OCR
RECOGNISING ACHIEVEMENT

GCE

Applied Science

Advanced GCE **A2 H575/H775**

Advanced Subsidiary GCE **AS H175/H375**

Examiners' Reports

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H175/H375/R/11

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This report on the Examination provides 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 specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

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Chief Examiner's Report

The numbers of candidates studying this qualification has continued to increase, with several new centres now following this applied science course both at AS and A2. It was evident from the type and quality of the work seen that the new candidates have come from a range of level 2 science backgrounds. Some have previously studied applied science at level 2, although this session, as some more traditional exercises were seen, it seems that candidates may have also come from more traditional science GCSE backgrounds.

OCR has now introduced Moderation Manager for both AS and A2 qualifications. This is an electronic system for the request and selection of the portfolio units which has consequently led to a much quicker turn around of scripts for moderators. There is now no need to send MS1 forms to moderators, although it is still necessary for centres to send Centre Authentication forms with the candidates' work. Centres are also asked to ensure that OCR's Unit Recording Sheet is completed for each candidate (available from the OCR website), with the centre and each candidate's name and number. More clerical errors were evident this session than previously.

Many centres have been accredited for this course, which allows candidates' work to be sampled over a three year period. Accredited centres need to ensure that the necessary Centre Authentication form is sent to OCR for each session that they are entering candidates for assessment and that if there is any change in the nominated staff, OCR is informed. It should also be noted that centres need to be accredited separately for the AS and A2 qualification.

It is important, in order to maintain standards for the portfolio work, that centres follow any guidance given in the moderation report which is provided for each unit moderated. These reports are available from Interchange. Internal moderation is particularly important in large centres where candidates have been taught by a number of teachers to ensure all work is assessed at the appropriate level and is consistent. A wider range of assessment decisions was more evident this session than previously.

Mark adjustments to candidate grades did occur this session, again at the higher mark bands and centres need to ensure that the quality of the work produced by the candidates reflects A grade standard, either at AS or A2. Additionally it was noticed that many centres were awarding top mark band 2 marks for work that was possibly only representative of mark band 1. Care needs to be taken for future submissions that work is not assessed too generously. Credit, however, should be given to those staff and candidates who are using the assessment criteria appropriately and consequently where work is being assessed at the correct level.

It was again noted by both moderators and the senior moderation team that candidates' portfolio work at A2 showed a marked improvement in research skills, evidence of independent working and more selective use of the Internet, although more accuracy and precision is still needed for higher level work. There is now a requirement to assess spelling, punctuation and grammar in both the portfolio and externally assessed units, and there is the opportunity to reach A* for the higher ability candidates.

There was again an increase in the number of candidates taking Unit G622 (Monitoring the Activity of the Human Body), and the level and quality of the work exhibited by the candidates was maintained with a good range of answers seen in this external assessment. The candidates seemed to cope well with the transition from GCSE as there were very few 'non responses' on the papers. The balance of the paper gave candidates the opportunity to access all questions.

Unit G623 (Cells and Molecules) also showed some increase in candidate entries. The plan gave candidates the opportunity to use the skills they gained from their portfolio work to plan an

investigation. Limited guidance is expected from staff during initial discussion of the tasks and centres also need to ensure that they allow and encourage independent thinking from the candidates. For the externally assessed test paper, the overall performance again varied between centres; centres either had a good range of marks or had many poor scripts. There was no evidence of candidates failing to complete the paper due to lack of time, although it was disappointing that candidates could not measure distances in mm.

The numbers of candidates taking both Unit G628 (Sampling, Testing and Processing) and G635 (Working Waves) has continued to rise with similar numbers opting for either unit. Centres need to note that these A2 papers do contain some part-questions that include Stretch and Challenge marks. These questions aim to test the ability of the candidates to demonstrate a deeper knowledge and understanding of the subject, to show ability to present a logical development of ideas, and to apply their knowledge to unfamiliar contexts.

For Unit G628, there continues to be gaps in candidates' answers as a result of a lack of knowledge of the scientific content relating to chromatography, IR spectroscopy and mass spectrometry, as responses were quite basic. Candidates still found it difficult to use their knowledge from the portfolio work to design or adapt experimental procedures for an externally examined paper. Apart from this, it was thought that generally the paper allowed candidates to demonstrate their knowledge and understanding and there were very few low scores.

For Unit G635, the overall performance was maintained from previous years with candidates now being better prepared on the new topics in the revised specifications which were introduced in June 2009. The candidate responses did, however, indicate that there was still some lack of understanding of standing waves.

G620, G621, G624, G625, G626
AS portfolio units

General Comments

This was the first summer session that this specification used Moderation Manager, which is an electronic means of requesting and selecting the portfolios for moderation. This did make the moderation process much more efficient and the majority of centres were very responsive in returning scripts for moderation and returning the Centre Authentication form (CCS160) with their candidates' work. There is now, no necessity to send MS1 forms to moderators or to include these forms with the sample if the candidate marks have been entered electronically – however, a copy of the MS1 can be useful for the moderator for additional clarification. It is important to ensure centre numbers and candidate numbers are recorded on the Unit Recording Sheet (URS) and attached to each piece of candidate's work.

Many centres are now accredited and are sampled over a three year period. Accredited centres need to ensure that the necessary Centre Authentication form is sent to OCR for each session that they are entering candidates

This year, moderators identified many clerical errors where the marks on the Interchange were not the same as the marks on the URS for the units. Centres are asked to check carefully the accuracy of their recording. Many centres have written comments and page references on the URS forms. This has been really appreciated and again supports the moderation process. Centres can help moderators to locate the work by indicating the assessment code eg AO1 (a) and indicating the mark band on the actual candidate's work.

Most portfolio work was well organised and presented using treasury tags, which allowed moderators to easily read and locate candidates' work. Centres are advised not to include candidates' work in plastic pockets or ring binders.

Good practice was seen in centres where detailed information was given which supported the competency of the candidates' practical ability. Again, it is useful if worksheets or assignment briefs can be included as this does give the moderator some background information of the support given to the candidate. In several centres, candidates had presented their work in clearly referenced bound booklets, work had clear contents and pages were well referenced with work easy to locate; the work seen also reflected commitment by both candidates and the centre, and was a credit to all those involved.

The majority of the candidates are competently carrying out a wide range of interesting research both on the Internet and by actual visits; this is to be commended and hopefully will continue. Most of the practical work seen shows a vocational link with suitable reasons of why the experimental work needs to be performed, but care needs to be taken that candidates are suitably recording their experimental results to the required precision and accuracy. Risk assessments are again showing improvements and are suitably focused on the specific hazards and risks of the experimental work carried out by the candidates and are used as working documents. Practical work needs to show progression from GCSE – some centres were not extending the practical work to reflect AS standard. These centres need to review their practical provision to ensure candidates can access the full range of the assessment criteria.

Credit should be given to those staff and candidates who are using the assessment criteria appropriately and consequently, where work is being assessed at the correct level. Whilst some high quality work has been seen from a number of centres, more mark adjustments of candidates' work occurred this session than in previous years, which again was mainly at the

higher mark band. Work submitted in these cases did not reach the necessary standards required by the assessment criteria ie work was not sufficiently detailed and accurate and evaluations not at a high enough level for A grade work. Centres need to be aware of this for future submissions and care needs to be taken by candidates to ensure that the level of the work reflects a full and detailed understanding of the required work. Candidates also need to take care that when they are using the Internet for their research, work is suitably selected and used to reflect the requirements of the criteria. Where work is taken from particular web sites, it needs to be referenced and integrated in the candidates' work. Centres are advised to spend time with candidates, teaching research and recording techniques.

Work selected for moderation reflected coverage of all the Units offered by this AS specification. A range of marks was seen. The portfolio units moderated this session were as follows:

- G620 Science at work
- G621 Analysis at work
- G624 Chemicals for a purpose
- G625 Forensic science
- G626 Physics of sport

G620 Science at work

The assessment requirements for the specification now include:

AO1: record of four surveys of science based organisations; one in-depth study; work on health and safety laws and regulations

AO2: evidence of impact organisation has on society; calculations on provided data or data obtained from experimental work

AO3: two practicals with a vocational context with recorded processed and evaluated results.

Candidates need only complete four surveys, with one of these used as a basis for the more detailed in depth study. Candidates should also be aware that spelling, punctuation and grammar are assessed within strand AO1.

Some candidates completed six or more surveys and included all their work in their portfolios. This is not required. If candidates carry out more than the required number of surveys, they should select the best for their assessment. There were also several submissions seen this session where it was difficult for the moderator to know which was the in depth study and which were the surveys. There should be a noticeable difference between the quantity and depth of work required for the surveys compared with the full study.

Each survey, however, needs to include:

- the products made or services offered
- the type of work that takes place
- an identification of the science involved
- information on health and safety constraints and guidance used in the organisation.

Care needs to be taken to ensure that these surveys do not include excessive 'copy and paste' material. The text of the survey should, where appropriate use candidates' own words. Lengthy detail is not required for these surveys as this work is intended to be an overview of science in different organisations. Centres should try and give more guidance to improve the quality of the selection, presentation and the level of the science identified, especially where candidates are aiming for mark band 3.

The range of organisations studied included water treatment works, food manufacturers, research organisations, pharmaceutical manufacturers, aquariums, zoos, garden centres, health clubs/gyms, supermarkets, bakeries, breweries, pharmacists, power stations, health centres, garages, colleges, universities, schools and fast food establishments, as well several chemical companies. Centres are urged to refer candidates to the requirements in the specifications so they can focus their work under the following bullet points:

- explanation of what is produced or details of the service offered
- information about the organisation including the number and range of staff employed
- further details on the scientific job roles specifically related to the chosen organisation
- some explanation and detail of the science involved in the organisation
- any further specific detail on research, quality control
- details and specific links of health and safety laws and regulations which can be used for the requirements of AO1c.

Centres need to take care that where assessment is at mark band 3, a comprehensive study is completed and information is 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. At times there was minimum evidence of evaluation and justification of the research material and assessment tended to be over generous at the higher levels.

Portfolio evidence for AO1c indicated that candidates are now giving the names of related health and safety laws and regulations. For mark band 3 however, candidates need to produce evidence that they understand how their chosen organisations comply with the necessary laws and regulations, so specific links need to be targeted. Assessment was often generous for these higher mark bands.

Candidates can link AO2a with their detailed study although where this is evident, it is essential that candidates do cover all the required bullet points. These are:

- benefits of the core business to society
- the contribution of the organisation to the economy
- details on waste management and environmental issues (where appropriate)
- ICT uses (where appropriate)
- details on the effect on the community of employment, transport issues and reasons for the position of the organisation.

A detailed and researched study of the impact of the chosen organisation on society is needed for mark band 2 and evidence of a full understanding of the core business of the organisation and its benefits to society are needed to support the higher marks. It is probably not advisable to focus on eg alcohol and its impact on society, as the specification refers to the impact of the *organisation*. An organisation that manufactures a product should be used rather than just the product itself.

The assessment guidance states a number of complex and straightforward calculations should be completed. If the data produced for practical work does not allow candidates to fulfil the higher mark bands then data can be supplied. It is useful if this is in the form of a task sheet which perhaps had to be completed by a technician, rather than just set examples. Although the completion of set examples indicates competence, the work provided should be linked to the requirements of work to be done in the workplace. It should be noted that mathematical guidelines of straightforward and complex calculations are given in the appendix of the specification. For mark band 3, work should be correct and answers given to the appropriate degree of accuracy. Correct significant figures errors were still seen here.

Good work was seen this session where candidates were linking practical activities to a vocational context, consequently giving a reason for the completion of the practical work. It is important however, to ensure that practical work is reflective of AS standard and consequently should show a step up from practical work covered at GCSE. Simple paper chromatography work is insufficient as a stand-alone practical exercise at this level. Practical work seen this session linked to analysis of water, vinegar, various foods and medical products, monitoring of healthy eating and lifestyle, and some physics related practicals on materials and electrical testing.

Candidates still need to ensure that for mark band 3, all relevant observations or measurements are made and accurately recorded with the appropriate precision. Some errors of significant figures and omissions of units were often seen. Centres are reminded that mark band 3 work should reflect A/B level candidates. Although some candidates are showing clear methods of processing their results and evaluation of the accuracy of the apparatus and method used, candidates generally need to spend more time in ensuring the accuracy of their work, if they wish to gain higher mark bands. Processing skills in graphs and calculations were clearly evident but units were still missing from graphs and scales were poor. Centres are encouraged to support their candidates to improve these skills.

G621 Analysis at work

The assessment requirements for the specification now include:

AO1: information showing an energy policy and energy usage of an organisation with a consideration of energy efficiency and environmental impact

AO2: study of large scale and small scale electrical generation to include energy transfers with data and calculations to show a comparison of fuel costs.

AO3: three practical analyses, one qualitative analysis, one quantitative and a third investigation with results processed and interpreted.

Work on energy policies seemed to be much better this session and some good energy policies were researched. Energy policies commonly seen included those from a range of supermarkets, eg Tesco, Sainsbury's and Asda, as well as British Sugar, Universities, schools and colleges. Most candidates seem now to be focusing on the energy policy rather than environmental policies.

It is evident from work seen this session that candidates are now using their research skills much better than previously seen. Candidates do still need to check that mark band 3 work needs not only to include a detailed description of an energy policy but also an evaluation of how energy consumption is limited.

Work for AO1b and AO1c seemed better this session and tended to relate to the candidates' chosen organisations.

AO2a was also better this session as work tended to support the requirements of the assessment criteria. Candidates do now seem to be focusing on describing and comparing large scale and small scale electrical generation. Care still needs to be taken however that mark band 3 work is of a high quality as well as covering the requirements of choosing two fuel or energy sources.

AO2b now gives candidates the opportunity to look at energy values and fuel/energy costs and to carry out appropriate mathematical calculations related to this data. This work generally showed improvement from previous assessment sessions.

A range of practical activities was seen for AO3a with some good work on enthalpy of combustion in addition to a range of qualitative analysis exercises. Again centres need to ensure that the work is a step up from that studied at GCSE, and that the quality of the observations recorded is accurate and detailed, with higher mark band work being supported by correct balanced equations where appropriate. Qualitative analysis is still quite weak in terms of the level of detail and accuracy that candidates submit. Accuracy and suitable precision are needed to support mark band 3 results. Evaluation 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 inclusion of an evaluation does not automatically indicate that candidates can gain mark band 3.

G624 Chemicals for a purpose

The assessment requirements for the specifications now include:

AO1: a description of two examples of inorganic and two examples of organic chemical compounds, discussing their chemical structure, properties and uses and a detailed account of two compounds one of which is made of oil

AO2: relevant research of one industrial process that involves the use of a catalyst; a report which includes an understanding of the social, economic and environmental impact of the product selected

AO3: a sample and an account of the preparation of two products that have been synthesised, purified and analysed.

Limited work was seen from this unit this session and it is still disappointing that work for AO1 still shows inaccuracies in formulae and a lot of 'copy and paste'.

This unit gives candidates the opportunity to extend their chemistry knowledge and study the properties and actions of examples of chemical compounds used in consumer goods.

Candidates should be guided to choose compounds which will allow them to find information on both uses and properties of these compounds. Sodium chloride, sodium carbonate, ammonia, sulphuric acid, ethene/polyethene, ethanol and ethanoic acid were commonly researched. It should also be noted that for the chosen compounds for mark band 3, details are needed on how the properties depend upon the molecular structure and how their uses depend upon the properties. Eleven marks are now allocated to AO1c, which involves candidates producing a detailed account of two chosen compounds one of which is made from oil. Candidates could do research and practical to support the understanding for this section, and could link to AO3 if required.

It is hoped that candidates will extend their chemical and experimental knowledge by preparing both an inorganic and organic compound.

Work seen this session was generously assessed, with candidates not including suitable observations, diagrams and suitable processing of results. For AO3a, centres needed to show evidence that candidates had researched, completed a detailed method for the preparations and completed some basic analysis of the compounds. Annotation by the teachers can support this and the method followed could be attached. For AO3a mark band 3, evidence that candidates had both purified and analysed the products was needed. Just a basic preparation alone will not allow candidates to gain mark band 3.

Candidates still need to focus more on the recording of initial and final weighings when carrying out preparations. Work should involve calculations on theoretical, actual and percentage yields, with the yield being calculated correctly. For mark band 3, evidence of how the theoretical yield is calculated should be included to reflect suitable knowledge at this level. For AO3 b mark band 2, candidates should record all mass results to the same number of decimal places.

For AO3c, candidates need to show an awareness that the yield can be increased by changing conditions. Actual workable suggestions are needed for mark band 2, and a full evaluation of the methods chosen with a possible comparison of the suggestions is needed for mark band 3. This is still not adequately covered.

G625 Forensic science

The assessment requirements for the specifications now include:

AO1: a knowledge and understanding of the need to preserve and record the scene of crime; the chemical, biological and physical techniques used to collect and visualise forensic evidence, including ethical considerations

AO2: a report on a forensic case study on evidence and proof; work which demonstrates the use of calculations to support forensic measurements or observations

AO3: at least one forensic analysis in each of the following areas – biological, chemical and physical techniques.

Some excellent forensic work was moderated this session. Work for this unit was generally appropriately assessed and reflected candidates demonstrating good research skills and interest in this topic. Good practice was seen by centres where work was selected, referenced and directly linked to the coverage of the assessment criteria. Evidence showed understanding of candidates' research work by either summarising in their own words or suitably referencing the work within the text.

Good evidence was seen for AO1a, with research work well selected to show knowledge and understanding of a range of techniques explaining the need to record and preserve a crime scene.

Candidates showed evidence of suitable research for AO1b which covered chemical, biological and physical techniques. Some good work was seen which indicated a range of ways in which forensic scientists collect and visualise evidence. This work in the main was suitably focused and evidence of research from forensic books, as well as the Internet, was evident. Centres, however, need to remember that spelling, punctuation and grammar need to be assessed within the requirements of AO1b.

Centres need to note, however, that for AO1c mark band 3, candidates' work should include the need for an ethical code, as well as a range of relevant information on ethical issues in forensic work. Several scripts were seen with no evidence to support this strand.

Strand AO2a again is showing good case study work with relevant information indicating:

- the ways in which forensic scientists ensure that the quality of evidence collected and analysed is objective
- the limitations
- the strengths and weaknesses of the analytical techniques used
- an understanding of the probability of guilt and of a need to review evidence.

For AO2b, standard calculations again show a range of Rf values for mark band 1, refractive index calculations and bullet projectiles for mark bands 2 and 3. It may be that centres are more inventive, in presenting the calculations. Several worksheets of the original exemplar work were seen this session.

For AO3, experimental work again included work on fingerprinting and taking footprints, measuring and use of photographs, a range of microscopic techniques, chromatography, qualitative and quantitative analysis, and the measurement of the refractive Index of glass. Some interesting work was seen on blood splatters, and use of pollen analysis was also included.

Mark band 3 candidates need to ensure detailed processing and interpretation of their results and a discussion of their significance.

G626 The physics of sport

The assessment requirements for the current specifications now include:

AO1: a series of four short sport guidance leaflets for the coaches at a sport and recreation centre to help them answer questions of a technical nature for trainees linked to Measurement, Seeing, Movement and Technique

AO2: a presentation which will discuss the required material properties and how these are achieved in sports equipment; evidence of the completion of a number of calculations related to the physics of sport

AO3: evidence of two investigations relating to the physics of sport.

Some higher level work was seen at moderation this session which reflected a good understanding of the requirements of the assessment criteria. Some excellent booklets were submitted by candidates, although some candidates still presented their work in the form of a report. Centres are directed to the information on page 106 of the assessment criteria regarding the target audience for these leaflets.

Candidates should be suitably selecting material for their leaflets and using the specification ref: page 33 for the content. Mark band 3 work needs to show detailed knowledge written, where appropriate, in candidates' own words, with evidence on the linking of scientific knowledge to the chosen sport or equipment.

For AO2a some good evidence of presentation work was seen. However, it is useful if centres record the outcomes of the actual presentation given by the candidates. If candidates complete PowerPoint presentations which include limited information, these should be supported with additional notes to indicate their knowledge and understanding. Opportunities for calculations did not seem to be a problem in this unit and a good range was seen.

Practical work this session has shown an improvement, with two investigations being completed by the candidates. A variety of investigative work was seen relating to optical work, properties of physical properties and momentum, which now reflects the correct amount of time being spent on practical work. Candidates who carry out two investigations do seem to have the opportunity to support in a practical way the theory they are researching in this unit.

G622 Monitoring the activity of the human body

Q.1 **(a)** Most candidates were confident when naming recreational and performance-enhancing drugs. No clear pattern of alternative responses was identified.

(b) The most common responses included chromatography and the ELISA test. Some candidates were slightly confused and referred to counting techniques for red blood cells.

(c) It was clear that many candidates appreciated the need to divide a sample into two or to take two blood samples at the same time. The checking against a standard was also understood.

(d)(i) The link between an increased number of red blood cells and the carriage of oxygen was recognised by many candidates. Some responses were slightly confused due to the inclusion of white blood cell counts.

(d)(ii) Many candidates were able to identify the key feature of taking a blood sample and checking it against a standard. Few considered repeating the test using the same sample.

Q.2 **(a)** It was encouraging to observe a wide range of symptoms for type 1 and type 2 diabetes. There was some misunderstanding about diabetes and weight gain but many candidates were aware of the differences between the two types of diabetes.

(b) The link between obesity in children/young adults and the early onset of diabetes was poorly expressed. There was some awareness of lifestyle issues, but many failed to identify type 2 diabetes as a possible consequence. Candidates did not appreciate that regular excess sugar in the diet and the resulting high levels of insulin could, in time, reduce the body's sensitivity to insulin.

(c)(i) The operation of a biosensor was generally not understood but it was reassuring to observe that many candidates were able to identify the impact of the biosensor's results on the sugar intake and/or insulin injections in a person with diabetes.

(c)(ii) Many candidates realised that it was important to reduce the intake of sugar in the diet and to take an insulin injection. However, keeping a careful record of food intake was not considered.

(d)(i) Relatively few candidates were able to calculate the answer correctly. Many were able to read the correct values from the graph but were not sufficiently skilled to then carry out the mathematical calculation for percentage increase.

(d)(ii) Although a number of candidates realised that the glucose was being used up, they did not link this to cellular respiration or ATP production. Very few appreciated that the loss of glucose via the urine would help to reduce the blood glucose concentration.

(e) The most frequent risk identified was contamination, with the corresponding procedure to reduce the risk being given as sterilisation or disposal of needles. Excess blood loss and bruising were rarely considered as possible risks. Some candidates showed poor examination technique and wrote their 'related procedure' in the section of the table describing the risk.

Q.3 **(a) (i)** It was surprising to note that many candidates did not correctly describe the features of alveoli for gaseous exchange. It was unfortunate for those candidates who described thin 'cell walls'. For those who obtained marks, the most common responses included thin membranes and large surface area.

(a)(ii) Many candidates obtained marks for this question. Diffusion was described in the correct context and the opposing direction of oxygen and carbon dioxide flow was appreciated. Some candidates struggled to complete their descriptions because of an apparent misunderstanding of alveoli and adjacent blood flow.

(b) The majority of candidates failed to recognise the blood vessel (B) in the photograph. Some described the structure as an alveolus.

(c) The damage caused to the alveoli was sometimes confused with that of smoking rather than disease. Some responses correctly included references to diminished surface area but the damage to blood capillaries was not appreciated by most candidates.

(d) It was encouraging to see that so many candidates understood the basic principles of using a peak flow meter, including the 'deep breath in' and 'hard breath out'. The need to take three readings and to select the highest value was described by relatively few candidates.

(e) Many candidates did well with this question. They had a good understanding of the roles of intercostals muscles, ribs, sternum and diaphragm. In some cases, the order of events was confused. It was rare to see a reference to the nervous system, but this did not affect the overall mark allocated.

(f)(i) A number of candidates realised that soft tissue was an important part of the response. Some, unfortunately, referred only to the generation of a 3D image.

(f)(ii) The wearing of metal jewellery and problems caused by noise or claustrophobia were successfully described by many candidates. Some candidates showed poor examination technique and presented the 'precaution' in the 'hazard' box in the table.

Q.4 **(a)(i) & (ii)** Many candidates were able to complete the two equations for cellular respiration. Some were less confident about anaerobic respiration.

(b) Although ATP was correctly identified by many candidates, other options were presented, including glucose.

(c) Many candidates successfully stated aerobic respiration but struggled to describe the features involved. Those who obtained further marks, tended to refer to the high level of ATP production, or correctly gave the number of ATP molecules produced.

(d) A number of candidates were able to refer to the lack of oxygen and the sudden supply of ATP for sprinting etc.

(e) A significant number of candidates failed to recall that cytoplasm was the site for anaerobic respiration. Some referred to mitochondria and others state muscle cells, indicating that they struggled to interpret the stem of the question.

(f)(i) Although the effect and supporting data were often well-described, some candidates struggled to provide an explanation or simply repeated the effect in this part of the table. However, a number of candidates did obtain five or six marks out of six for this question.

(f)(ii) This question was generally poorly answered. It was clear that the concepts involved were challenging and the question discriminated well at the top end of the ability range.

(g)(i) The correlation was often described correctly but some candidates incorrectly concluded that the running speed was increased because the lactic acid levels increased.

(g)(ii) Many realised that the lactic acid levels were lower, but some candidates gave confusing responses.

(g)(iii) The relevance of lactic acid retention was understood by many candidates. However, some described muscle pain rather than fatigue. Many realised that the overall performance of the athlete would be inhibited and their responses expressed this in a variety of interesting ways.

(g)(iv) The experience of candidates with planning practical investigations was put to good effect for this question. Many were able to make relevant suggestions to enhance/extend the study.

Q.5 **(a)(i)** Some candidates struggled to describe the use of gel for the use of ultrasound equipment. However, a number successfully appreciated that the exclusion of air was an important feature.

(a)(ii) This question did not present a problem for many candidates. They appreciated that the ultrasound waves would not pass through the bone. Some, unfortunately, simply considered that the bone got in the way.

(a)(iii) Some candidates did well with this question but a number struggled to describe the events and features fully. It was clear that a number of candidates were well-informed about the overall process of ultrasound scanning, such as it being not-invasive, but tended to include this information, incorrectly, in their response. The question required candidates to focus on explaining the principles.

(b) The unfamiliar context of the VSD in the heart was challenging for some candidates, but many did well and described the effect clearly.

(c) The key features of 'quick and cheap' were understood by many candidates. The idea of 'non-invasive' and 'real time' were also appreciated. However, relatively few candidates recalled that soft tissue was viewed.

(d) Many candidates obtained one or two marks for this question. Most recalled the use of ultrasound to examine the foetus in the uterus and its use for the identification of problems in named soft tissues. The uses of keyhole surgery, angioplasty and insertion of pacemakers were rarely considered.

G623/01 Cells and molecules – planning exercise

General Comments

A limited range of different methods to investigate the effect of sodium hydrogencarbonate concentration on the growth of a named cyanobacterium were seen in this task ie changes in mass/dry mass and colorimetry. Too many candidates did not use the information in the insert; many of the planning exercises from a large number of centres used haemocytometers and coulter counters, which were inappropriate for a filamentous organism. Centres are asked to ensure that candidates read the instruction brief carefully to avoid misinterpretation ie to ensure that sodium hydrogencarbonate concentration related to cyanobacterial growth was included in the plan. Some centres investigated the effect of changes in temperature and pH, whilst others chose to use inappropriate organisms such as yeast.

Whilst there is no requirement for candidates to carry out the investigation, some of the assessment objectives are more easily accessed if candidates do so. Limited guidance is anticipated from subject staff, during initial discussions of the task. Centres however, must ensure that by signing the authentication form, the work submitted is that of the candidate. Plans from too many centres had evidence of heavily guided and assisted work which should have been reported using the necessary paperwork provided.

In future, it is suggested that centres provide candidates with a self assessment tick sheet to ensure that they address all the marking points in their plans before final submission.

Centres are asked to ensure that attendance registers for both components are included with the candidate scripts. There are still anomalies in script packaging. Centres must ensure that each component for unit G623 is sent in a separate grey sack using the pre-printed OCR labels to ensure effective script tracking by OCR.

Comments on Individual Questions

Marks ranged from 1 to 23 out of 25.

A This was achieved by many candidates who could identify at least three potential hazards from glassware/electrical/allergy/chemical/ biohazard. Many centres used standard forms which cued candidates into identifying relevant hazards, risks and control measures. A few candidates had copied and pasted long generic risk assessments that were not specifically related to the task.

B This marking point was awarded if a relevant statement was made with reference to changes in sodium hydrogencarbonate concentration and growth. Weaker candidates described the effects of temperature and/or pH and failed to link concentration changes to growth.

C This marking point was awarded if the prediction was clearly justified. Common justifications made reference to the availability of carbon dioxide for photosynthesis or environmental changes in pH.

D-F Evidence of relevant preliminary work carried out by candidates was seen in this session. However, weaker candidates still lack clarity about the role or purpose of supporting preliminary work. Preliminary work **must** inform or develop the main investigation. 'E' and 'G' marks were lost due to lack of detail.

H-I The majority of candidates achieved marking point 'H', although the range of secondary sources cited was limited in many centres (eg Wikipedia and Google images). There is an expectation that candidates should use the stimulus material within the OCR insert to extend their research to include other reliable sources, which help to inform the planning process. Weaker candidates failed to explain the benefit or relevance of their sources in the development of the plan and the inclusion of large quantities of downloaded material from the internet was not credit worthy.

J-K Marking point 'J' was achieved by the majority of candidates, whose methods indicated basic practical skills and reasonable accuracy. However, marking point 'K' was not awarded very often due to the planned use of haemocytometers, which was inappropriate for the choice of organism used.

L-M The majority of candidates were awarded marking point 'L' for a generic list of the main items of equipment and materials. However, marking point 'M' was not readily awarded since candidates failed to indicate the numbers of each item and specific volumetric sizes required. This is an area for development in future examination sessions.

N The majority of candidates appreciated the need for repeats.

O Very few candidates achieved this marking point. Some candidates did appreciate the need for a control using distilled water whilst others appreciated the need for a suitable range to find the optimum concentration for growth.

P The majority of candidates stated an appropriate range of at least four different concentrations, based on their prediction or research. However, where appropriate, candidates are advised to plan for five different values in the range in future sessions.

Q-R Misunderstanding between independent, dependent and control variables was still apparent in some centres. However, the majority of candidates could state at least two control variables although few could state how these would be controlled. Many referred to the equipment items to be used but made no reference to quantitative methods. In future, candidates must state how a variable is to be controlled, using quantitative data, if appropriate. Consequently R was not awarded very often.

S-T Tables were usually drawn for 'S' although lack of appropriate headings and/or units in the header(s) lost the mark. Candidates must ensure that tabulated data is presented in a clearly defined box and not as a 'list' and that appropriate units are given in the headers of the table. Graphs were included by approximately 50% candidates although marks were lost for lack of relevant units on axes.

U Well answered. For those candidates who included the need for repeats in their plan, many calculated the mean % absorbance/transmission or mean % change in dry mass.

V It was pleasing to note that more candidates linked their expected observations to confirm or reject their original prediction in this session. Those that did, often achieved the marking point through annotation of an appropriate graph, credited in 'T'.

W Many candidates just stated 'systematic' 'procedural' and 'equipment' errors without further clarification. 'W' was only awarded for at least two sources of error, explained in detail.

X This was awarded if candidates could suggest ways for improving accuracy and/or reliability. X was often awarded for alternative methods to measure population growth. Whilst some candidates referenced the use of published data, others extended the concentration range to find optimum growth.

Y This was achieved by most, although candidates are advised to complete a thorough check of their work prior to submission to avoid unnecessary misuse of scientific terminology and incorrect spelling of key words.

G623/02 Test

General Comments

Centres are asked to ensure that attendance registers for both components are included with the candidate scripts. There are still anomalies in script packaging. Centres must ensure that each component for unit G623 is sent in a separate grey sack using the pre-printed OCR labels, to ensure effective script tracking by OCR.

Marks ranged from 2 to 33 out of a total of 45.

Each of the questions, and the paper as a whole, achieved satisfactory differentiation across the ability range. Questions which targeted the A/B grade boundary were Q2c; Q3b, Q3e; Q4a and Q4b. Question 4(a) and Q4(b) revealed few high marks due to the demographics of the cohort.

There was no evidence of candidates failing to complete the paper due to lack of time. There was no common misinterpretation of the rubric.

The overall performance varied between centres. Centres either had a good range of marks or had many poor scripts.

It was disappointing that so many candidates could not correctly measure the distance between points X and Y in mm (particularly as units were given) or calculate the magnification of the diagram. It is also noted that many candidates struggled to draw a suitable line to complete the graph in question 3.

Comments on Individual Questions

Q.1 **(a)** This section was not well answered. Very few candidates gained more than three of the available five marks. Of the five clues in the crossword, 'dead', 'and 'vacuum' were most regularly identified correctly and 'heavy metals' least so.

(b) Most candidates gained one mark in this section although many did not appreciate that since electrons are easily absorbed, sections must be thin to enable the electron beam to pass through the specimen to create sufficient contrast in the image.

(c) The majority of candidates achieved at least two out of the three available marks in this section. However, centres are asked to ensure that candidates provide comparative responses in future eg greater resolution or magnification.

Q.2 **(a)** Structures A and B were correctly identified by most candidates. The spelling of 'vacuole' created problems on many scripts so some tolerance of inaccurate spelling was accepted during the marking process.

(b) This section was not well answered. Many candidates lost marks for stating the distance between X and Y in cm rather than mm. Many did not convert mm to µm correctly. Many candidates multiplied by 24 rather than divided.

(c) Many answers in this section were of poor quality. Accounts were often too vague to award marks despite many candidates who chose to use haemocytometers in the planning component, and gave very detailed information in their plans. Despite this, a minority of candidates only scored two out of the four marks. Answers of this type need to be in a clear and logical sequence and include the relevant points, as indicated in the published mark scheme.

(d) This section was generally well answered. In section (i) many candidates made reference to monitoring temperature to optimise yeast cell growth. More able candidates appreciated the monitoring of microbial contamination or alcohol content.
In d(ii) and d(iii), most candidates were familiar with the use of a Coulter counter and so gained full marks in both sections.

Q.3 **(a)** It is pleasing to note that there was an improvement on previous sessions in candidates' responses to this section. Many could state 'Biuret' as the named chemical test although some confusion still exists with the test for a reducing sugar in the chemical result.

(b) This section was not well answered. A few candidates appreciated the 3D or compact shape of the polypeptide or amino acid chain. More able candidates could correctly name specific examples of the chemical bonds responsible for maintaining the tertiary structure. However, many candidates failed to attempt the question or produced responses that were too vague to be credit worthy.

(c)(i) Few candidates could correctly calculate the rate of digestion and time taken for digestion in the table.

(c)(ii) The majority of candidates were awarded two marks in this section for correctly plotting data from the table, despite many previous incorrect calculations in (c)(i).

(c)(iii) There was considerable variation in the quality of suitable lines needed to complete the graph. Centres are asked to ensure that candidates complete tasks such as this using a sharp pencil and avoid drawing multiple/ 'hairy' lines.

(d) Common answers included reference to an increase in temperature by $5^{o}C$ intervals. However, few candidates really appreciated the need to repeat the experiment at shorter intervals around the optimum. A common mistake held by many, made reference to repeat readings.

(e) Many candidates achieved at least one out of the three marks, mainly for a reference to the optimum temperature of 'Bio-White' activity or a decrease in rate after $45^{o}C$. Very few full explanations were given by candidates. Least common answers included references to enzyme denaturation and breakage of hydrogen bonds. A few candidates also discussed reductions in enzyme-substrate complexes after $45^{o}C$.

Q.4 **(a)** This section was not well answered. Responses from candidates provided little evidence of knowledge of DNA structure and its role in the concept of protein synthesis (albeit in outline only).

(b) Very few candidates achieved marks in this section. Knowledge of osmosis was vague with many candidates failing to refer to water potential in their definitions of osmosis and many just stating a 'movement from a high concentration to a low concentration', which is insufficient. Very few candidates appreciated the build up of chloride ions in cells of CF sufferers and consequently the changes in water potential in the cells/intercellular fluid, which results in water uptake by cells from epithelial mucus.

(c) Most candidates achieved at least two out of the three marks in this section. Common answers included reference to breathing/ventilation difficulties; blocked airways; coughing and increased risks of infection.

(d) Surprisingly, few candidates achieved more than one out of the two marks in this section. Many had little knowledge of CF problems relating to digestion. Weaker candidates referred to the need to digest mucus in the respiratory tract which was not appropriate here.

G627, G629, G630, G631, G632, G633, G634 A2 portfolio units

General Comments

Work selected for moderation reflected coverage of all the units offered by this A2 specification. A range of marks was seen for each unit. The portfolio units moderated this session were as follows:

- G627 Investigating the scientist's work
- G629 Synthesising organic chemicals
- G630 Materials for a purpose
- G631 Electrons in action
- G632 The mind and the brain
- G633 Ecology and managing the environment
- G634 Applications of biotechnology

It was again pleasing to see that several centres had followed the guidance given in the moderators' reports in June 2010. This is essential if standards are to be maintained and scaling is to be avoided in future submissions.

It was noted by both moderators and the senior examiner team that generally candidates' portfolio work at A2 has continued to show a marked improvement in research skills, evidence of independent working and more selective use of the Internet. Portfolio work, in the main, showed good progression from AS to A2. However, there is a minority of centres where work is not suitably referenced, with candidates continuing to include excessive information taken directly from websites and practical work not showing progression. There is now a requirement to assess spelling, punctuation and grammar in the portfolio units, and the opportunity to reach A* for the higher ability candidates.

Several centres had their marks adjusted this session, mainly due to generous assessment of the higher mark bands. Centres are advised to refer to Appendix A (page 93) of the specifications for the performance descriptions for A2 work. Scaling of the higher mark bands was due mainly to candidates' not demonstrating the necessary standards required by the assessment criteria ie work was not sufficiently detailed and accurate, with insufficient data at a high level of precision and reliability. Centres also need to be aware that when awarding full marks at mark band 3, work should be free of any minor errors, should reflect independent work and show evidence of scientific understanding and generally full coverage of the requirements of the assessment criteria. The practical work completed by the candidates must be reflective of A level standard for all levels of assessment.

Where centres are awarding candidates 42+ marks for their overall work, evaluations should be sufficiently detailed and written to show a high level of scientific and practical understanding. Teachers are advised to spend time with candidates in ensuring that they are aware of what is needed to evaluate procedures reflective of mark band 3 A2 work. Specific suggestions rather than generic overviews are a requirement.

Moderation Manager, which is an electronic means of requesting and selecting the portfolios for moderation was used this June for the moderation of A2 portfolios. This did make the moderation process much more efficient and the majority of centres were very responsive in returning scripts for moderation and returning the Centre Authentication form with their candidates' work. There is now, no necessity to send MS1 forms to moderators or to include

these forms with the sample. Centres are asked to check carefully the accuracy of their recording. Several clerical errors were again found this year. This seems to be an ongoing problem, which is not improving. It is important to ensure that centre numbers and candidate numbers are recorded on the URS (Unit Recording Sheet) attached to the candidates' work. It was appreciated by moderators where work included the relevant task and assignment sheets given to the candidates.

Where Centres are writing comments and page references on the URS forms, this is really appreciated and again supports the moderation process. Centres can try and help moderators locate the work by indicating the assessment code eg AO1 (a) and even better if they can indicate the mark band on the actual candidates' work. Good practice was seen in centres where detailed information was given which supported the competency of the candidates' practical and researching abilities.

Many Centres are now accredited and are sampled over a three year period. Accredited Centres need to ensure that the necessary Centre Authentication form (CCS160) is sent to OCR for each session that they are entering candidates for assessment and that if there is any change in the nominated staff, OCR is informed. It should also be noted that Centres need to be accredited separately for the AS and A2 qualification.

Good practice was seen by centres where staff had supplied supporting evidence about group or independent work and the competency of candidates. The inclusion of suitably detailed and focused risk assessments written and used by candidates also reflected good practice.

G627 Investigating the scientists' work

The assessment requirements for the current specifications include:

AO1: a detailed and workable plan for one scientific vocational investigation, to include the aims and objectives, full details of experimental work with constraints under which the work will take place, and documented evidence of appropriate research.

AO2: evidence showing the tracking and understanding of the outcomes of the investigation, with evidence that data collected has been processed and interpreted.

AO3: evidence to show the investigation was implemented safely and an evaluative scientific report on the outcomes has been produced.

Investigations seen generally showed suitable progression from AS level and candidates are now providing holistic, detailed and workable plans. Centres using the unit G632 (*The mind and the brain*) as a base for their candidates' investigations must take care that they progress from the basic work studied in the unit. Several investigations based on this unit did not allow candidates to fulfil the requirements of AO3a mark band 2 or 3 (*candidates will show evidence of a range of experimental techniques and procedures*) and work was repetitive of what had been previously studied. This is not what is expected in the investigation. G627 should give candidates the opportunity to expand on their knowledge and skills studied in other units.

There was a again a wide range of vocational investigative work evident, with examples of work using knowledge from a range of units including *Materials for a purpose*, *Synthesising organic chemicals* and *Applications of biotechnology*. Further examples of work included enthalpy investigations, physical chemistry work linked to cells etc, food analysis, vitamin C work in a range of food products and drinks, microbiological investigative work, yeast /sugar/fermentation, bio food additives and their effects, catalysis and their uses, health and fitness and physical investigations linked to sport, materials and motion. Topics linked to aspirin seemed the most popular this session. Generally opportunities were given for candidates to offer a range of experimental techniques.

Good practice was seen where candidates were given the opportunity to independently investigate topics further and carry out a wide range of experimental techniques and procedures which they had developed. Most centres now seem to be allowing candidates to show independent organisational and investigative skills.

It is important that the standard of experimental work is AS/A level and that candidates have the opportunity to use equipment that will provide suitable accurate data for processing. Centres are encouraged to include evidence that candidates had actually carried out the practical work, with further evidence that they had completed and used risk assessments. A statement written on the candidates' work is sufficient or alternatively, a certificate of completion of practical. Good practice was seen here where centres had clearly indicated the routes the candidates had taken and the opportunities available.

Again it was good to see work where candidates had thought out their own investigative and experimental requirements. A suggestion is to give candidates a topic and then get them to ask a question about the topic. This can allow a number of candidates the opportunity to work on the same basic investigation but follow an individual approach.

Work for AO1 generally showed candidates' plans with selected research. Higher band work clearly showed evidence which included

- vocational links – which were fully referenced and validated
- experimental work – which included a range of both techniques and different procedures
- health and safety guidance – which was clear and focused.

Candidates need to ensure that they include in their portfolio work the risk assessments that they have used, in order to fulfil the health and safety requirements. A standard procedure which was used can be attached. The report, however, needs to show the outcomes of the investigation with suitable evidence of an understanding of the scientific concepts involved. Centres also need to ensure that candidates relate these outcomes to the original aims of their investigations. Mark band 3 guidance indicates that candidates should not only show how the investigation achieved its aims and objectives but also give a discussion of the reliability of the work carried out. Again, centres need to take care that work assessed at mark band 3 is accurate and suitably detailed to reflect A grade work.

Evaluations need to focus on the whole investigation not just single experimental tasks and where suitable amendments are included, the level of discussion supporting these needs to be high if mark band 3 is to be awarded.

Centres need to be aware that when awarding full marks at mark band 3, particularly in this unit, work should be free of any minor errors, and needs to reflect independent work with evidence of high level scientific knowledge and understanding relevant to the investigation carried out.

G628 Sampling, testing and processing

General Comments

The number of candidates taking this examination has increased from 600 in June 2010 to 780 in June 2011.

The total mark for this paper is 90 and many papers were seen in the range 30 to 50 with very few scoring more than 60. However, there were very few papers with very low scores. The examiners felt that the range of marks was not as high as last year, with a consequent decrease in the standard deviation.

The number of irrelevant responses was again reduced and nearly all candidates tried to relate their answers to material in the Case Studies for questions 1 and 2. As in previous examinations, the weakest area seems to be the response to questions where candidates are required to design or adapt an experiment. In this paper, there were two questions of this type, both of which carried a number of marks. Poor responses to these questions (which carried differentiated mark schemes) tended to reduce the overall total obtained by a margin.

Numerical questions continue to cause problems for many students. In general, rearrangement of equations and the calculation of percentages sometimes give quite unrealistic answers. Candidates should examine their answers and consider whether the number obtained is really meaningful.

There were several places in the paper where questions tested students' knowledge of chromatography in its different forms, infrared spectroscopy and mass spectrometry. The responses for these fairly basic questions continue to be disappointing.

In general, apart from the experiment design questions, the examiners thought that the paper had worked well and had given candidates a chance to demonstrate their knowledge and understanding.

Comments on Individual Questions

Q.1 **(a)** An easy first two marks from the case study material on apples.

(b) It was unusual to award four marks for a description and explanation of different fungicides.

(c)(i) A risk assessment or the use of PPE was the usual correct response.

(c)(ii) Surprisingly not all candidates knew why it was necessary to collect representative samples.

(c)(iii) Rain reducing the concentration of fungicide was the commonest answer.

(d) Many candidates found it difficult to state 'so that only one variable will affect the result'.

(e)(i) This question on GLC was generally poorly done and this area needs attention.

(e)(ii) Sadly, some candidates could not count the number of peaks seen in the chromatogram (12).

(e)(iii) Some candidates could not deduce that peak D must be ethyl butanoate and butyl.

(iv) This was a challenging question and few were able to provide a reasoned answer.

(f)(i) The response 'stored under the same conditions' was not always clearly stated.

(f)(ii) This was well answered but 'length of time of apple storage' was not really in context.

(f)(iii) The problems caused by impurities and contamination were well understood.

(f)(iv) The graph was rather small and the region from 12 to 14 on the y axis needed expanding. It was common to only award one mark out of the two available.

(g) The term 'invasive' was generally described well.

(h)(i) To obtain an 'average' was generally given and gained credit. 'Accurate' was not enough.

(h)(ii) Surprisingly, come candidates could not find the mean of these figures.

(h)(iii) 'The apple was not ripe / or a different variety' was the usual correct response.

(h)(iv) The description of this application of infrared spectroscopy, carrying three marks, was often disappointing.

(i) This concerned the browning of apples and its suppression by Vitamin C. The response was often disappointing, with many candidates simply immersing the apple slices in the Vitamin C solution. Four or five marks out of ten was a common score to award.

Q.2 **(a)(i)** The toxicity of mercury was generally recognised and hence the need for a face mask.

(a)(ii) In 'separate' containers was not often seen.

(a)(iii) Labelling of the container was generally correct but mass was not deemed to be creditworthy.

(a)(iv) This was a difficult question. Few candidates noticed that the concentration of mercury initially rose, until the 5cm mark. However, candidates knew where to seek relevant data.

(b)(i) Addition of water would make the total mass rise, reducing the % of mercury. This was seldom stated.

(b)(ii) 'To make the particles the same size' was not commonly seen.

(b)(iii) & (iv) The correct answers, 6.00 and 600 were often provided.

(b)(v) Candidates found this conversion hard and only the strongest ability candidates gained a mark.

(b)(vi) The reasons for using AAS gave many candidates an easy two marks.

(c)(i) The need to avoid contamination was indicated by most candidates.

(c)(ii) Surprisingly, few candidates realised the need to ensure that the sample was completely dry.

(c)(iii) A number of candidates could not carry out the subtraction correctly to get 0.0045 g.

(c)(iv) Only the stronger candidates obtained 0.0075.

(d)(i) An easy mark from the graph.

(d)(ii) The first mark was generally correct but many candidates could not give a reason why.

(e)(i) The height would increase if the pressure increased but the explanation was often wrong.

(e)(ii) The shockwave velocity was usually correct but care should be taken with significant figures.

(f)(i) Most candidates gave a correct reason for the use of Nessler's solution.

(f)(ii) The reasons given for excluding ammonia were often unclear.

(f)(iii) Many candidates did not state that a volumetric flask is accurate / has a graduation mark.

(iv) The flask must be shaken to achieve a uniform concentration – few said this though.

Q.3 **(a)(i)** This proved to be a challenging question. Relatively few addressed the question and gave details of suitable large scale equipment. Many gave laboratory scale apparatus and lost marks.

(a)(ii) Few realised that the concentration would be increased by boiling the mixture for longer. Adding more 'sugar' was not an acceptable response.

(b)(i) Very few could calculate that 4 dm^3 would be required to obtain the correct % concentration.

(b)(ii) Hardly any candidates knew about a fractionating column and the description of B was often disappointing.

(c) Most candidates gained at least one mark for considerations about the added colouring agent.

(d)(i) Although many candidates gained a mark for stating compound D, few showed the Rf calculation necessary for the second mark.

(d)(ii) Very few candidates mentioned the need for another solvent or two way chromatography.

(d)(iii) Only a few candidates stated that the molecular ion provided the relative molecular mass.

G629 Synthesising organic chemicals

The assessment requirements for the current specifications include:

AO1: a report or leaflet which demonstrates an understanding of organic chemistry by the correct identification and naming of functional groups, the importance of different types of isomerism and different types of reactions; an investigation of therapeutic drugs, their usage and mode of action in the body.

AO2: research on a process used to manufacture an organic compound showing an understanding of factors to be considered by the manufacturer, to include information about costs and benefits of the product; evidence of appropriate calculations.

AO3: practical work on two organic compounds, detailing preparation and purification methods (to include some planning); make, record and display observations and measurements; evidence of processing results (to include % yield); suitable conclusions and evaluation included.

The number of candidates studying this unit has gradually increased over the last three years. Work seen this session did seem to be much more focused on the requirements of the assessment criteria than previously and although the 'copy and paste' approach was less, centres still need to work with candidates to ensure they are understanding basic organic chemistry. Too many errors in formula and equations are still being seen. General guidance continues to focus on the following points:

Candidates need to ensure accuracy when giving organic formulae and show understanding when writing equations rather than just 'copy and paste'.

AO1 – evidence needs to be focused on the requirements of the specification and not just a repetition of candidates' notes. This is, however, improving.

AO1a – the classification and identification of functional groups with evidence of understanding the different type of isomerism work needs to be accurate and clearly focused on the requirements. The importance and an explanation of isomerism linked to specific examples are really needed to secure mark band 3. This was still not evident in many candidates' work.

AO1b – the explanation of reaction types needs to be linked to specific organic chemistry and not generic explanations. The work sheet supplied in the original teacher guidance needs candidates to *describe* the reaction types for mark band 2 and *explain* for mark band 3. Assessment tended to be generous for this strand.

AO1c – tended to be completed well by many candidates; they do however need to check that evidence of understanding is shown from their research and to take care there is not 'copy and paste'.

AO2 – work needs to show evidence of research on a process used to manufacture one organic compound, examples which can include alcohol, haloalkanes, esters and medicinal drugs.

AO2b – needs to focus on the costs and benefits to individuals, companies and society associated with the manufacture of the selected organic compound. More detail is generally needed for this strand as assessment tended to be generous.

AO3 – this session, preparations of aspirin, a range of organic acids and esters, iodoform (triiodomethane) and paracetamol were seen. Candidates need to take care that for mark band 3, risk assessments are accurate and sufficiently detailed. Justification of the reasons for using chosen techniques in the preparations is essential for mark band 3. Some generous

assessment was seen for this strand. Detailed annotation can help to support the ability of the candidates.

AO3b and AO3c – evidence for this strand is still not sufficiently detailed. Candidates need to be guided to ensure they record suitable observations for both their preparations and show evidence of processing their results. Evidence on calculations of theoretical yield is needed.

AO3d – candidates need to draw detailed conclusions on their preparative work and purification techniques; they need to be commenting on the percentage yield and reasons for their outcome; evaluations needs to be detailed and focused on the techniques used, sources of errors and reaction route.

Centres need to note that a total of 26 marks is given for practical work and hence between 25 to 30 hours should be allocated to AO3 work.

G630 Materials for a purpose

The assessment requirements for the current specifications include:

AO1: information (poster/leaflet) on structure of a polymer/ metal/ceramic or glass/composite

AO2: one case study where candidates are required to select materials for a stated purpose; calculations to include tensile stress and strain, the Young's modulus and toughness using graphical methods

AO3: reports to show evidence of the following three sets of experimental work:

- design and use a testing device, with results
- tests on samples that have been work-hardened, annealed and tempered, and results
- experiments to measure electrical conductivity or specific heat capacity and results.

Although entry numbers for this unit has doubled over the last three years, this unit tends to be less popular than other units. General guidance is as follows:

AO1 – candidates need to ensure that they show understanding when extracting research information on structures of the materials chosen. This session, 'copy and paste' material was still very apparent for these strands. Work at mark band 3 needs to show an increase in quality and in the number of examples researched. Candidates also need to ensure that for mark band 3, information is included to show how the physical properties of materials are related to their structures.

AO2 – the introduction of one case study in the revised specification supported improved quality in candidates' work and a range of work was seen from the household to the sporting requirements of materials. Whilst some good work was seen, candidates generally need to ensure that for mark band 2 and 3 the work not only covers all bullet points in the assessment criteria, but is also written and presented to the appropriate standard. Candidates need to justify their choice of material with suitable reasons and evidence.

For AO2c – although calculations reflected the requirements of the assessment criteria, for mark band 3, errors were still seen and answers were not always given to the correct number of significant figures. Candidates therefore need to check their answers.

AO3 – a suitable range of practical work was seen and the introduction of the reduced number of practical activities seemed to improve the quality with some clear and logical reports. Candidates wishing to gain the higher mark bands must ensure for AO3a that evaluations are detailed; for AO3b that a full discussion and evaluation relating to whether or not the treatments have produced the expected results is given; for AO3c, that repeat readings, estimations of uncertainty of results, and evaluations compared to data values are needed to support 8-10 marks.

G631 Electrons in action

The assessment requirements for the current specifications include:

AO1: a report outlining the principles and application of electrochemical changes, to include research into the production of electric currents and metals.

AO2: a comparison of commercial cells; calculations to include the EMF of cells and quantity of charge

AO3: practical investigations into the measurement of EMF of cells and mass of copper formed in copper plating.

Although entry numbers has shown some increase this session, this is the least popular unit and evidence indicates that candidates need to focus more on the practical requirements in this unit. General guidance is as follows:

AO1 – it is advisable that candidates show separate evidence to cover this strand to ensure that all the requirements are met. Several centres appeared to have assessed the work integral to the practical, which is acceptable. However, when this is done, care needs to be taken that the full requirements for AO1 are covered. Assessment often tended to be generous. Candidates need to be guided towards the relevant requirements of the specifications reference 3.12.1, 3.12.2 and 3.12.3 (pages 51 – 53) to ensure full coverage where the higher mark bands are to be attempted.

AO2 – for AO2a, comparisons are needed and the bullet points listed below need to be followed:

- construction method and method of producing the electric current
- resources used in production
- efficiency
- safety and environmental effect
- sustainability and use.

Some good calculation work for AO2b was seen, often supported with a range of additional exercises and where this is the case, centres should continue to maintain vocational contexts by possibly linking the work to a technician or an analyst, rather than setting student 'worksheets' for candidates to complete.

AO3 – practical work this session was variable. It is essential that care is taken to ensure candidates cover the requirements set ie candidates should plan suitable experiments to investigate the effect of changing conditions on the emf of a cell and the mass deposited during electrolysis. Work at mark band 3 should additionally include an explanation of any practical techniques that will improve results. Risk assessments need to be evident to support safe working. All candidates should be showing evidence of individual planning and should not just be following set experiments. Diagrams can be used to support planning and understanding.

G632 Mind and the brain

The assessment requirements for the specifications now include:

AO1: the production of two sets of fact sheets designed to raise mental health awareness, one set on stress and illness, and the second set on research methods employed in the study of the healthy and damaged brain

AO2: an evaluation of the scientific methods and techniques used in the study of mind and brain, together with a consideration of associated ethical issues and evidence of statistical research

AO3: the design and safe execution of a simple experiment to investigate one aspect of cognitive function and an investigative study on memory.

The number of candidates studying this unit has gradually increased over the last three years and this is now one of the most popular of the optional units. General guidance is as follows:

AO1 – candidates still need to ensure that for AO1, sets of fact sheets / leaflets are produced which are designed to raise mental health awareness. Suitable illustrations should be included. Lengthy reports are still being submitted. Work at mark band 3 should reflect appropriate selection of relevant material, not extensive pages of researched material which candidates do not understand. Good practice was seen where candidates produced interesting information on stress and illness and the healthy and damaged brain which was targeted at the correct audience. Good evidence was also suitably supported with accurate and detailed referencing.

AO2 – AO2a allows candidates to research and produce information giving the clinical methods of studying the brain. Diagnosis of brain diseases was generally well covered but work should be supported by labelled illustrations.

AO2b – moral and ethical implications of brain research for mark band 3 work needs to reflect the statements given in the assessment criteria. A comprehensive discussion and conceptual considerations are needed for higher mark bands. This section was often quite brief and centres are advised to spend time with candidates in discussion work on this topic. Assessment was quite generous for this strand.

AO2c – asks for a Fact Sheet detailing statistical evidence and some excellent sheets were submitted this session. However, some generous assessment was seen for this strand.

AO3 – in general, assessment for AO3 tended to be generous and centres need to take care with this assessment for future submissions. Centres need to note that 26 marks are available for AO3 and therefore candidates need to spend the appropriate amount of time on their experimental work (25-30 hours). For mark band 3, a range of data needs to be collected and processed. Generally, suitable statistical processing was completed using candidates' experimental data. For AO3e, however, care needs to be taken to ensure that the requirements of the criteria are suitably covered for mark bands 2 and 3. Some very good practical work and initial research was seen from several centres this session. Evidence should be collected from a wide range of candidates and suitable statistical evaluation completed if higher marks are to be targeted.

Centres need to ensure candidates aiming for mark band 3 should be presenting work that uses correct grammar and punctuation and that detailed referencing of all sources is included. For AO3c care needs to be taken that full coverage of the assessment criteria is completed.

G633 Ecology and managing the environment

The assessment requirements for the current specifications include:

AO1: a knowledge and understanding of the effects of change on ecosystems and biodiversity, describing ecological succession and researching the effects of agricultural practice, human habitation and greenhouse gas production.

AO2: information on scientific moral and ethical reasons for preserving ecosystems and species diversity; descriptions of methods used to manage ecosystems and to preserve species diversity with information on the success of a project managing one ecosystem; calculations on ecological data.

AO3: a planned investigation of an ecosystem; with relevant observations made and recorded; data displayed, interpreted and results related to the occurrence and distribution of the species within the ecosystem.

The number of candidates studying this unit has gradually increased over the last three years and this is one of the most popular optional units. Again some high quality work has been submitted but it is essential that centres do take care not to over assess their candidates' work. Quality rather than quantity is important and although candidates' work continues to indicate interest and enthusiasm in this topic area, care still needs to be taken that suitable selection of researched material is presented in portfolios. General guidance is as follows:

AO1 Candidates need to ensure that they present suitably detailed information which shows their understanding of the relationship between the organisms, their physical environment and each other in ecological succession. Candidates who present their work in poster form need to take care that there is sufficient detail to reflect the higher mark bands.

Where 'cut and paste information is used it needs to be accurately referenced, it is hoped that candidates for mark bands 2 and 3 are showing their understanding by using their research rather than including large pieces of detail obtained from the Internet. For AO1b evaluations where required, need to be at an appropriate high level to reflect A grade A2 work with suitable justification included. Assessment now also includes clear and logical presentation with correct spelling and grammar.

Work for AO2a was still generously assessed and centres are advised to spend time with candidates to initially identify and discuss moral and ethical reasons for preserving ecosystems and species diversity. Work for this strand tends to be very brief and at quite low levels. Candidates need to know how to describe or explain and evaluate their reasons in order to support marks awarded for mark band 2/3.

AO2b work has again been omitted from portfolio submissions from some centres. Candidates need to be able to describe methods used in the management of ecosystems and to interpret data relating its success.

AO2c. This unit does offer the opportunity for candidates to collect sufficient ecological data to allow candidates opportunities to carry out complex calculations, however again candidates aiming for mark band 3 need to be aware of all the requirements of the criteria. Work needs to be submitted showing the appropriate range and accuracy.

AO3 work gives candidates an excellent opportunity to carry out a planned investigation of an ecosystem. It is important to ensure that a range of experimental techniques are available. A range of informative photographic evidence was included as evidence to support work carried out. Risk assessments have shown improvement and seem to be suitable working documents.

AO3c the displaying of data was generally well done with candidates showing a range of different ways eg kite diagrams were often seen to support data display, but accuracy needs to be maintained for mark band 3 work. 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. Some generous assessment was seen for this strand.

G634 Applications of biotechnology

The assessment requirements for the current specifications now include:

AO1: the production of an information booklet to include information on the science of genetic engineering and the use of recombinant DNA technology in medicine or agriculture.

AO2: description of how successful DNA technology is in food production with suitable conclusions based on evidence found; financial, statistical evidence involving calculations; consideration of the moral and ethical issues and the impact of legislation associated with using genetically modified food plants.

AO3: a practical investigation into enzyme technology (including the production and use of an immobilized enzyme); to include the construction of a bioreactor and the effect of temperature on enzyme activity.

This is the most popular of the optional units and centres need to take care that assessment at the higher mark bands is not over generous. Where full marks are awarded for mark band 3 strands, work needs to be accurate and suitably selected with all parts of the required assessment criteria completed to the required high levels. General guidance is as follows:

For AO1 evidence on the science of genetic engineering and the use of recombinant DNA technology needs to be suitably selected to demonstrate candidates' understanding. There was still evidence of 'cut and paste' material which showed no logical format or reason for inclusion in a public information booklet. Candidates need to research the relevant science and also plan how the booklet needs to be constructed and presented.

Candidates need to ensure that for AO2a evidence is provided which describes how successful recombinant DNA technology is in solving problems associated with food production. Many candidates just included the use of the technology and not how it is used in problem solving. Work for mark band 2 and 3 needs to be sufficiently focused on at least two specific examples. Evidence was seen that was very generic and did not clearly describe the success of the technology. Assessment for this strand was generous.

AO2c seems to show that centres are now focusing more on moral and ethical and environmental issues and some good discussion work was apparent. However, even for mark band 2 candidates need to explain two types of controls placed on scientists working in this area, several candidates just stated the controls without any explanations. Mark band 3 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. This strand was often generously assessed.

For AO3 care needs to be taken that suitable immobilised enzymes are prepared and used, and appropriate practical work is carried out to ensure quantitative results are obtained. Several candidates indicated they had problems with their investigative work, where this is the case, suitable interpretation of results can still be credited.

For AO3c generally good displays of results were produced but for AO3d candidates need to work on improving conclusions and interpretation of results. For AO3d candidates aiming for mark band 2 need to check that as well as interpretation of results and basic conclusions, the advantages of using bioreactors and enzyme immobilisation are included. Centres also need to ensure candidates are spending the appropriate time on AO3c and AO3d to produce sufficient in depth coverage. Centres need to note that 26 marks are available for AO3 and therefore candidates need to spend the appropriate time in their experimental work (25-30 hours).

G635 Working waves

General Comments

The overall performance of the paper was similar to that of previous years.

Candidates were better prepared for topics that have been included in the specification since it was first introduced. Lack of familiarity with standing waves and with the terms spatial and thermal resolution suggested the possibility that some centres have not yet adjusted to the 2009 amendments to the specification.

Only a minority of candidates were unable to correctly give terms such as amplitude, but few clearly understood the difference between binary and digital.

Comments on Individual Questions

Q.1 **(a)** The most common means of scoring was "distance moved from its equilibrium position". A common incorrect answer was to confuse displacement with amplitude or "distance trough to peak". Other candidates gave incomplete answers such as "how much the wave moves" and a smaller number of candidates gave answers involving time, energy, frequency or volume of water.

(b) Many correct answers were seen for this question. Incorrect answers attempted to give alternative descriptions such as "the highest peak".

(c) The most common error was to give the total length shown on the graph, ie 4.5 m.

(d) Many of the incorrect answers attempted to use the equation:

$$\text{velocity} = f\lambda$$

sometimes using their value of f from part (e), resulting in a circular logic. Working was often unclear. By far the most common way of scoring was via 4.5/5 = 0.9. A number of responses included errors with the decimal point.

(e) Some candidates attempted to use f = 1/T or incorrect versions of:

$$\text{velocity} = f\lambda$$

Others presented the correct equation, often using 'magic triangles', but made mistakes in substitution, transposition or units. However, many of those who made f the subject were able to substitute correctly.

(f) Many candidates managed to arrive at the correct answer without showing any working.

(g) Few candidates showed familiarity with standing waves. A minority were able to state that interference was taking place but failed to answer the question by describing the appearance of the resulting wave.

(h)(i) Again many candidates seemed unfamiliar with the topic. Many placed nodes and antinodes at the same point along the wire, typically marking 'A' at a peak and 'N' at the corresponding trough or vice versa. It is possible that may of these were the result of guesswork.

(h)(ii) 1 m was a very common incorrect answer.

(h)(iii) Most candidates multiplied or divided the distance given by 2, again suggesting a lack of knowledge of standing waves. Few stated clearly that 'node to antinode = $\lambda/4$ '

Q.2 **(a)** A majority of candidates provided the correct answer. Incorrect spellings were common but most were given credit. Incorrect answers included other regions of the electromagnetic spectrum.

(b) A large number of candidates gave correct answers. Some narrowly failed to score, for example by stating 'absorbs all types of radiation'. Significant proportions of answers variously included incorrect statements such as "does not emit radiation" or "appears black in an image".

(c) Most candidates recognised that a thermal imaging camera would produce an image consisting of different colours. A smaller but substantial number related this to differences in temperature and/or related the fault to differences in temperature. Very few mentioned wavelength, frequency or intensity. Spelling, punctuation and grammar were generally of a standard at least matching the content of responses.

(d) Most candidates recognised that the cat's ears are at a different temperature compared to other parts of its body. Many made a reasonable attempt at suggesting the cause of this difference.

(e) There was little indication that many candidates had any awareness of these definitions and almost all answers were based on the appearance of a good-quality image.

Q.3 **(a)** Most candidates demonstrated a good familiarity with the endoscope and the difference between coherent and incoherent bundles. Some lost marks due to careless diagrams or descriptions that lacked precision. Many clearly understood the reason for using both types of bundle in this application. A minority presented answers based on the difference between monomode and multi mode fibres. Most responses were reasonably well set out.

(b)(i) Most candidates gave sensible suggestions. Non medical applications of endoscopes were accepted, but other medical applications appeared to have ignored the emboldened word "other" in the question.

(b)(ii) Most candidates provided correct answers by referring to some form of decorative lighting. Most of the non-scoring responses were due to an application which requires coherent fibres. The answers "light" and "light bulbs" were too brief.

(c)(i) A majority of answers were correct. "Refraction" in place of "reflection" was a common error. Some less able candidates thought the first word was thermal and improvised the other words accordingly.

(c)(ii) Most drew rays undergoing repeated reflections as they passed down the fibre, but "i" was commonly very different from "r", and < "C". Few candidates correctly showed refraction of the ray as it entered the fibre. Some showed the ray reversing in direction as it entered, as if reflected by an imaginary mirror.

(c)(iii) Few candidates were able to score both marks. Better candidates stated either that refractive index of air < refractive index of glass or
angle of incidence > critical angle. Many candidates did not use the term, 'angle of incidence' or express their idea sufficiently eg "it hit above the critical angle".

(d)(i) Although a substantial number of candidates did correctly recognise that the angle given was the critical angle, a considerable number gave the complementary value (51°) suggesting that the concept that TIR occurs when angle of incidence > critical angle had not been fully understood. Other answers close to these two suggested that candidates had ignored the measurement given and attempted to measure the angle themselves. Values of 90° and values > 90° were also seen.

(d)(ii) Many candidates simply gave the sin of their angle. Many of those who correctly performed the calculation failed to give the answer to 2 significant figures. Answers to 2 decimal places were common. Annotations on several scripts indicated that some candidates interpreted this instruction as "2 decimal places".

(e)(i) Although the correct answer was given by a large number of candidates, a wide variety of incorrect alternatives was also seen.

(e)(ii) This was poorly answered even by those who had correctly named the cladding. Most thought that rays entering at a wider range of angles would be reflected. Many responses were ill-thought-out and based on "bigger is better" predictions of more rays, more quality, faster rays.

(e)(iii) Few were able to correctly name this layer. Misspellings were not uncommon and generally condoned. Most candidates thought that the function of the layer was to prevent light form escaping.

Q.4 **(a)(i)** This section was well answered. Some referred to "only using one frequency" and omitted to describe how this limits communication.

(a)(ii) This section was well answered. CB radio and walkie-talkie were the usual answers.

(b)(i) This section was well answered. Some referred to "using two frequencies" and omitted to describe how this allows communication in two directions at once.

(b)(ii) This section was well answered.

(c) A pleasing number of candidates demonstrated good understanding of the term half-duplex by clearly distinguishing it form the definition of simplex given in the stem.

(d)(i) Most, but not all, candidates correctly identified each of these examples. The bar code provided the best differentiation.

(d)(ii) Although many candidates scored at least one mark, most commonly by stating that binary consists of zeros and ones, most candidates seemed to think the two terms were synonymous, while others suggested that one or the other meant analogue.

(e)(i) Many candidates provided correct answers. Analogue was sometimes substituted for amplitude.

(e)(ii) Many correct answers were provided for this question. A significant minority of candidates described the quantities which changed but omitted the quantities which remained the same. Some scored a compensatory mark by mentioning the better quality of FM transmissions.

Q.5 **(a)** The most common errors were sizes or a mobile phone rather than a geographical cell, and use of the abbreviation m, which candidates had possibly intended to stand for miles rather than metres.

(b) Most candidates successfully drew a hexagon pattern, although a variety of other shapes were seen. Some drew sketches of mobile phones and masts, but with no indication of geographical cells.

(c) Most candidates scored one mark by indicating base stations at the centre of cells or the intersections of three cells. Fewer placed the base stations at alternate intersections.

(d) Many candidates stated that cell structure allowed many frequencies to be used, rather than focusing on the reuse of a limited number of frequencies. Many responses strayed form the question by discussing ideas of mobile phones switching frequency as they entered a new cell.

(e) Incorrect responses included further detail about use of cells and statements about using many frequencies.

(f) This question was generally wells answered with fewer references to satellites than in the past. Some incomplete answers omitting mention of who or what was at one of the ends of the transmission failed to score.

Q.6 **(a)** Most candidates were able to give several correct points. Some failed to score because their answer referred to precautions rather than the potential harm.

(b) Only a minority of candidates gave the intended answers, ie image intensify screens and filters, but others scored by presenting acceptable alternatives.

(c)(i) The open ended nature of this question enabled candidates to score with a wide variety of reasonable suggestions. Many candidates confused the scenario with diagnosis or with radiotherapy using internal sources, in the latter case referring to how long the patient might remain radioactive after treatment.

(c)(ii) Answers such as lowering the dose were not accepted as they did not indicate how the treatment might still be effective.

(d)(i) & (ii) Disappointingly, many answers showed no understanding of the concept of half-life, but many candidates who did understand also recognised the significance of biological half life as well.

(d)(iii) Many candidates failed to realise that the question concerned a rate meter as was indicated by the unit counts per second. They also failed to realise that the rate at which radiation is emitted by the sample would decrease over the time in question. A very common answer was therefore to multiply the 20 counts per second by the number of second in the 12 hour period. A smaller number of candidates gave the count rate after one half life, ie 10 counts per second.

(e) Few fully correct answers were seen. Many simply added the two half lives obtaining the answer 18 hours. Of the minority who knew the equation, a number failed to carry out the inversion at the end of the calculation and gave the answer 0.25 instead of 4 hours.

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