

Applied Science

Advanced GCE A2 H575/H775

Advanced Subsidiary GCE AS H175/H375

Report on the Units

June 2010

H175/H375/R/10

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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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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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General Comments

This session saw a significant increase in numbers of candidates taking the AS single qualification. This was pleasing as a good range of work was seen both during the moderation process and at the Awarding Meeting. Several new centres are now following this specification and it is evident from the type and quality of the work seen that many of the new candidates have previously studied some applied science.

For both AS and A2, all candidates should now be using the revised specifications which were introduced for teaching from September 2009. For this session, where work was presented for moderation using the original specification and assessment criteria, the work was moderated against the criteria studied. Please ensure that for teaching starting September 2010, all candidates are using the revised specifications and assessment criteria.

The majority of work moderated against the revised criteria indicated that the revised specifications were accessible to both staff and candidates and supported the assessment of this Applied A Level subject. The majority of the candidates are competently carrying out a wide range of interesting research both on the internet and by actual visits. Most of the practical work seen showed a vocational link with suitable reasons on why the experimental work needed to be performed. Credit should be given to those staff and candidates who are using the assessment criteria appropriately and consequently work is being assessed at the correct level.

Many centres are now accredited. Accredited centres need to ensure that the necessary Authentication form is sent to OCR for each session that they are entering candidates for assessment. If there is any change in the nominated staff, OCR needs to be informed. It should also be noted that centres need to be accredited separately for the AS and A2 qualification.

Work selected for moderation reflected coverage of all the units offered by this AS specification and a wide range of marks was seen. Candidates use and selection of research material obtained from the internet is showing a noticeable improvement, although there is still evidence of 'cut and paste' without suitable referencing. There were a number of scaled centres this session, again mainly at the higher mark bands. Work submitted did not reach the necessary standards required by the assessment criteria ie work was not sufficiently detailed and accurate, with limited data at a high level of precision and reliability and evaluations not at a high enough level for 'a' grade work. Centres need to check carefully that when awarding candidates 42 + marks that their overall work reflects the performance descriptors given in the specification reference Appendix A. However, it was pleasing to see that many centres had followed the guidance given from the Moderators' Reports supplied in June 2009.

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

The majority of centres were again very responsive in sending the requested portfolios for moderation and returned the Centre Authentication Form with the candidates' work. Most work was well organized and presented using treasury tags which allowed moderators to easily read and locate the work. Where centres provided annotation throughout the portfolios with an

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indication of how marks were awarded against the criteria, this was appreciated by moderators and supported the assessment decisions made by the centres. These factors helped to support an efficient moderation process and this is appreciated. It is also appreciated that when centres have 10 or fewer candidates that all work is sent directly to moderators. Centres are again asked to include the tasks sheets given to the candidates as this helps to support the moderation process.

Moderators continually discovered clerical errors where the marks on the MS1 forms were not the same as the marks recorded on the URS. It is hoped that in the future, centres will ensure suitable checks are done to make sure that these are reduced to a minimum. This seems to be an ongoing problem.

Risk assessments are now being included with practical work as evidence of safe working but possibly more guidance is needed to ensure these are suitably detailed and not generic. Concentration of solutions must be included where higher mark bands are being awarded.

G620: Science at Work

The assessment requirements for the revised specifications now include:

AO1: record of four surveys of science based organisations; one in depth study; work on health & 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

The revised specification for AO1(a) now requires **four** surveys and includes the assessment of spelling, punctuation and grammar. Candidates need to ensure that their surveys are not lengthy reports and where appropriate, summaries written in the candidates' own words. This work is intended to be an overview of science in different organisations. Work selected from websites is acceptable but it needs to be suitably referenced. Work assessed at Mark Band 3 needs to show detailed referencing of sources ie ISBN numbers for books and dates of internet access. A fully detailed reference should allow the reader to be able to access the information used, directly from the reference quoted; a bibliography here also supports good practice. The citing of references within the text and referencing illustrations and charts supports evidence that relevant information has been selected from a range of sources.

Candidates need to be continually guided to follow the bullet points listed below for their surveys:

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

The range of organisations studied continues to be varied and hopefully supports the interest of the candidates. These include a range of gas and electric service industries, power stations, armed forces, NHS, pharmacies, opticians, dentists, physiotherapy services, health centres, analytical services, zoos, aquariums, garden centres/botanic gardens, health clubs/gyms, supermarkets, bakeries, breweries, garages, colleges, universities, schools and fast food establishments, as well several manufacturing organisations including chemicals, pharmaceuticals (pain relief medicine), glass, cement, steel (Corus) manufacturing/aircraft industry.

For AO1(b) candidates need to produce a detailed study of **one** of their chosen organisations. New centres need to ensure that candidates only focus on one study. Several scripts were seen where moderators were expected to chose. It is the assessors who need to ensure only one detailed study is submitted in the portfolio. Assessment requirements for Mark Band 3 indicate a comprehensive study is required and information should be selected and clearly and logically presented. Some evaluation and justification of the use of the material also needs to be included. Comments on the validity of the sources used must be included if Mark Band 3 is to be reached. There was minimum evidence of evaluation and justification of the research material.

Candidates need to be continually guided to follow the bullet points below for their detailed study:

- 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

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- details and specific links of health and safety laws and regulations that can be used for the requirements of AO1(c).

Selection and justification are key features which must be considered for the higher mark bands.

Assessment for AO1(c) at Mark Bands 1 and 2 was generally within the accepted tolerance and centres are working towards ensuring candidates give names of related health and safety laws and regulations. For Mark Band 3, evidence must show that candidates understand how the organisations studied comply with the necessary laws and regulations, relevant links need to be focused on. Candidates who just summarise health and safety laws and regulations should not be awarded 5/6 marks.

For AO2(a) many candidates linked this section with their main study. This worked well, especially when visits had taken place and research was included. Candidates who had been given structured guidance produced detailed work which linked to the requirements of the specification and higher mark band marks were justified. A simple statement of the overall effect of the organisation to society is insufficient for Mark Band 2 and above. Evidence showing an understanding of the core business of the organisation on the benefits of society will support the higher marks.

Guidance to help could include:

- benefits of the core business to the 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.

For AO2(c) the assessment guidance states that a number of complex and straightforward calculations should be completed. It should be noted that mathematical guidance of straightforward and complex calculations are given in Appendix C of the specification.

If the data produced for practical work does not allow candidates to fulfil the higher mark bands, then data can be supplied. Additional work could be provided in the form of a task/data sheet that perhaps a technician or analyst would complete in a work based environment; it is not advisable just to give examples for candidates to complete. For Mark Band 3, calculations should be correct and answers given to the appropriate degree of accuracy and correct significant figures; errors were still seen here. Candidates should not be gaining 4 marks for one set of practical processed results.

For AO3, practical work was varied and generally showed an improvement from GCSE. The majority of centres linked the practical activities to a vocational context, consequently giving a reason for the completion of the practical work. Very few traditional AS practicals were seen and the centres should be complimented on the originality of some of the experimental work carried out. Good practice was seen where centres linked the work to the in depth study e.g. health and swimming with the practical work linked to these organisations e.g. analysis of the water, healthy eating and lifestyle. Organisations involving the production of materials or treatments of materials were seen with practicals linked to the properties needed to fulfil the necessary requirements. Food preservation and micro biological experiments continued to be popular. Forensic case studies were also seen.

Centres are reminded that Mark Band 3 work should reflect 'A/B' level candidates. For AO3(a) assessment, the marks are generally supported by the moderators, but centres need to ensure that when 7/8 marks are awarded, the risk assessments produced by the candidates do reinforce evidence to support high level and accurate practical working. Brief generic risk assessments are not adequate for Mark Band 3 work. Again, for AO3(b) and (c) at Mark Band 3, all relevant observations or measurements should be made and accurately recorded and

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evidence should be seen that data has a high level of precision and reliability. Errors in significant figures and the omission of units were often seen even when Mark Band 3 marks were given. Some candidates are showing clear methods of processing their results for the higher mark bands and, in some cases, evaluation of accuracy of apparatus and method is being included for Mark Band 3. However, care still needs to be taken to ensure accuracy at this higher level. Processing skills in graphs and calculations were clearly evident in work seen but units are still missing from graphs and scales are poor, more guidance is needed on this. Titration readings need to be recorded to two figures after the decimal e.g. 20.00 cm³ and it is good practice to record readings before and after the titration, several candidates just recorded the volume used.

G621: Analysis at Work

The assessment requirements for the revised specifications 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 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.

The revised specification has amendments in AO1, the energy policy. Evaluative work into the ways that organisations limit their energy consumption is now needed to achieve Mark Band 3. Some excellent work was seen where candidates chose their own establishments for the energy policy; universities, supermarket chains, and airports were also popular choices. The additional guidance for AO1(b) and (c) have allowed candidates to focus more on specific bullet points linked to energy efficiency and how it has been considered. Definitions of energy efficiency have now been commonly seen and some illustrative calculations for energy efficiency have supported high band work for AO1(b). The inclusion of spelling, punctuation and grammar assessment is needed in AO1(c).

Environmental issues are very topical and this issue is now being covered in a lot more depth and at a high level by several centres. Candidates still need to ensure that they extract relevant information and relate this to their chosen organisation. It is hoped that the additional guidance for AO1(b) & (c) will allow candidates to produce evidence needed for Mark Bands 2 and 3.

In AO2, candidates presented information related to the generation of electricity along with the energy transfers. Centres need to ensure candidates compare large- and small-scale generation rather than just renewable and non-renewable. A comparison is needed of two fuel or energy sources for Mark Band 2 and a description with a comparison that includes benefits and problems for Mark Band 3. AO2 content should now link more to the assessment requirements. AO2(b) should give candidates the opportunity to look at energy values and fuel/energy costs and to carry out appropriate mathematical calculations related to this data. Centres now seem to correctly assess calculations at the appropriate mark band; a number of centres were scaled but this was mainly due to the quality of the work rather than specific assessment problems.

For AO3, **three** practical activities are now required. Centres need to ensure the content of the work produced for assessment does reflect AS standard. Some of the work seen only focused on minimal specification coverage. In qualitative work, although candidates are not expected to cover all the possibilities, it is expected that the quality of the practical is reflective of AS standard. Single chromatography experiments are really insufficient at AS level.

The revision of the practical AO3 section of this unit should address the previous lack of opportunity to include energy related practicals. Centres can now include enthalpy of combustion experimental work or energy related investigations. Work seen generally reflected Mark Bands 1 and 2 but it still needs to be noted that work for Mark Band 3 needs to be suitably detailed, with evidence of vocational links. Evidence from the assessor that risk assessments have been produced, used and equipment has been safely used should also be included. Suitable evaluation is needed and this needs to be focused on the method and outcomes of the specific experimental work completed, not just a generic statement of the success of the work.

G624: Chemicals for a Purpose

The assessment requirements for the revised 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 that includes an understanding of the social, economic and environmental impact of the product selected

AO3: a sample and account of the preparation of two products that have been synthesized, purified and analyzed.

It was hoped that the amendments to AO1 would allow candidates to study their chosen compounds in more depth and the requirements of the assessment criteria would allow differentiation from Mark Band 1 to Mark Band 3. However, inaccurate work that had been 'cut and pasted' was still regularly seen. Spelling, punctuation and grammar requirements need to be assessed in AO1.

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

Candidates should be guided to choose compounds that will allow them to find information on both uses and properties of these compounds. It should also be noted that, for the chosen compounds for Mark Band 3, details are needed on how the properties depend upon the structure and how uses depend upon the properties.

Eleven marks are now allocated to AO1(c) which involves candidates producing a detailed account of **two** chosen compounds, one of which is made from oil. Candidates could do research and practical work to support the understanding for this section, and could link to AO3 if required. Generally, work for this strand was not as detailed as required; centres will need to ensure more quality work is completed for future submissions.

For AO3, two preparations are now required. It is hoped that candidates will extend their chemical and experimental knowledge by preparing both an inorganic and an organic compound. Copper(II) sulfate was a commonly used preparation, this is quite a basic preparation and it was hoped that candidates would possibly prepare a double salt, however if this salt is chosen full descriptions are needed for the preparation of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, and a crystalline sample should be obtained, or if the anhydrous sample, reasons for the loss of the water of crystallization.

For AO3(b), candidates need to ensure they present observations, draw diagrams and correctly show suitable processing of their results. This may involve calculations on theoretical, actual and percentage yields. The yield needs to be calculated correctly and for Mark Band 3, 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. Much of the work seen was not sufficiently accurate and detailed.

For AO3(c), 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. Again candidates need much more focus on the criteria if they wish to support higher mark bands.

G625: Forensic Science

The assessment requirements for the revised 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 that 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.

The revised specification has amendments in AO1 in that evidence is now directed to three strands - chemical, biological and physical techniques, which link to the requirements of AO3. Spelling, punctuation and grammar need to be assessed within the requirements of AO1(b). Candidates showed evidence of suitable research for AO1(b) which covered chemical, biological and physical techniques. The majority of work seen for the higher mark bands for AO1(b) needs to ensure that for four marks, for each of the techniques candidates show a range of ways in which forensic scientists collect and visualize evidence and work is suitably focused and not just taken directly from the abundance of web sites that discuss this topic. Work should be suitably referenced to support in depth research techniques. AO1(c) must show the need for an ethical code, and a range of relevant information on ethical issues in forensic work; several scripts were seen with no evidence to support this strand. Higher level work needs to show a range of relevant information and not just a mention; this is not suitable for Mark Band 3 and marks were not supported where this occurred.

For AO2(a) good practice in case study work was seen where relevant information on evidence and proof was seen. This covered:

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

For AO2(b), calculations included a range of Rf values for Mark Band 1, and refractive index calculations and bullet projectiles for Mark Bands 2 and 3.

For AO3, experimental work again included work on fingerprinting and taking footprints, measuring and the use of photographs, a range of microscopic techniques, chromatography, qualitative and quantitative analysis, and the measurement of refractive index of glass. Mark Band 3 candidates need to ensure detailed processing and interpretation of their results and a discussion of their significance.

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 summarizing in their own words or suitably referencing the work within the text.

G626: The Physics of Sport

The assessment requirements for the revised 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 their trainees linked to - Measurement, Seeing, Movement and Technique

AO2: a presentation that 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.

The revised specification has amendments in AO1 in that the evidence required is four leaflets based on measurement, seeing, movement and technique. AO2 is now linked to equipment and two investigations have been introduced to support AO3. Spelling, punctuation and grammar are assessed in AO2.

It was noticed this session that candidates gaining 20-25 marks tended not to show selection and reports were completed rather than leaflets. All candidates should be working towards producing guidance leaflets suitable to be used at sport centres. At the higher end, however, some excellent detailed and focused guidance leaflets were produced with evidence indicating use of suitable research techniques and selection of the relevant information. Mark Band 3 work needs to show detailed knowledge written in candidates' own words with evidence on the linking of scientific knowledge to the chosen sport or equipment.

AO2(a) gives the candidates opportunity to present the work on properties of materials related to sports equipment as a presentation. Presentations of slides which include limited information should be supported with additional notes to indicate their knowledge and understanding. Where candidates have chosen to give their presentation, witness statements can be used to support understanding of the underlying principles.

It should be noted that time spent on practical work should relate to about 20 hours of class time. It is hoped that the addition of a further investigation will give candidates the opportunity to support practically the theory researched in this unit. A range of practical work linked to materials, forces and momentum was seen.

G622: Monitoring the Activity of the Human Body

General Comments

This unit did not appear to present any significant access issues for the majority of candidates. Most were able to complete all items in the time allocated and many were capable of following the rubric of the paper without any difficulty. The marks ranged from around 6 or 7 minimum to 69 maximum out of a total of 90 marks available. The majority of candidates were located within the range 16 to 56 marks.

It is clear that candidates are increasingly familiar with objective-style questions. Such questions were incorporated within the paper to supplement the free-response items. Some candidates struggled to express themselves clearly when completing the longer, free-response items. Graphical interpretation skills were appropriate in many cases although the terminology used was sometimes inappropriate or non-biological.

Comments on Individual Questions

- 1 (a) (i)(iii) Many candidates used the key words provided in the stem of the question to identify the veins and arteries.
 - (iv) This part was more challenging because the oxygenated property of the blood was required.
 - (v) This part did not present a problem for many but some candidates continued to choose artery or vein for this item.
- (b) (i)1 A number of candidates were confident with the structure of the respiratory system but some were undecided about the label for bronchiole, choosing bronchus as an alternative. The biological terms, trachea and alveolus, were familiar to many.
 - 2 Candidates were frequently uncertain about the change to the diaphragm during inhalation and the volume and pressure changes in the thorax were occasionally written the wrong way around. The air movement was not appreciated by many candidates.
- (ii) 1 The candidates are very familiar with sentence completion items using words provided. Many obtained full marks for this question but the first two words, less/more, were sometimes reversed.
 - 2 Candidates were often challenged by the topic of oxygen and nutrient transport in the blood. Whilst many understood about oxygen in the red blood cells, many did not refer to haemoglobin as a critical component or the use of blood plasma as a medium for oxygen transport. Nutrients were rarely understood and candidates were tempted to describe their absorption at the digestive tract, some incorrectly referred to nutrient transport in red blood cells.

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- 2 (a) Relatively few candidates understood the role of Barack in this question. Some considered that Barack was at risk of George landing on him, when falling off the treadmill. The hazards facing George were generally described correctly but the concept of evaluation of risk presented a challenge to many candidates. Some described a cause of the risk without identifying the level of risk (as low). The description of precautions was generally more correctly applied to George, rather than to Barack but not clear pattern of alternative responses was observed. The idea of reporting an accident was fully understood by relatively few candidates. Some returned to descriptions of injury or accidents, rather than to the formal procedures of calling for assistance/medical care or recording the incident in an accident log.
- (b) (i) Many candidates correctly chose 'aerobic' as the form of respiration but few linked this to mitochondria. It is possible that a number of candidates do not appreciate that the mitochondria represent the site of aerobic respiration in cells.
- (ii) Lactic acid was often correctly selected as the response but other products such as water were sometimes provided.
- (iii) Oxygen debt was understood by some candidates but there was a tendency for many to guess a response, some giving 'tired' or using other terms such as 'glucose'.
- (iv) The idea of lactic acid being removed was expressed by some candidates without a more precise reference to it being oxidised or converted back to other intermediate compounds such as pyruvate. This was challenging to most candidates.
- 3 (a) (i) It was encouraging to see candidates correctly identifying the values for pulse, body temperature and blood pressure. The temperature was often correct. The absence of units did prevent a number of candidates from obtaining marks for this question. Blood pressure values were occasionally slightly out of range. Some candidates gave values for an 18-year-old male, rather than those required for a 40-year-old.
- (ii) The first and final choices were often correct, particularly for the trace for ventricular fibrillation (A/6). Some candidates appeared to guess all choices and failed to obtain any marks. No clear pattern emerged with regards to alternative responses.
- (b) (i) Many appreciated that the brain is the location for the thermoregulatory centre but some were confused with the function of the medulla, rather than that of the hypothalamus. Some chose pituitary gland or other, very different locations, such as the heart or blood vessels.
- (ii) 1 Shivering was often, correctly, linked to increasing the body temperature or 'warming up'. The idea that muscles contract and relax, thereby generating heat was not understood by many.
- 2 The operation of the sweat glands in the production of sweat appeared to be understood but was often poorly explained. Some candidates were very challenged by this topic but did realise that a cooling effect was provided by the process.

- 3 Some candidates incorrectly described the 'movement' of blood vessels nearer or further away from the skin. Others gave good descriptions of more or less blood flow in this region of the body. There was a general understanding that the body temperature may decrease or increase but this concept was usually not linked to more or less heat loss at the skin surface.
- 4 (a) Many candidates obtained three marks for this item. They were able to select the correct sequence between H/F, F/G and G/E but failed to identify the J/H link in the correct position. Candidates are clearly familiar with this type of objective question.
- (b) (i) The diagram generated a number of interesting responses. The concept of blood pressure decreasing in relation to either increased resistance to flow or the availability of more space for the blood, was challenging and few candidates obtained a mark for this item.
- (ii) Although some candidates gave very good descriptions of the cardiac cycle, with clear references to systole and diastole, many were apparently confused and failed to describe the variation correctly. Some repeated the item in their response.
- (iii) This item was often completed fully and correctly by candidates. The values and names for systole and diastole were understood. Some used the terms 'high' and 'low' for the name of the pressure, thereby giving descriptions but not names. Such candidates often obtained two out of the four marks available.
- (c) (i)(ii) Many candidates were able to read and interpret the data presented in this form of graph.
- (iii) A significant number of candidates were challenged by the description of valve action. The term 'valve' appeared in the stem; many responses did not refer to valves but did give correct descriptions of events in the chambers. Some referred to valves but did not know their names. Relatively few candidates obtained full marks for this item.
- 5 (a) (i) Many candidates were fully aware of the application of ultrasound scanning for the detection of pregnancy. It was unfortunate that some gave a response 'pregnancy' without describing the 'detection of the foetus' or 'checking for pregnancy'. Observation of heart action was also chosen correctly by some candidates. A small number of candidates confused the use of ultrasound with X-rays.
- (ii) The benefits of ultrasound scanning were often described correctly. Some referred to seeing soft tissue without qualifying this with reference to good resolution of this tissue. There was also some confusion with the concept of radiation, some indicating that no radiation was involved, rather than observing that it was non-ionising radiation. The idea of this type of scanning as being non-invasive was frequently and correctly chosen.
- (iii) Many candidates did well with this item and gave clear descriptions of the basic principles of ultrasound scanning. Unfortunately, a number of candidates continued to confuse the technique with X-rays. The concept of image formation and the use of the gel to reduce interference was often described clearly. In general, the presentation of answers was clear and logical with only some spelling errors. Some candidates did, however, struggle with writing an extended response.

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- (b) A number of candidates did very well with this item and gave good, well-presented responses. However, the logical presentation of benefits and risks was sometimes muddled for other candidates. Whilst this did not have a significant impact on the overall mark, it did present some difficulty in relation to the clear link between the benefit and/or risk and the process of diagnosis and treatment. Again, a few candidates continued to confuse this topic with that of X-rays.

G623/01 Cells and Molecules – Planning exercise

General Comments

Centres should remind their candidates to read the instruction brief carefully to avoid misinterpretation. Also, it is suggested that centres provide candidates with a self-assessment tick sheet to ensure that all the assessment criteria have been addressed in the plans before final submission.

Whilst it is pleasing to note that candidates from some centres have provided evidence of many of the marking criteria, the quality of this has sometimes been superficial. Details of preliminary work and reasons for it, must inform the development of the main investigation. There is an expectation that candidates will identify and use secondary sources, other than those stated in the OCR Insert source material. A full range of appropriate equipment and materials to be used should be listed which indicates the number of each and specific sizes to be used, where appropriate. Consequently, there will be a tightening of the marking criteria in subsequent sessions.

Centres are asked to ensure that:

- (i) attendance registers for the planning component are included with the candidate scripts
- (ii) candidate plans and tests are sent in separate OCR envelopes using the labels provided to enable effective script tracking for BOTH components.

Task: investigate the effects of incubation temperature on the yield of juice after enzyme treatment from one variety of English apple.

Marks ranged from 2 to 24 out of 25

- A** This was achieved by many candidates who could identify at least 3 potential hazards from sharps/electrical/allergy/electrical. Many centres used standard forms which cued candidates into identifying relevant hazards, risks and control measures for this task.
- B** Awarded if a relevant statement was made with reference to temperature and yield. Weaker candidates described enzyme activity and failed to link the effect of temperature to juice yield.
- C** Awarded if prediction was clearly justified. Weaker candidates referred to 'body temperature' which was not credited.
- D-E** Greater 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 details.
- H-I** The majority of candidates achieved marking point 'H', although the range of secondary sources cited was limited in many centres. There is an expectation that candidates should use the stimulus material within the OCR insert **AND** to extend their research to include other reliable sources. Fewer candidates explained the benefit or relevance of their sources in the development of the plan.
- J-K** Both marking points were achieved by the majority of candidates. The task is based on well documented Key Stage 5 practical work and required some adaptation from published sources.

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- L-M** The majority of candidates were awarded both marking points. Comprehensive lists of equipment and materials were given, with numbers of each and specific sizes stated. Weaker candidates failed to list key items such as apples and enzyme preparation, whilst others listed 'tinned apples' as a material.
- N** The majority of candidates appreciated the need for repeats.
- O** Very few candidates achieved this marking point. A reason for the temperature range chosen was omitted by the vast majority.
- P** The majority of candidates stated an appropriate range of at least 4 different temperatures, based on their prediction or research.
- Q-R** Misunderstanding between independent, dependent and control variables was seen in some centres. However, the majority of candidates could state at least two control variables although very few could state how these would be controlled. Many referred to the equipment items to be used but made no reference to quantitative methods of control. In future, candidates must state how a variable is to be controlled, using quantitative data, if appropriate. Consequently R was rarely awarded.
- S-T** Tables were usually drawn for 'S' although lack of appropriate headings and/or units in the header(s) lost the mark. Graphs were included by approximately 50% of the candidates.
- U** Well answered. For those candidates who included the need for repeats in their plan, many calculated the mean volume of juice produced.
- V** Rarely awarded. Few candidates linked their expected observations to confirm or reject their original prediction. 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 awarded for at least two sources of error, of which one was limited to human error.
- X** Unlike previous sessions, 'X' was awarded frequently since many candidates could recognise an alternative method to prepare the apple tissue ie use of a blender. Whilst some candidates referenced the use of published data, others extended the temperature range around the optimum and some planned to vary the enzyme concentration to improve yield.
- Y** This was achieved by all candidates.

G623/02 Test

General Comments

The overall difficulty of the paper was similar to that of previous years. Each of the questions and the paper as a whole achieved satisfactory differentiation between candidates. There was no evidence of candidates failing to complete the paper due to lack of time. There was no common misinterpretation of the rubric.

Marks ranged from 4 to 38 out of a total of 45. The overall performance varied between centres. Centres either had a good range of marks or had many poor scripts.

It was disappointing that many candidates could not calculate real size given the magnification of the diagram in Question 1.

It is a concern that many candidates have had limited practical experience of performing food tests, measuring sizes of cells or looking at slides of blood disorders.

Comments on Individual Questions

- 1 (a) The majority of candidates achieved all four marks in this section. It was pleasing to note the large number of comparative statements in candidate's responses.
- (b) (i) Generally well answered although weaker candidates confused mm and cm in their answer.
- (ii) Many candidates could divide their value in part **(b)(i)** by the magnification, which had been given in the stem. However, very few could correctly convert this value to μm .
- (c) (i)(ii) Few candidates could correctly identify both structures and state their functions. Many identified Y as the nucleus and cited Golgi as the site of protein synthesis. Candidates who correctly identified Y as a mitochondrion, lost the function mark for failing to link the role to aerobic respiration.
- 2 (a) The majority of candidates achieved 3 out of 6 marks, mainly for iodine; purple/lilac and brick red. A large number of centres did not give the full list of reagents required for lipid and non-reducing sugar.
- (b) (i) This was not done well. Neither NH_2 nor COOH groups were well known. More able candidates managed to achieve at least one mark. Double bond would show $\text{C}=\text{OH}$ rather than $\text{C}=\text{O}$. Many candidates confused amino acid structure with that of a triglyceride or hexose sugar.
- (ii)&(iii) Many candidates could state either peptide or hydrolysis.
- (iv) Candidates omitted to link the primary structure of a protein to the order or sequence of amino acids in a (poly)peptide chain. Most candidates could state either the α helix or the β pleated sheet as examples of the secondary structure of a protein.

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- 3 (a) (i) Well answered – the majority of candidates scored two marks for plotting the points.
- (ii) All but the weakest candidates achieved one mark for a suitable line. Centres should promote the use of sharp pencils by candidates in order to achieve greater precision when drawing a suitable line on a graph.
- (b) (i)&(ii) Whilst many candidates gave a correct data quote from the graph, few correctly calculated the average rate of reaction in $\text{cm}^3 \text{min}^{-1}$. The majority gave rate per sec.
- (c) Whilst most candidates gained marks in this section with the banded mark scheme, few were at the highest level. A detailed description AND explanation of two effects of temperature on enzyme activity, expressed clearly and logically was expected for four to five marks. Unfortunately many candidates ignored low temperatures.
- 4 (a) (i) Very few candidates could correctly identify P and Q.
- (ii) Very few candidates could explain how to use a stage micrometer. Common responses from candidates who scored two out of three marks included 'line up scales' and 'conversion of P divisions to actual measurements'. Responses from weaker candidates included reference to the use of Q to make direct measurements of cell dimensions.
- (b) (i)(ii) Whilst more able candidates could suggest suitable diagnoses of anaemia and leukaemia from the photomicrographs, few could give a correct explanation for each. Many lost marks for not making reference to specific blood cell types, which was disappointing.
- (c) Most candidates could suggest at least one moral and ethical issue and subsequently scored at least one mark in this section.

G627, G629, G630, G631, G632, G633, G634: A2 Portfolio Units

General Comments

For both AS and A2, all candidates should now be using the revised specifications which were introduced for teaching from September 2009. For this session, where work was presented for moderation using the original specification and assessment criteria, the work was moderated against the criteria studied. Please ensure that for teaching starting September 2010, all candidates are using the revised specifications and assessment criteria.

It is hoped that centres have found the revised specification and assessment criteria improved and more accessible and any of the amendments that have been made support the teaching and learning of this specification. For more information, please read the new specification and sample assessment materials found on the OCR website (www.ocr.org.uk). 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 were scaled this session as work at the higher mark bands tended to be generously assessed. Centres are advised to refer to Appendix A (page 93) of the revised specifications for the performance descriptors for A2 work. Where centres were scaled, work submitted did not reach the necessary standards required by the assessment criteria ie work was not sufficiently detailed and accurate, with limited data at a high level of precision and reliability. Where centres are awarding candidates over 42 marks for their overall work, evaluative work needs to be sufficiently detailed and show a high level of understanding. 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 understanding, and should fully cover the requirements of the assessment criteria.

Many centres are now accredited. Accredited centres need to ensure that the necessary Authentication form is sent to OCR for each session that they are entering candidates for assessment. If there is any change in the nominated staff, OCR needs to be informed. It should also be noted that centres need to be accredited separately for the AS and A2 qualification.

Work selected for moderation reflected coverage of all the units offered by this A2 specification and a wide range of marks was seen. It was pleasing to see that several centres had followed the guidance given from the Moderators' Reports supplied in June 2009. It was noted by both moderators and the senior examiner 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.

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

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The majority of centres were again very responsive in sending the requested portfolios for moderation and returned the Centre Authentication Form with the candidates' work. Most work was well organized and presented using treasury tags which allowed moderators to easily read and locate the work. These factors help to support an efficient moderation process and this is appreciated. It is also appreciated that where centres have 10 or less candidates that all work is sent directly to moderators.

Moderators continually discovered clerical errors where the marks on the MS1 forms were not the same as the marks recorded on the URS. It is hoped that in the future, centres will ensure suitable checks are done to make sure that these are reduced to a minimum. This seems to be an ongoing problem.

Where centres are providing annotation throughout the portfolios with an indication of how marks are awarded against the criteria, this is appreciated by moderators and does support the assessment decisions made by the centres. Centres are again asked to include the tasks sheets given to the candidates as this helps to support the moderation process, very few were seen.

G627: Investigating the Scientists' work

The assessment requirements for the revised specifications now 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 chosen did on the whole show evidence that candidates had progressed from AS level and were working independently and following holistic work plans. Most candidates were now including much more detail in their plans supported by evidence that they are actually using them to support their work. Monitoring occurring during the investigation was also evident from a number of candidates.

AO1 should now include a workable and clearly presented plan and selected research to include the following:

- vocational links
- experimental work (a *range* is needed for higher mark bands)
- health and safety guidance
- suitable referencing of sources (validation of sources is needed for higher mark bands).

This guidance seemed to produce much more detailed evidence to support the investigations. Mark Band 3 work needs to show both identification and discussion of the constraints and suitable contingency plans written to a high level.

Centres offering the A2 are still advised to ensure candidates are given topics at AS which will give them opportunities for progression. Investigations chosen should build on work studied at AS level and centres need to ensure that if candidates are to access the highest mark bands, their investigations do give them the opportunity to carry out a wide range of experimental techniques and procedures. Candidates for this A2 investigation should not just be carrying out one type of experiment several times. The candidates should be showing their skills by completing different types of experimental procedures.

A range of work on Vitamin C and related topics were very popular this session. Investigative work was seen on enzymes which built on work studied for the biotechnology unit. This was good to see, but care is needed to check that full holistic plans are used. Further investigative work included research on properties of materials, investigative work on organic compounds, aspirin and various methods of preparation. Esters were also quite common and extensions of environmental investigations were seen, but again care is needed that the investigation does extend work covered in the separate units.

Redox investigative work seen included iron tablets and their uses, potassium manganate(VII) titrations, Iodine thiosulfate titrations, the use of back titrations in the investigations of antacids and food analysis, again vitamin C in a range of food products and drinks, yeast /sugar/fermentation, health and fitness, and the effects of stimulants, energy drinks, caffeine etc. on performance. Care needs to be taken that when candidates study health and fitness investigations, they are given the opportunities to complete different types of experimental

Reports on the Units taken in June 2010

techniques, if they are aiming for the higher mark bands. Analysis of bleach supported by microbiological practical activities, allowed the higher mark bands to be reached as a wide range of experimental procedures and techniques can be included.

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 then allow a number of candidates the opportunity to work on the same basic investigation but allows an individual approach.

It is important that the standard of experimental work is at A2 Level and 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 work. Risk assessments need to be included with all experimental work to fulfil the health and safety requirements.

The report does not necessarily need the candidates to include details of methods used. A standard procedure that was used can be attached. However, the report does need to show the outcomes of the investigation with suitable evidence of an understanding of the scientific concepts involved. Centres need to ensure candidates also relate the outcome to the original aims of the investigation. Mark Band 3 guidance indicates that candidates should not only indicate 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.

G629: Synthesizing Organic Chemicals

The assessment requirements for the revised specifications now include:

AO1: a report or leaflet that 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.

Limited work was seen this session for this unit. Guidance is as follows:

Work seen at the higher levels was better this session; however, candidates should be producing a report or leaflet for AO1. There is still evidence of notes and answers to questions and although this shows understanding, the candidates' research should be presented as requested by the assessment criteria. Evidence for higher marks should show suitable selection to reflect the guidance given in the assessment criteria. For AO1(a), classification and identification of functional groups with evidence of understanding the different type of isomerism, work needs to be accurate and clearly focused to the requirements. The importance and an explanation of isomerism linked to specific examples is really needed to secure Mark Band 3. Candidates need to ensure accuracy when giving organic formulae, too many mistakes were seen in both basic formulae and in equations. For AO1(b) the explanation of reaction types needs to be linked to organic chemistry and not generic explanations. The revised specifications have now limited the research required on the drug types. Some excellent tabulated work was seen from candidates, which reflected good research techniques with work suitably selected and referenced. Spelling, punctuation and grammar are now assessed within this strand.

AO2 work needs to show evidence of research work on a process used to manufacture an organic compound; alcohol, several selected haloalkanes, esters and medicinal drugs were chosen. AO2(b) needs to focus on costs and benefits to individuals, companies and society associated with the manufacture of the organic compounds. Mark Band 3 work again needs to be at a much higher level than some of the work seen, explanations, evaluation of benefits and costs related to individuals, companies and society are required.

Preparations of aspirin, ethanoic acid, benzoic acid, iodoform (triiodomethane), ethyl ethanoate, bromo butane and paracetamol were all quite common. Candidates need to take care that for Mark Band 3, risk assessments are accurate and sufficiently detailed. Risk assessments tended to be Mark Band 2 rather than Mark Band 3. Candidates still need to be guided to ensure they record suitable observations for both their preparations and that the processing of results is recorded and completed to a sufficiently high level. Evidence on calculations of theoretical yield is needed. Evaluation of the process again 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 are allocated for this 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 revised specifications now 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 by using graphical methods.

AO3: evidence to show the following 3 sets of experimental work:

- a) design and use a testing device/plan/results
- b) report and results from tests on samples that have been work-hardened, annealed and tempered
- c) completion of experimental work on electrical conductivity or specific heat capacity.

Limited work was seen this session for this unit. Guidance is as follows:

Much of the poster work seen reflected the requirements for AO1 and was assessed to the appropriate standard; however, some candidates need to check that for Mark Band 3 the physical properties are related to the structures. The introduction of one case study supported improved quality in candidates' work and a range of work was seen, from household uses to sporting requirements of materials.

For AO2(c), 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 need to check their answers.

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 that for AO3(a) evaluations are detailed, for AO3(b) a full discussion and evaluation relating to whether or not the treatments have produced the expected results is required and for AO3(c) reasons need to support repeats, estimations of uncertainty in results and evaluations compared to data values are needed to support 8-10 marks.

G631: Electrons in Action

The assessment requirements for the revised specifications now 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.

Limited work was seen this session for this unit. Guidance is as follows:

Although this unit continues to have limited entry, a range of work was seen this session. Candidates gaining higher overall marks are showing understanding in the basic redox /half equations and emf calculations which reflected clear understanding of the physical chemistry involved. Candidates should be advised to read their work through before submission to avoid errors in spelling and grammar.

For AO2(a) it is hoped that the guidance in the assessment criteria will now focus the candidates on the outcomes of their research. 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 environment effect
- sustainability and use.

It is hope this guidance will allow candidates to access the available marks. Good practical work was carried out which supported the understanding of redox reactions and the electrochemical series. Risk assessments need to be evident to support safe working. In AO3, candidates now need to show evidence of planning suitable experiments to investigate the effect of changing conditions on:

- the emf of a cell
- the mass of copper deposited during electrolysis.

Candidates should be showing evidence of individual planning and should not be just following set experiments. Centres also need to ensure that evidence of both types of experiments is included. Diagrams can be used to support planning and understanding.

G632: The Mind and the Brain

The assessment requirements for the revised 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 revised assessment requirements now include minimal change for AO3, just a rearrangement of the requirements.

Some excellent fact sheets were seen on stress and illness and the healthy and damaged brain. Suitable selection of material is being seen from the higher level candidates but care needs to be taken that candidates only achieving at the lower mark bands are presenting their research appropriately in the form of fact sheets and not as a set of reports. Candidates also need to work on their referencing techniques at all levels.

AO2(a) again allowed candidates to produce information giving the clinical methods of studying the brain. Diagnosis of brain diseases was generally well covered and some good illustrations supported the candidates' work.

Work for AO2(b) moral and ethical implications of brain research tended to be Mark Band 2. Mark Band 3 work needs to reflect the statements given in the assessment criteria. Much more comprehensive discussion and conceptual considerations are needed to reflect these higher mark bands.

AO2(c) does ask for a fact sheet detailing statistical evidence. Candidates are using a wide range of statistical testing on their results but additional information is still needed to ensure the higher mark bands.

Centres need to note that 26 marks are available for this section and therefore candidates need to spend the appropriate time in their experimental work (25-30hours). For Mark Band 3 a range of data needs to be collected and processed. Generally, suitable statistical processing was completed on experimental data. For Mark Bands 2 & 3 for AO3(e), care needs to be taken to ensure the requirements of the criteria are suitably covered.

G633: Ecology and Managing the Environment

The assessment requirements for the revised specifications now 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.

Candidates' work seen this session continues to reflect the interest and enthusiasm candidates have for this topic area. Photographic evidence is good to see where it supports evidence written in reports. Quality rather than quantity seemed to prevail this session with suitable selection of researched material presented in portfolios, this was good to see and centres should be congratulated on the guidance given to their candidates. Candidates still need to ensure that for Mark Band 3, work demonstrates both a thorough knowledge and understanding of the factual information and evaluations, where needed, are at an appropriate high level to reflect 'A' grade A2 work with suitable justification included.

Calculations were usually linked to data gathered from practical work carried out. Centres do need to ensure that if they are going to use this, suitable opportunities are given for candidates to collect quantitative data. Good statistical analysis was generally seen in this section.

A good range of experimental techniques work continues to support the requirements of this unit. Participation in field trip work gives candidates an excellent opportunity to gather a range of quality data, in order to produce good detailed work, although it is not essential and some very good work was submitted where candidates have either worked within the school/college grounds or from local nature reserves/ river areas etc. Candidates generally seem to be producing suitably detailed risk assessments that are usable, but they need to include activities that take place both inside and outside.

AO3(c) the displaying of data did show a range of different ways, kite diagrams were commonly seen to support data display, but accuracy still 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.

G634: Applications of Biotechnology

The assessment requirements for the revised 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.

Some excellent booklets were seen for AO1 on the science of genetic engineering and the use of recombinant DNA technology, where work has been suitably selected from a variety of sources and reflected clear understanding of a complex topic.

For AO2(a), candidates still need to take care that they describe how successful recombinant DNA technology is in solving problems associated with food production. Two examples are needed to support Mark Band 3 work. Detailed evaluative work is needed to increase the marks to Mark Band 3.

For AO2(c) Mark Band 2, work on moral, ethical and environmental issues concerning the use of recombinant DNA technology in the production of GM plants needs an explanation of two types of controls placed on scientists that work in this field. To achieve Mark Band 3, candidates need to produce a more detailed report with additional explanations and evaluative work on the two types of controls placed on scientists and how effective they are.

For AO3, generally suitable practical work was seen but plans still need to be clearer. Care needs to be taken that suitable immobilised enzymes are prepared and used. Evidence of good displays of results need to be included for AO3(c). Conclusions and interpretation of results are still basic and candidates need to check they spend the appropriate amount of time on AO3(c) and AO3(d) to ensure sufficient coverage. For AO3(d) Mark Band 2, candidates need to check that as well as interpretation of results and basic conclusions, the advantages of using bioreactors and enzyme immobilisation are included.

G628: Sampling, Testing and Processing

General Comments

The number of candidates taking this examination in the summer had increased by about 25% to over 600.

The total mark for this paper was 90 and, as on previous occasions, many papers were in the range from thirty to fifty five. The examiners noted that the number of very low scoring papers was less than in previous sessions but few papers were again seen that scored sixty or more.

The examiners were pleased to see that the number of irrelevant responses, not linked either to case study material or to the question, were few. This continues a welcome trend seen in previous papers.

The weakest area continues to be the ability to design and describe simple experiments, even with basic guidance being given in the questions. Another weak area is where candidates do not read the questions carefully enough and give answers that are correct in themselves and related to the topic but that do not address the question itself.

The answers to the questions on spectroscopy and chromatography, where candidates are required to know about the applications of these instrumental methods, were generally disappointing, and this is an area where more attention should be directed.

The responses to Question 3, which was not based on the case study were, in general, better answered this time but there was some evidence that the timing for the examination was tight and some candidates had not spread their efforts evenly in terms of time allowance.

There were fewer questions on this paper that required candidates to use mathematics. However, many candidates still have trouble when changing the subject of equations and in calculating percentages. The use of standard form showed an improvement.

In general the examiners thought that the paper had worked well and that candidates had been given a chance to demonstrate their knowledge and understanding and to adapt this to new situations.

- 1 (a) Most candidates gained both marks, often for considering health/safety and environmental concerns.
- (b) A more detailed response was needed than just stating 'quality'. One mark for 'ripeness' was commonly seen.
- (c) Nearly all candidates devised a correct method for reaching pods in the upper branches.
- (d) Most candidates gained the mark for **(d)(i)** but fewer gained the mark for 500 kg in part **(d)(ii)**.
- (e) (i) An easy question for many, stating 'representative sampling' or the need to make a comparison.
- (ii) Few candidates failed to know where to seek advice about the ripeness of the cocoa pods.

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- (iii) 'Temperature' and 'labelling' were the most common correct responses but a number of other answers were also acceptable.
 - (iv) The reasons for washing were generally clearly stated.
 - (v) 'To avoid contamination' was usually seen and gained credit.
 - (vi) Most candidates stated 'they would turn brown'. This obtained from the article.
 - (vii) Few candidates could use the percentage information provided. The correct unit was required here.
 - (viii) The need to have written evidence for others to follow was not very clearly stated.
 - (ix) The advantages of using a graph were well described by many.
 - (x) This was a testing question that required candidates to consider the evidence given carefully. Few correct answers were seen.
- (f) Many candidates responded with sound answers and gained at least one out of the two marks.
- (g) This was a challenging question and it was uncommon to award two marks, although the information was provided in the question stem.
- (h) (i) Most candidates realised that chocolate is a solid at 25 °C.
(ii) The effect on temperature on viscosity was generally recognised.
(iii) The need for comparisons to be made was not always realised.
- (i) (i) 'So that the temperature reached the water bath temperature' was seldom provided.
(ii) Nearly all candidates mentioned that cleaning or sterilising were required.
(iii) Many good graphs, gaining both marks, were seen. A few drew curves.
- (j) Candidates had to design an experiment to find the hardness of chocolate at various temperatures. Many disappointing scripts were seen that lacked a logical sequence. It was unusual to see a script that gained five or more of the seven marks.
- (k) Most candidates could gain one or two marks by interpreting the data in Table 1a of the article.
- 2 (a) (i) Most candidates gained both marks, for referring to the stream and the stream bed rocks.
(ii) This was a discriminating question and few candidates related the sediments to the density of the lead ore.
(iii) Very few candidates could think of a suitable method for drying and separating the tin ore.
(iv) A significant number of candidates could not calculate the percentage required.

- (v) This was an easy mark and many candidates gave 'glass breaks' as a valid answer.
- (vi) Nearly all candidates gained two marks for suitable labelling of the specimen jar.
- (b) (i) The toxic nature of the gases was usually given.
- (ii) The question asked how you would show that it did not contain copper sulfate - the answers given often did not address what was being asked.
- (iii) Most correct answers considered the high temperatures needed and the lack of equipment.
- (c) This calculation used large numbers and a number of candidates managed to use these correctly.
- (d) (i) Many candidates correctly stated the need to repeat the measurement. Those who stated anomalies / outliers needed to qualify these to gain credit.
- (ii) Many candidates could not read the figure correctly from the graph and / or could not then carry out the calculation.
- (e) (i) The question focused on the method; many candidates focused on the sample.
- (ii) This was a difficult question and few grasped that the focus should be on the small mass of zinc present in the penny.
- (iii) Many realised that it was important to choose a method that did not damage the coin.
- (f) Not all candidates were able to comment that the concentration of TBT diminished away from the coast and at a greater depth.
- 3 (a) The problems caused by high pressure and toxicity were recognised by most candidates.
- (b) (i) Most candidates realised that an advantage for Method 1 was a shorter reaction time.
- (ii) Nearly all candidates gained full credit for the advantages of the second method.
- (iii) Distillation (or its description) was not given by many candidates.
- (iv) Few realised that the molecular ion value gives the relative molecular mass.
- (v) A larger number mentioned the need for comparing the fragmentation pattern of both compound X and ethanal.
- (vi) Very few scripts showed that candidates had met infrared spectroscopy.
- (c) (i) It was necessary to relate the increased surface area and the consequent increase in reaction rate to gain credit.

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- (ii) This question required candidates to design a simple hydrometer, given outline details of a commercial instrument. Sadly, very few were able to design a piece of equipment and give a reasoned method of how it worked.
- (iii) The need for a risk assessment was clearly stated by nearly all candidates.
- (iv) This was a simple multiplication question but many could not do it correctly or left it blank.
- (v) This was a continuation of **(c)(iv)** but many could not use the simple figures given.
- (d) (i) An easy two marks with the use of PPE and avoiding naked flames commonly given.
- (ii) Relatively few candidates avoided open flames by correctly using an electrical heater.

G635: Working Waves

General Comments

- 1 (a) (i) Most candidates scored at least one of the two marks, drawing a reasonable approximation to a sine wave. The most common error was a large change in amplitude between successive cycles. A number of candidates failed to draw enough of the wave to show that they understood it to be a repeating pattern.
- (ii) Few graphs clearly showed random values for both amplitude and period. Some responses to this section were closer to a pure sine wave than the candidate's answer to part (a)(i). It is not until the second subsection of the specification that the focus is narrowed to repeating waveforms.
- (b) Some candidates scored one mark by recognising that the variations in amplitude may differ. Few candidates suggested a greater prevalence of overtones in many musical instruments. Similarly, few recognised that both produce repeating waveforms.
- (c) (i) A substantial number of candidates failed to score because they wrote 'sound (waves) cannot be polarised' without referring to the fact that they are longitudinal. 'Electrical signals cannot be polarised' was suggested by a number of candidates
- (ii) 1 Many correctly suggested the use of Polaroid. Very few mentioned polarisation by reflection. As is to be expected, given the breadth of this specification, other polarising material such as quartz were very rarely mentioned. Answers that accurately described the function of a Polaroid filter, without naming it, were acceptable, but many such explanations demonstrated a very limited grasp of the process.
- (ii) 2 Many attempted to draw diagrams of the filters rather than the light. Some showed polarised light as travelling in a single direction, along the direction of propagation and unpolarised light as spreading radially from a source. This suggests that they may have learnt that unpolarised light travels in all directions, but not fully grasped the difference between the direction of the displacement and the direction of travel.
- (iii) Many correctly gave the expected answer, glass. Perspex was also correct and any TRANSPARENT material (including 'transparent plastic') was accepted because candidates are not expected to remember refractive indices. Vacuum was not acceptable as candidates should know that the speed of light in air and glass is very close. Plastic did not score, as it is not necessarily transparent although these candidates may have been thinking of Perspex. Some of the weaker candidates suggested opaque materials such as wood or lead.
- (iv) Candidates commonly scored a mark for stating that the speed was the same but few gave good explanations of why. Those who did score the second mark generally did so by referring to the constancy of the speed of light (in a vacuum).

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- 2 (a) Most candidates demonstrated some understanding but few achieved full marks. A significant minority suggested that the ball had been warmed by the bowler's hand or friction in the air.
- (b) (i) Most candidates drew curves of generally the correct shape with the exceptions being bar charts or a single curve with three different regions labelled. The most common error was to extend the 'room' curve into the visible region.
- (ii) Most candidates recognised that the metal became white hot, or at least gave off a greater intensity of radiation. The second mark required a fuller understanding and was only met by a minority.
- (c) (i) Detailed responses were not required at this stage, so most candidates gave acceptable answers. Applications were commonly forensic, fire-fighting, hidden pipes and worn engineering parts.
- (ii) Few candidates gave full answers. Most commonly, candidates stated what could not be seen by the visible light camera, but not what it could detect. Few answers focussed on the different parts of the electromagnetic spectrum to which the cameras are sensitive. Most responses did include reference to **(c)(i)** but some omitted this.
- 3 (a) Most candidates completed the first two blanks, although reflective was seen in place of refractive on some scripts. Few candidates recognised high bandwidth as the third blank.
- (b) i All options were circled by a significant number of candidates.
- ii Most candidates knew the correct formula but only a minority could handle the substitution (ecf was allowed) and transposition and even fewer were able to arrive at the correct answer for their figures. Often candidates did not understand the prefixes and could not use standard notation correctly.
- c Only a minority successfully reproduced all the answers from the short passage provided.
- d i Most candidates were able to label the core and cladding and draw at least one ray. An approximation to $i = r$ was expected but not always seen.
- ii A majority of correct answers were seen.
- e Most candidates achieved at least some of these marks, although complete answers were rare. Common errors were confusion with monomode, or with coherent/incoherent bundles of fibre.
- 4 a i & ii Generally well answered. 'AM' and 'FM' were not accepted as the word modulation was given.
- b i Few candidates recognised that their measurement was a time by recording the unit. Most achieved at least one mark for knowing the unit of frequency.
- ii Many candidates were unable to distinguish between the carrier and modulating wave.
- c Candidates were better at correctly identifying an advantage than a disadvantage.

Reports on the Units taken in June 2010

- 5 a Many candidates would have achieved better marks on this section if they had identified the significance of the frequencies used for dial-up and broadband.
- b i Many correct answers were seen. Incorrect answers included wireless, satellite, ADSL and TDMA.
- ii&iii Candidates who had not recognised this application of optical fibres struggled with these answers.
- 6 a Candidates were successfully able to answer this question which relates to a common experience for many of them.
- b Many thought the tall building was an obstruction rather than a source of the signal. As expected, only the better candidates recognised the inverse square law.
- c Many correct answers were seen. However, some thought that being on the interface between two antennas was a problem rather than distance from either of them or obstructions.
- 7 a i Almost all candidates mentioned the rotation but few identified the lateral movement.
- ii Only a minority of candidates demonstrated a development of their understanding of the CAT scanner beyond their AS studies.
- b Generally well answered. A minority of answers related to possible claustrophobia or irradiation.
- c Many candidates had sufficient knowledge to score one or two marks. A minority were able to give reasonable accounts of the scintillator and photomultiplier, but full answers were rare. A significant number thought that the camera emits gamma radiation.
- d i Very few candidates could describe what it meant by a radioactive tracer. A relatively high proportion thought it was a device for detecting radiation.
- ii Many candidates had clearly learned about the significance of half life and a number were able to add additional points although few scored full marks. A minority gave what appeared to be guesses.

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

OCR Customer Contact Centre

14 – 19 Qualifications (General)

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Telephone: 01223 552552
Facsimile: 01223 552553