OCR
RECOGNISING ACHIEVEMENT

GCE

Applied Science

Advanced GCE **A2 H575/H775**

Advanced Subsidiary GCE **AS H175/H375**

Examiners' Reports

January 2011

H175/H375/R/11J

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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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EXAMINERS' REPORTS

Chief Examiner's Report

All centres should now be following the specifications for both AS and A2 work which were introduced for teaching from September 2009. It was noticed, however, that for this series some candidates were still focussing their portfolio work on the original set of assessment criteria. Centres do need to amend any previously used assignments to ensure candidates are not disadvantaged by working from old specifications and assessment criteria. It is particularly important that staff use the 2009 specifications for both the externally assessed work as well as the portfolio units. It was noticed that particularly for G628 (*Sampling*, *Testing and Processing*) there were gaps in candidates' answers as a result of a lack of knowledge of the additional content in the 2009 specification.

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 at level 2. Portfolio evidence indicates that generally candidates are carrying out a wide range of interesting research both on the Internet and by actual visits and practical work is showing a vocational link. Credit should be given to those staff and candidates who are using the assessment criteria appropriately, consequently work is being assessed at the correct level.

Many centres are now accredited and consequently limited work was externally moderated this series. Accredited centres need to ensure that the necessary Centre Authentication form is sent to OCR for each series 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.

There was again an increase in the number of candidates taking G622 (*Monitoring the Activity of the Human Body*), however, the level and quality of the work exhibited by the candidates was maintained with a good range of answers seen in this external assessment. Candidates can however expect to encounter new and unfamiliar contexts for the assessment of the AO2 skills in this examination, which is the application of skills and knowledge in appropriate vocational contexts. The inclusion of a particular scenario does not indicate that candidates are expected to have had prior knowledge of that specific context. They should use the question topic and information given to act as a trigger to access the relevant information for their answer.

For G623 (*Cells and Molecules*) the candidate entries for this series were not as large as in June series, although there was a significant improvement in the performance of candidates for the Plan, which was presented more clearly and concisely this series. For the externally assessed Test 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 had limited knowledge of magnification and showed little understanding of performing food tests.

The number of candidates taking the A2 papers this January had also increased although it was felt that there were a number of candidates who were not adequately prepared for these A2 papers. For G628 (*Sampling*, *Testing and Processing*) as noted in previous examinations, questions that test candidates' ability to design an experiment for a particular purpose were still done rather poorly. For G635 (*Working Waves*) there was a tendency for candidates to write what they knew about a subject, rather than directly answering the questions set. Centres need to note that these A2 papers do contain some part-questions that include Stretch and Challenge marks. These 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.

It was noted however 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. There is now a requirement to assess spelling, punctuation and grammar in both the portfolio and externally assessed units, and the opportunity to reach A* for the higher ability candidates.

G620, G621, G624, G625, G626: AS Portfolio Units

General comments

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 on 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 need to be much more focused on the specific hazards and risks of the experimental work carried out by the candidates and should be working documents.

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. Some high quality work has been seen from a number of centres this assessment series, however some scaling of candidates' work occurred, which again was mainly at the higher mark bands. Work submitted in these cases did not reach the necessary standards required by the assessment criteria i.e. 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 the candidates to ensure that the level of the work reflects a full and detailed understanding of the required work.

The portfolio units moderated this series were as follows:

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

Centres are asked to check carefully the accuracy of their recording. 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 e.g. 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 ability. Again it is useful if worksheets or assignment briefs can be included as this does give the Moderator some back ground information of the support given to the candidate.

Work selected for moderation reflected coverage of all the units offered by this AS specification. A range of marks was seen. Candidates use and selection of research material obtained from the Internet still needs to be worked upon, there is still evidence of 'cut and paste' without suitable referencing. Centres should be advised to spend time with candidates teaching research and recording techniques.

G620 *Science at work*

The assessment requirements for the current specifications now include:

AO1: Record of four surveys of science based organizations; one in depth study; work on health & safety laws and regulations

AO2: Evidence of impact organization 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 base for the more detailed in depth study. Candidates should also be aware that spelling punctuation and grammar are assessed within strand AO1.

Generally, the surveys were reflective of the requirements. Care needs to be taken that these do not include excessive 'cut 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. 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 & safety constraints and guidance used in the organisation.

Centres should try and give more guidance to improve the quality of the selection, presentation and the level of the science identified.

As in previous series the range of organisations studied included zoos, garden centres, health clubs/gyms, supermarkets, bakeries, breweries, pharmacists, power stations health centres, garages, colleges, universities schools, fast food establishments, as well several manufacturing organisations. Much of the work seen did reflect the guidance from the specification which resulted in studies which were focused on the correct requirements.

- 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 AO1(c).

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. There was minimum evidence of evaluation and justification of the research material. Assessment tended to be over generous for this strand.

Assessment for AO1(c) 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.

Candidates can link AO2(a) 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 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 organization.

A simple statement of the overall effect of the organisation to society is insufficient for mark band 2 and above. Evidence of an understanding of the core business of the organisation on the benefits of society is needed to support the higher marks.

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 fulfill 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, and significant figures errors were still seen here.

Candidates are now 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 linked to analysis of water, vinegar, various foods and medical products, monitoring of healthy eating and lifestyle and some physics related practical on materials and pulley systems.

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 at 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 need to spend more time in ensuring accuracy of their work, if they wish to gain higher mark bands. Processing skills in graphs and calculations were clearly evident but units are still missing from graphs and scales are poor, centres are encouraged to support their candidates to improve these skills.

G621 *Analysis at work*

The assessment requirements for the current 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.

It is essential for future submissions that centres take care to ensure that candidates give suitably selected and relevant information to describe a non-domestic consumer's energy policy.

It is evident from work seen this series that candidates are not researching, selecting and then presenting their information sufficiently, too much 'cut and paste' irrelevant material was seen. For 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.

Candidates need to ensure that they extract relevant information for AO1(b) and AO1(c) and relate it to their chosen organisation.

The range of work seen for AO2(a) tended to support the requirements of the assessment criteria. Candidates do seem to be focusing this work suitably on describing and comparing large scale and small 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.

AO2(b) 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 series.

A range of practical activities was seen for AO3(a) 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 the quality of the observations recorded is accurate and detailed, with higher mark band work being supported by correct balanced equations where appropriate. Again accuracy and suitable precision are needed to support mark band 3 results and evaluation. 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.

G624 *Chemicals for a purpose*

The assessment requirements for the current 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 account of the preparation of two products that have been synthesised, purified and analysed.

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. Although limited work was moderated, some detailed chemistry was seen but care still needs to be taken to ensure accuracy in equations and where 'cut and paste' is used detailed referencing is included.

Candidates should be guided to choose compounds which will allow them to find information on both uses and properties of these compounds. Sodium chloride proved popular this series with ethene/polyethene as examples made from oil. 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. 11 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 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 series was appropriately assessed and candidates generally had included suitable observations, diagrams and suitable processing of results. Candidates need, however, still to focus more on the recording of initial and final weighings etc. 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 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. This is still not adequately covered.

G625 Forensic science

The assessment requirements for the current 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.

The forensic work moderated this series was limited and the level of practical work seen was quite basic.

Suitable research, however, was seen for AO1(b) which covered chemical, biological and physical techniques, with suitable evidence to show an understanding of the need for an ethical code.

Candidates still need to ensure that their reports based on case study information do contain information on evidence and proof to include:

- the ways in which forensic scientists ensure the quality of evidence collected and analysed 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.

Limited calculation work was seen this series and centres do need to ensure they allow candidates the opportunity to carry out suitable practical work which will enable them to complete complex calculations. Refractive index work was not seen, and this can be recommended to fulfill suitable physical analysis and give opportunities for complex calculation work. Again, mark band 3 candidates need to ensure suitable AS level practical has been carried out with detailed processing and interpretation of results with 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 their 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 series which reflected a good understanding of the requirements of the assessment criteria.

Some candidates, however, still need to ensure that the evidence they provide for this unit is in the form of leaflets, some work was seen where evidence was presented as reports, this is not what is required. The level of guidance leaflets produced by the candidates varied in quality, with some showing good selection and relevant material whereas others included too much generic information just 'cut and pasted form the Internet. 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.

AO2(a) gives the candidates opportunity to present the work on properties of materials related to sports equipment as a presentation. It is hoped that evidence to support the giving of the presentation will be included. If candidates complete slides which include limited information, these should be supported with additional notes to indicate their knowledge and understanding.

It should be noted that time spent on practical work should relate to about 20 hours of class time. It is hoped that through carrying out two investigations candidates will have the opportunity to support practically the theory they have researched in this unit.

G622 Monitoring the Activity of the Human Body

There was a significant increase in the number of candidates taking this unit this January however, the level and quality of the work exhibited by the candidates was maintained with a good range of answers seen. The mean mark was 40, the same as last January.

Comments on individual questions

Question 1

(a) Many candidates recalled the normal core body temperature of an adult but some referred to an upper limit as 36 ^{0}C.

(b) Most candidates were capable of giving a realistic description of the physiological mechanisms but were confused with vasodilation, rather than vasoconstriction.

(c)(i) The graph enabled many candidates to choose the recovery period.
(c)(ii) A good explanation of events before and after the recovery date were provided in many cases.
(c)(iii) Although many candidates realised that some form of exercise was undertaken, other candidates gave interesting (and correct) responses relating to anxiety and stress.
(c)(iv) Most candidates were capable of taking the highest and lowest readings but some were unable to manipulate the data to calculate the correct answer.
(c)(v) Many candidates struggled to make the link between hyperthermia and vasodilation but appreciated that pulse rate was likely to be increased.

(d)(i) Good descriptions were given for the use of a clinical thermometer but many failed to conclude with the correct method used to take a reading.
(d)(ii) Clear and realistic responses were given for this item.
(d)(iii) Most candidates were aware of other types of thermometer but some interesting descriptions were given for the application of the same, clinical type.

Question 2

(a) Many understood about non-invasive features of X-rays, but some candidates struggled to obtain both marks available.

(b) Candidates are generally familiar with the topic of X-ray use. However, the details of events with regards to bones and soft tissues were often incomplete. The responses were often not presented in a clear and logical format.

(c)(i) Many have a good idea about the differences between CT and X-ray scanners.
(c)(ii) Again, candidates tend to have a good understanding of MRI techniques.
(c)(iii) It was surprising to note that some candidates are not aware of ultrasound and ECG techniques with regards to the monitoring of heart defects.

(d) A good understanding of risk and safety precaution was presented by many candidates for this item. Some, unfortunately, referred to the patient rather than the radiographer (as stated in the stem).

Question 3

(a) Almost all candidates can recall the correct values for normal blood pressures.

(b) Again, many were able to refer correctly to systole and diastole. This topic appears to be well understood.
(c)(i) This item was challenging for many candidates. It appeared to be difficult for candidates to relate events in the body to lack of energy and changing blood pressure. It often seemed to relate to a lack of clarity in the explanation but sometimes the candidates expressed poor biology in their responses.
(c)(ii) It was unfortunate that some candidates described the use of a traditional, manual sphygmomanometer. However, many were able to give a confident and clear description of how to use the digital equipment shown in the item. Most candidates were able to describe the preparation phase involving the cuff position etc.
(c)(iii)1 Candidates were able to interpret the graph and obtain the correct readings.
(c)(iii)2 The correlation between the two curves was challenging to describe for many.

(d) It was encouraging to find that so many candidates were able to complete an assessment form in the correct manner. Some remain confused about what to do when dealing with an accident.

(e)(i)(ii) Many candidates gave a good account of the issues relating to the treatment of the elderly lady in this item. They provided sensible options for benefits and inappropriate application of treatment.

Question 4

(a) The table was completed fully and correctly by a number of candidates but some were unable to define the features of the large bronchiole and the alveolus.

(b) It was encouraging so see a good explanation of goblet cells and cilia, working together in the trachea. Many realised that goblet cells produce mucus and that the cilia move the mucus (together with the collected dust etc.) up the trachea.

(c) The confidence to answer this item was based on a sound understanding of the goblet cells, supported by 'scaffolding' statements in the stem. Many candidates coped well with this item.

(d) Many candidates showed a good understanding of the link between tidal volume and the limited gaseous flow through the restricted trachea in COPD patients. They dealt with the scenario well.

(e)(i) It was clear that many candidates have a good knowledge of spirometer use and the preparatory stages involved in using this equipment. Unfortunately, some candidates became confused and described the use of a peak flow meter, giving full (and often correct) instructions for this different piece of equipment.
(e)(ii) Some candidates incorrectly described the use of the three readings to obtain an average/mean value. The more able candidates recalled that the highest reading is finally recorded.
(e)(iii) It was very encouraging to see that some candidates worked this question through to the correct conclusion. It was tempting for some to, incorrectly, refer to an increase in both gases in the blood plasma.

Question 5

(a)(i)(ii)(iii) Although almost all candidates were able to correctly use the table to described the changes in ATP, glycogen and lactic acid (some using actual values and calculations from the table), they struggled to describe the events causing such differences. The link between cellular respiration during rest and after sprinting was rarely appreciated.

(b) The toxic property of retained lactic acid was understood by some candidates. However, a number of candidates incorrectly referred to the creation of cramp. References to aching muscles and damaged muscles were also presented by some candidates but this did not negate the correct response, if combined in an overall response.

(c) A good understanding of ATP levels and other biological processes was shown by many. No clear pattern of incorrect, alternative response was noted.

(d) The features of blood sampling were well-described by many candidates. This aspect of fitness monitoring appears to be correctly recognised.

G623/01 (Cells and molecules) – Planning Exercise

General comments

Task: Investigation to compare the rate at which bread dough rises when made with gluten-containing (wheat flour) and gluten-free flour.

Marks ranged from 6 to 21 out of 25.

Although candidate entries for this series were not as large as in the June series, there was a significant improvement in the performance of candidates. However, a small proportion of candidates included copious background information which was largely irrelevant to the planning of the investigation.

In general, the Plan was presented more clearly and concisely than has often been the case. Candidates should be encouraged to continue to show a clear delineation between preliminary and later work, which was more apparent in this series.

It would be most useful if centres could provide students with a 'tick sheet' proforma at the start of the planning exercise. This will focus students to the marking points and the marking criteria and avoid omissions of evidence in the Planning task.

Comments on individual questions

A This was achieved by many candidates who could identify at least three potential hazards from allergies; glassware and electrical. However, whilst many centres used standard forms which should have cued candidates into identifying relevant hazards, risks and control measures for this task, some candidates gave a 'general' risk assessment rather than related to this investigation.

B Most candidates included a comparative prediction but were only credited if they made reference to differences in 'rate'.

C Many candidates made reference to the information in the INSERT to justify their prediction.

D, E, F & G Greater evidence of relevant preliminary work carried out by candidates was seen in this series. They normally gave an appropriate reason (**F**) and many described their experiment to score **E**. Few included relevant scientific information for **G**. Some weaker candidates still lack clarity about the role or purpose of supporting preliminary work. Preliminary work MUST inform or develop the main investigation.

H & I The majority of candidates achieved marking point 'H', although the range of secondary sources cited was limited in some centres. There is an expectation that candidates should extend their research to include other reliable sources, beyond that given in the OCR source material. Fewer candidates explained the benefit or relevance of their sources in the development of the Plan for marking point '**I**'.

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 to enable a comparative study on the rate of dough rise.

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 flour and yeast.

N Many candidates appreciated the need for repeats.

O Very few candidates achieved this marking point. Candidates had to appreciate the need to compare the changes in dough (made with two types of flour) rise over repeated short time intervals.

P The majority of candidates stated an appropriate range of at least four time intervals, using two types of flour, based on their prediction or research.

Q & R Some misunderstanding between independent, dependent and control variables was still apparent in some centres. A significant number of candidates did not identify variables. Of those that did, many failed to explain how they could 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. Many included graphs although axes often were inappropriately labelled &/or units were missing.

U Approximately half of candidates scored this mark. For those candidates who included repeats in their Plan, many calculated the mean dough height at specific time intervals. Some candidates made reference to statistical tests which were not appropriate for this investigation.

V Very few candidates offered a conclusion which included a comparative reference to 'rate'.

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 only one was limited to human error.

X Was awarded frequently since many could suggest appropriate improvements to their experiment. Whilst some candidates referenced the use of a standardised procedure in dough preparation, others extended the temperature range around the optimum growth for yeast and some planned an alternative method to measure dough height.

Y This was achieved by the majority of candidates.

G623/02 (Cells and molecules) – Test

General comments

Marks ranged from 4 to 38 out of a total of 45.

Each of the questions and the paper as a whole achieved satisfactory differentiation between candidates. Questions which targeted the A/B grade boundary were **Q1c(i)**, **Q3b(ii)**, **Q4b(i)**, **Q4c(ii)** and **Q4c(iii)**.

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

It was disappointing that many candidates could not calculate the actual distance between **X** and **Y** across the cell given the magnification, in **Q1(b)**.

It is still a concern that many candidates have had a limited practical experience of performing food tests and that considerable confusion exists in how to use an eyepiece graticule and stage micrometer to determine actual dimensions of cells.

Comments on individual questions

Question 1

(a) This section was not well answered. Very few candidates gained more than two of the available four marks. Of the four structures, 'cell wall' was most regularly identified correctly and the 'vacuole' least so. Confusion of the 'vacuole' with the 'nucleus' or 'cytoplasm' was a common error.

(b) Measurement of the distance **X–Y** was generally accurate but in some cases, the calculation was carried out incorrectly as a consequence of multiplying the magnification value. Those candidates who measured inaccurately, gained the second mark for an appropriate method for the calculation (ecf). Weaker candidates still confused mm and cm in the measurement of distance.

(c)(i) The majority of candidates gained 1 mark (level 1). A very few scored 3 marks (level 3). Many were aware of the eyepiece graticule and stage micrometer but found it difficult to explain calibration etc. with sufficient clarity to gain more than 1 mark. Reference to the published mark scheme may help here.

(c)(ii) Most candidates simply stated 'larger' without reference to the scale.

Question 2

(a) Plotting of the graph was completed accurately by the great majority of candidates who also drew an appropriate line of best fit for **2a(ii)**.

(b) This was generally well answered.

(c) Approximately half of candidates correctly suggested '…to reduce evaporation…' or '…prevent contamination…'.

(d) The most common, correct response was a reference to 'allowing a comparison/AW'. Few candidates gained the second available mark.

Question 3

(a)(i) Most candidates gave an appropriate suggestion for performing a diagnostic test.

(a)(ii) This was reasonably well answered, with the majority of candidates referring to blood counts, tests for anaemia and diabetes as well as HIV. Other correct responses were rare.

(b)(i) Generally well answered.

(b)(ii) This question proved difficult for most candidates. Those who did gain marks did so by referring to 'larger' cells and/or nuclei. Suitable explanations for these observations needed to relate to uncontrolled cell division or an increase in DNA replication or protein synthesis.

(c) Most candidates made a reasonable attempt to explain the use of monoclonal antibodies, with many scoring two of the three available marks.

Question 4

(a) Many candidates attempted the crossword although marks were lost due to lack of candidate knowledge on the reagents used and expected observations of the chemical tests, which are stated in the specification in section 3.4.3.

(b)(i) Many of the more able candidates gained marks here, with some naming at least three out of the four structures correctly.

(b)(ii) Relatively few candidates correctly identified 'hydrogen bonds'.

(c)(i) 'Codon' was rarely offered.

(c)(ii) Very poorly answered by the majority of candidates.

(c)(iii) With very few exceptions (some were very good), candidates rarely gained any marks.

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

General comments

It was noted by both Moderators and the senior Examiner team that candidates' portfolio work at A2 showed suitable progression from the AS work studied in year one of this course. This was pleasing to see. It is essential, however, that 'A' grade work is detailed, accurate and reflects that the candidate understands the research carried out. All researched information should be suitably referenced and relevant. Centres need to be aware for all future submissions that when awarding full marks at mark band 3, work should be free of any minor errors, and needs to reflect independent work with evidence of high level scientific understanding.

The portfolio units moderated this series were as follows:

- G627 *Investigating the scientist's work*
- G629 *Synthesising organic chemicals*
- G632 *The mind and the brain*
- G633 *Ecology and managing the environment*
- G634 *Applications of biotechnology*

It was appreciated by Moderators where work included relevant task and assignment sheets given to the candidates. Good practice was seen by centres where staff had supplied supporting evidence about group or independent work and where appropriate, availability of equipment. Risk assessments written and used by candidates that were suitably detailed and focused on the experiment, that were not generic or giving basic laboratory safety rules 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 were giving detailed and workable plans. Some good research was seen linking vocational contexts to the aims and objectives of their chosen investigation. Vitamin C investigative work was again amongst the most popular; however where this was supported with more complex volumetric work, opportunities were given for candidates to offer a range of experimental techniques. Several organic investigations e.g. extension of aspirin work /ester synthesise and use, were seen this series in addition to food analysis, further vitamin C work in a range of food products and drinks, microbiological investigative work, yeast /sugar/fermentation, health and fitness. Good practice was seen where candidates were given the opportunity to investigate topics further and carry out a wide range of experimental techniques and procedures.

It is important that the standard of experimental work is AS/A 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. 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 ask 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.

Work for AO1 generally was showing 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 – 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.

The report does not necessarily need the candidates to include details of methods used etc. 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 candidates 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.

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 completed.

G629 *Synthesising organic chemicals*

The assessment requirements for the current specifications now 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.

Limited work was moderated this series for this unit, although the work seen was generally well structured and allowed candidates the opportunity to cover the required assessment criteria.

General guidance is as follows:

- AO1 evidence needs to be focused on the requirements of the specification and not just a repetition of candidates' notes
- AO1(a) 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 is really needed to secure mark band 3
- Candidates need to ensure accuracy when giving organic formulae and show understanding when writing equations rather than just 'cut & paste'
- AO1(b) the explanation of reaction types needs to be linked to specific organic chemistry and not generic explanations
- AO2 work needs to show evidence of research work on a process used to manufacture one organic compound examples which can be used include alcohol, haloalkanes, esters and medicinal drugs
- AO2(b) needs to focus on costs and benefits to individuals, companies and society associated with the manufacture of the selected organic compound
- AO3 preparations of aspirin, ethanoic acid, benzoic acid, iodoform (triiodomethane) and paracetamol can be used. Candidates need to take care that for mark band 3, risk assessments are accurate and sufficiently detailed
- Candidates still need to be guided to ensure they record suitable observations for both their preparations and the processing of their results. Evidence on calculations of theoretical yield is needed
- Evaluation 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 allocated to the practical work and hence between 25 to 30 hours should be allocated to AO3 work.

G632 *The 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.

Limited work was moderated this session. Centres 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. Candidates should not be submitting lengthy reports.

Candidates continue to produce interesting information on stress and illness and the healthy and damaged brain. Accurate and detailed referencing is also needed.

General guidance as follows:

- AO2(a) allows candidates to research and produce information giving the clinical methods of studying the brain. Diagnosis of brain diseases is generally well covered but work should be supported by labeled illustrations
- AO2(b) 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 is often quite brief and centres are advised to spend time with candidates in discussion work on this topic
- AO2(c) does ask for a fact sheet detailing statistical evidence. Candidates use a wide range of statistical testing on their results but additional information is still needed to ensure the higher mark bands for this strand.

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). For mark band 3, a range of data needs to be collected and processed. Generally suitable statistical processing is completed on experimental data. AO3(e) however for mark bands 2 and 3 needs care to ensure the requirements of the criteria are suitably covered.

G633 *Ecology and managing the environment*

The assessment requirements for the current 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.

Limited work was moderated this series. Candidates' work continues to indicate interest and enthusiasm in this topic area and although candidates seem to enjoy completing large quantities of work for this unit, care still needs to be taken that suitable selection of researched material is presented in portfolios.

General guidance as follows:

- AO1 evidence for mark band 3 should demonstrate that research has been suitably selected, showing a thorough knowledge and understanding of the factual information and where appropriate candidates using their own words. Where 'cut and paste' information is used it needs to be accurately referenced. For AO1(b) evaluations, where required, are at an appropriately high level to reflect 'A' grade A2 work with suitable justification included
- Centres need to spend time with candidates to initially identify moral and ethical reasons for preserving ecosystems and species diversity for AO2(a). Work for this strand tends to be very brief and at quite low levels. Where mark band 2/3 marks are given candidates need to know how to explain and evaluate their reasons

- AO2(b) is sometimes omitted from portfolio submissions, candidates need to be able to describe methods used in the management of ecosystems and to interpret data relating its success
- AO2(c) Good statistical analysis is often seen in this section.

Generally candidates take part in field trip work; this is an excellent opportunity for candidates to produce high quality work. It is important to ensure that a range of experimental techniques are available and photographic evidence can be included as evidence of work carried out. Care needs to be taken again that risk assessments are focused and not generic, again these should be workable documents. AO3(c), the displaying of data usually shows a range of different ways, kite diagrams are 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.

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.

Limited work was moderated this series. Work seen was generally assessed at high levels, but care needs to be taken that where full marks are awarded in mark band 3 strands, work is accurate and all parts of the required assessment criteria are completed at the required high levels.

General guidance 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. In addition, work for mark band 3 should indicate work has been suitably selected from a variety of sources; it is clearly and logically presented with correct spelling punctuation and grammar
- 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 also needs candidates to explain two types of controls placed on scientists that work in this field. 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 is 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. It is also useful in the moderation process that staff indicate where candidates have had problems with their investigative work so suitable interpretation of results can be credited. For AO3(c), generally good displays of results are produced but for AO3(d) candidates need to work on improving conclusions and interpretation of results. For AO3(d) level 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. Centres also need to ensure candidates are spending the appropriate time on AO3(c) and AO3(d) 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).

G628 (Sampling, testing and processing)

General comments

There were around 500 candidates for this examination and this was an increase from about 300 in January 2010.

As in the past, many candidates scored between 25 and 45 (out of a paper total of 90). There seemed to be fewer candidates who scored more than 55 and only a few managed a score in the 60s. There was an increase in the number of candidates who gained very low scores and who seemed ill prepared for the examination at this stage.

As noted in previous examinations, questions that test a candidate's ability to design an experiment for a particular purpose were generally done rather poorly. In some cases the response provided did not match the question task.

Questions needing calculations were, in many cases, poorly attempted and candidates gave numerical answers that, on reflection, could not possibly be the answer. Questions requiring percentages continue to cause a number of problems. Candidates, in general, had little idea of how to draw and manipulate gradients on a straight line graph.

There appeared to be adequate time to attempt all the questions in the paper.

On balance, the Examiners felt that this paper was seen by a number of candidates as more difficult than in the past. In general it was felt that the candidates had adequate opportunity to demonstrate and apply their knowledge but the Examiners were disappointed by the responses of some candidates.

Comments on individual questions

Question 1

(a)(i) Candidates were well informed about information sources.
(ii) The connection between variables and comparability was generally correct.
(iii) 'Woad stains the fingers' was the usual correct response. Contamination of the woad by workers was not accepted.
(iv) The need to use the information in the future was generally recognised.

(b)(i) 'To remove impurities' was a popular correct response.
(ii) Some candidates misunderstood this question. The examiners were looking for references to quantities and temperature.
(iii) The most popular answer was 'sieve' but some persisted in filtering, although the question stated that this would not gain credit.
(iv) Almost all candidates realised the need for a risk assessment.
(v) Most candidates realised that more soda ash was needed to raise the pH to 9.
(vi) The need to write or record their modifications was a mark gained by most candidates.
(vii) This question required both a method and the apparatus needed. The latter was often not provided.
(viii) Many candidates could not perform this simple sum, which required a change of units.
(ix) The responses were disappointing; many candidates seemed to be guessing rather than thinking out a scientific answer.

(c)(i) Most candidates gained two marks for this question on safety.
(ii) Many candidates used a hot plate, but this was unsuitable for the size of vessel. Few candidates suggested internal heating by steam pipes or an immersion heater.
(iii) The need to maintain a constant temperature in the dye bath was usually provided.
(iv) Most candidates realised that the time factor was missing.
(v) Only stronger candidates suggested that the rinse water needed to be colourless.
(vi) This was answered well. Time and concentration increases, were the most common answers.

(d)(i) Few realised that an exothermic process would not need heating.
(ii) Few stated that propanone was flammable. There were many speculative responses.
(iii) Many candidates realised the need for the reaction to go to completion.
(iv) Cost and the length of the process, were the most common correct responses.

(e)(i) In many cases 'a control' and the need for it were poorly explained. This is an area that requires attention.
(ii) Many candidates could not use the information in the article to obtain the numerical answer.

Question 2

(a) This was a challenging question and few could use the article to respond correctly.

(b) Surprisingly few candidates recognised the need for representative sampling.

(c) Although safety precautions were given, relatively few could give reasons for their answers.

(d) Most candidates recognised that the sample was relatively small in size.

(e)(i) Many correctly plotted graphs were seen.
(ii) Although the anomaly was recognised, fewer could state a possible reason for this anomaly.
(iii) Nearly all candidates scored one mark for a line of best fit.
(iv) Very few correctly drawn gradients were seen.

(f) The need to avoid contamination was well recognised.

(g) This question gave candidates an opportunity to design an experiment. Some good responses were seen but there were many poor efforts where the candidate had not addressed the problem.

(h)(i) Very few candidates could equate the economics of the two processes.
(ii) Stronger candidates recognised the need to find a process with a better separation.

(i)(i) 80 million tonnes was the correct answer – this was not a common answer.
(ii) Very often the response given did not reflect the answer given to **(i)**.

(j) Many candidates muddled economic and environmental considerations and one mark was the commonest mark awarded.

(k) This question was about colorimetry. There were three types of answer – a number had never done colorimetry, some had but could not describe it scientifically, and good sound responses.

Question 3

(a)(i) Although a suitable volume was often given, the reasons for their choice were weak.
(ii) 'Temperature can be controlled' was the usual correct response.
(iii) Very few candidates could describe refluxing.
(iv) This percentage calculation defeated many candidates.

(b)(i) Many correctly responded by stating the use of suitable goggles or a risk assessment.
(ii) R_f values were a mystery to many and this is an area that needs exploring.
(iii) Very few candidates could suggest the use of another eluting solvent.

(c)(i) Although many candidates completed the table, a number did not round up their figures correctly.
(ii) Most candidates said that a sample was above the limit but could not give a sound explanation.
(iii) The need to repeat the experiment was the commonest acceptable answer.

(d) The responses to this were generally weak – 'heat' and 'powder the crisps' were sometimes seen.

G635 Working Waves

General comments

Candidates had prepared for most topics, but often only to pass level or slightly above. More candidates showed some familiarity with the gamma camera than in the past, but this is still an area of weakness. Other weak areas were sound waves, unit prefixes and standard notation.

Comments on individual questions

Question 1

(a) Most candidates scored some marks but few gave fully correct answers. Common errors included 'ultraviolet' for the ultrasonic scanner, sound for radio and 'radio' for radiotherapy. A significant minority did not attempt to enter any ticks, possibly because they did not read the question fully.

(b)(i) Graph reading skills did not always correlate with performance in other parts of the paper. m s^{-1} was commonly given instead of ms for the unit of time. A variety of incorrect numerical answers were given. Double the amplitude and half the wavelength and period values were given by some. Others confused period and wavelength. Period was the most difficult for candidates to answer.
(b)(ii) Many candidates attempted to use $v = f\lambda$ for both parts, scoring error carried forward marks in the second part only.
(b)(iii) A number of candidates did not attempt to answer this question. It was recognised that understanding the direction of phase shift on a distance–time graph is conceptually difficult therefore a correct phase shift in either direction was awarded full marks. A number of those responding were within tolerance of this.

(c)(i) Many correctly answered Polaroid. Fewer knew about polarisation by reflection. A small number correctly mentioned the polarisation of sunlight in a blue sky. Although polarising filter was accepted, polarised filter was not. Some thought that Polaroid cameras polarised light.
(c)(ii)(iii) Very few candidates demonstrated understanding of a simple model of electromagnetic waves. Even those who had some idea of what is meant by a transverse wave and polarisation often failed to give clear answers. E.g. 'up' or 'down' relative to a presumed but unstated direction of propagation in **1c(ii)** and confusion between the displacement and wave directions in **1c(iii)** e.g., '…The light waves would travel in all directions…'.

Question 2

(a) Candidates who did not know the correct answer commonly attempted answers relating to later parts of the question.

(b)(i) The majority of candidates were able to draw at least one curve of roughly the correct shape. A considerable number failed to correctly label the axes and only a minority indicated which of their curves represented the higher temperature
(b)(ii) Most candidates scored some marks, but few gave a full account of all the colour changes and related them to temperature changes. Some failed to score because they ignored the word 'appearance' in the question and gave answers relating to wavelength and frequency.

(c)(i) Many answers focused on what the fire-fighters might see rather than why. Many failed to mention infrared. Most missed the point that infrared radiation passes through the smoke but visible light does not.
(c)(ii)(iii) Well answered.

(d) A variety of appropriate applications were given, the most common being police or military examples, leaking pipes medical uses and overheating machinery were also frequently given. Detail tended to focus on the benefits and the appearance of the image to the exclusion of the temperature differences.

Question 3

(a)(i) Many correctly drew the refracted rays but showed the TIR ray with *i* not equal to *r*. Few drew the partially reflected rays in the first two diagrams. A minority of 'no responses' or apparently randomly drawn rays suggested that perhaps some candidates had not carried out experiments to measure refractive index.
(a)(ii) Some answers related to the application of TIR to optical fibres without demonstrating an understanding of the process. Of those who addressed the question asked, many failed to recognise that some internal reflection occurs at any angle of incidence. Of those who referred to the critical angle many were unable to clearly express what had to exceed what.
(a)(iii) Most had grasped the importance of TIR to fibre optics.

(b)(i)(ii) This part of the question asked about the structure of the fibres. Many candidates gave details of how light passes along them, often to the exclusion of structure. Very few answers included both the materials used and the difference in refractive indices.
(b)(iii) A number of candidates were able to reproduce diagrams showing curved ray paths but fewer were able to support this with further explanation. A significant number did not attempt this section.

(c) Although the question clearly indicated that most broadband connection use conventional phone lines many answers gave the use of fibre optics as the reason for faster data transmission.

Question 4

(a) This question was well answered. Incorrect responses were often related to too many people trying to use the system at the same time, which may be a reason for being unable to make contact, but not for low signal strength.

(b) Generally not well answered. Most candidates were able to score some marks by discussing signal strength and distance, but disappointingly few identified one of the core reasons why the cell structure makes mass use of mobile phones possible, i.e. reuse of a scare number of available frequencies.

Question 5

(a) This question discriminated well.

(b) This question was generally well answered, the most common error being to refer to protective clothing or shielding without mentioning suitable materials such as lead that these should be made of.

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