of mark band 3 requirements and this was good to see.

Centres which gave candidates assignments focused on the requirements of the assessment objectives allowed them to produce logical and relevant work which gave access to the high mark bands, and work produced for AO1 reflected high level knowledge and understanding of the relationship between organisms, their physical environment and each other in ecological succession. Research on the effect of agricultural practice, human habitation and greenhouse gas production on ecosystems and biodiversity was also extensive where candidates had been given the appropriate guidelines and support. It needs to be noted however that for mark band 3 evaluative work and justification on the choice of material needs to be included. A great deal of up-to-date and interesting research was included in this section. The weakest strand for this unit was possibly AO2a the scientific, moral and ethical reasons for preserving ecosystems and species diversity. Candidates produced information related to (eg) wildlife preservation work, the RSPB and good work was seen where candidates had had visiting speakers, been on visits and had gathered their information by questioning staff involved in projects involved in methods used to manage ecosystems and preserve species diversity. Candidates however must include data /information which related to the success of a project managing one ecosystem.

Calculations were usually linked to data gathered from practical work carried out and again, Centres need to ensure that if they are going to use this, suitable opportunities are given for candidates to collect quantitative data.

Practical work was wide-ranging and included investigative work based around candidates' school or college or to field trip work which took place over one or many days. A range of experimental techniques was seen and it was good to see photographic evidence of work carried out. Risk assessments need in some cases to include more detail and should be working documents rather than an addition to a report. Where chemicals have been used in testing work these should be mentioned in the report. It may be useful to include a risk assessment for candidates when they are out gathering their data and one when they are analysing in the laboratory. Risk assessments for work completed back in the laboratory were often omitted. Conclusions at mark band 3 must show suitable interpretation of results and be related to the occurrence and distribution of species within the ecosystem studied.

Unit 15 Applications of Biotechnology

This was also a popular unit for this assessment session. Again candidates produced some high quality work which showed good research skills and investigative practical work. Booklets produced for AO1 showed a variety of information on the science of genetic engineering and the use of recombinant DNA technology. High marks were gained where candidates had clearly structured their research work, showed the relevant understanding of these topics and given evidence of the use of a range of sources. Quantity does not necessarily mean high marks can automatically be given. Work for the higher mark bands should not be sections just cut-and-pasted from the internet but show suitable selection and use of the researched information.

AO2 was possibly the weakest strand for this unit. Mark band 1 was easily covered, with candidates adequately describing how successful recombinant DNA technology is in solving problems associated with food production by crop plants. Basic conclusions were given to support the overall benefits of the technology, however, for mark band 2 and 3 for AO2a and AO2c, more evaluative work is needed to support these higher mark bands. Mathematical requirements seen were generally reflective of mark band 1 & 2 but additional work is needed to ensure suitable coverage of complex calculations. Centres are asked to refer to the Appendix on mathematical requirements in the specifications.

Again in order to reach the higher mark bands for AO2c for mark band 2, candidates need to summarize moral, ethical and environmental issues concerning the use of recombinant DNA technology in the production of GM plants with an explanation of two types of controls placed on scientists that work in this field. Mark band 3 however needs a more detailed report with additional explanations and evaluative work on the two types of controls placed on scientists and how effective they are.

For AO3 a range of relevant practical work was seen but plans need to be clearer and indicate to the reader the full intention of the investigation. It was good to see preliminary work from candidates and in some scripts good research work on enzyme activity was included. Evidence of good displays of results need to be included for AO3c. Conclusions and interpretation of results were often quite basic. Candidates need to ensure they spend the appropriate time on AO3c and AO3d to ensure sufficient coverage for the requirements of the assessment criteria. For AO3d level 3 candidates need to check the industrial links are made and care needs to be taken to cover all parts of this strand.

**Advanced GCE Applied Science AS (H175, H375)
January 2007 Assessment Series**

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of candS
G620	Raw	50	40	35	30	25	20	0	377
	UMS	100	80	70	60	50	40	0	
G621	Raw	50	40	34	29	24	19	0	279
	UMS	100	80	70	60	50	40	0	
G622	Raw	90	70	61	52	44	36	0	751
	UMS	100	80	70	60	50	40	0	
G623	Raw	90	70	61	52	44	36	0	177
	UMS	100	80	70	60	50	40	0	
G624	Raw	50	40	35	30	25	20	0	106
	UMS	100	80	70	60	50	40	0	
G625	Raw	50	40	35	30	25	20	0	52
	UMS	100	80	70	60	50	40	0	
G626	Raw	50	40	35	30	25	20	0	101
	UMS	100	80	70	60	50	40	0	

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
H175	300	240	210	180	150	120	0

	Maximum mark	AA	AB	BB	BC	CC	CD	DD	DE	EE	U
H375	600	480	450	420	390	360	330	300	270	240	0

Report on the Units taken in January 2007

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

	A	B	C	D	E	U	Total nos of candidates
H175	0.0	408	19.0	57.1	85.7	100.0	26

	AA	AB	BB	BC	CC	CD	DD	DE	EE	U	Total nos of candidates
H375	0.0	0.0	0.0	3.1	12.5	31.3	53.1	81.3	93.8	100.0	32

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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