RECOGNISING ACHIEVEMENT

GCE

Applied Science

Advanced GCE **A2 H575/H775**

Advanced Subsidiary GCE **AS H175/H375**

OCR Report to Centres

January 2012

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Oxford Cambridge and RSA Examinations

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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.

OCR will not enter into any discussion or correspondence in connection with this report.

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OCR REPORT TO CENTRES

Overview

AS and A2 Applied Science January 2012

Several new Centres now following this applied science course submitted work and entered candidates for the externally tested units for this January session, both at AS and A2. Care needs to be taken by both new and experienced Centres that the portfolio assessment does not become too generous and that candidates, especially for the A2 units, are suitably prepared for the appropriate level of external examination.

In order to maintain standards for the portfolio work, it is important that Centres follow any guidance given in the moderation report provided by Moderators, and if scaling has occurred they review their level of assessment as suggested. Internal moderation is particularly important in large Centres where candidates have been taught by a number of teachers. Where Moderators find a major difference in assessment by different teaching staff, the Centre is asked to revisit the assessment for the complete cohort.

Scaling did occur this series, not only at the higher mark bands but also where there is a range of marks offered for a particular strand. Many Centres awarded the top mark in the range even when all the assessed work was not at the appropriate level. Where full marks are awarded by Centres, it is essential that the quality of the work produced by the candidates reflects A* work and all aspects of the criteria are covered accurately. Several pieces of work were moderated at this high level and were found not to reflect the high quality needed for A/A* grades at A level. Centres are advised to internally moderate work at this level to ensure quality standards are maintained. Credit, however, should be given to those staff and candidates who are using the assessment criteria appropriately and where, consequently, work is being assessed at the correct level.

Moderation Manager, which is an electronic system for the request and selection of the portfolio units, is now in use for the moderation of all the portfolio units. There is now no need to send MS1 forms to Moderators, although it is still necessary for Centres to send Centre Authentication forms with the candidates' work. Centres are also asked to ensure that OCR's URS form is completed for each candidate, with the Centre and each candidate's name and number. Accredited Centres need to ensure that the necessary Centre Authentication form is sent to OCR for each series and that if there is any change in the nominated staff, OCR is informed. It should be noted that Centres need to be accredited separately for the AS and A2 qualification. It is also important that Centres working as a consortium do inform OCR about this.

The numbers and level and quality of work for candidates taking unit G622 **(**Monitoring the Activity of the Human Body), were maintained. The paper was accessible to the majority of candidates, with the free-response items continuing to be challenging for many candidates. The most able candidates provided clear responses, presented in a logical order. In general, candidates showed a sound knowledge and understanding of many of the topics covered. The majority of items did not appear to generate errors due to the misinterpretation of instructions or rubric. The candidates' scores demonstrated a wide range of performance according to their knowledge and understanding. Many candidates appeared to have been well-prepared for this paper and completed all items. The 'level of response' items presented a challenge to a number of candidates. However, some were able to use the information provided within the stem of such items to good effect, supported by knowledge from prior learning.

In unit G623/01 (Cells and Molecules), entry this session was limited. Many candidates chose to use colorimetry to investigate the effect of temperature on the leakage of pigments from beetroot cells. Although it is recognised that information regarding this technique is widely available from published secondary sources, Centres are asked to make certain that candidates read the

instruction brief carefully to avoid misinterpretation. It was pleasing to see that some Centres had investigated the effect of temperature quantitatively, using standard curves and generally, candidates did not include lengthy and unnecessary facts of 'background' information. Whilst there is no requirement for candidates to carry out the investigation, some of the assessment objectives are more easily accessed if candidates do so. Limited guidance is anticipated from subject staff, during initial discussions of the task. Teachers, however, must ensure that by signing the authentication clause the work submitted is that of the candidate.

The external test G623/02 as a whole achieved satisfactory differentiation between candidates. There was no evidence of candidates failing to complete the paper due to lack of time and no common misinterpretation of the rubric. The overall performance still varied between Centres. It was disappointing that many candidates could not calculate the actual length of the mitochondrion, given the magnification. It is also a concern that candidates from some Centres clearly had not covered all the learning objectives in the specification prior to completing the examination this series. Candidates from these Centres failed to attempt whole questions or parts of questions.

The numbers of candidates taking both G628 (Sampling Testing and Processing) and G635 (Working Waves) has remained steady over the last two series. 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. Candidates need to be suitably prepared for these A2 papers to ensure that they do themselves justice.

For unit G628 (Sampling, Testing and Processing) there were fewer scripts showing disappointing scores, although the number of candidates scoring more than 50 was smaller than in previous sessions. Questions that test candidates' ability to design experiments continue to be difficult for many and, as noted in recent examination reports, a number of candidates still struggle with questions that include an element of calculation. Candidates should always look at their answer and judge whether the response is realistic. The answers to the questions based on the pre-release case study material generally indicated that candidates had worked hard at this material and were well equipped for the questions. There was little evidence that the paper was too long although Centres need to ensure that candidates are suitably prepared for the range and type of questions examined by this paper.

For unit G635 (Working Waves), the examination paper performed in a manner similar to previous years. The vocational contexts continue to motivate weaker candidates.
Questions on newer areas of the specification such as resonance and spatial/thermal resolution were not well answered by some candidates. Some answers referred to details such as FDMA/TDMA which were dropped at the 2009 amendment to the specification. Centres should be aware that the Institute of Physics have a range of support and guidance on their website which may be helpful to candidates and staff studying this unit.

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

General Comments

Work selected for moderation of the AS specification reflected coverage of the units listed below. A range of marks was seen overall, however, some units tended to be generously assessed. 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 Physics of Sport

Many centres are now accredited and are sampled over a three year period. Accredited Centres need to ensure that the necessary Centre Authentication form is sent to OCR for each series that they are entering candidates, and if there is a change in the staff named for the accreditation that OCR is informed. Most portfolio work was well organised and presented using treasury tags, which allowed Moderators to easily read and locate candidates' work. Centres are advised not to include candidates' work in plastic pockets or ring binders.

Moderation Manager, which is an electronic means of requesting and selecting the portfolios for moderation, is now used. This makes the moderation process much more efficient and centres were very responsive in returning scripts for moderation and returning the Centre Authentication form with their candidates' work. There is now no necessity to send MS1 forms to Moderators or to include these forms with the sample. It is, however, important to ensure centre numbers and candidate numbers are recorded on the URS attached to the candidates' work. Accuracy of recording candidates' marks has shown considerable improvement this session, which helps the efficiency of the moderation process.

Comments and page references on the URS forms support the moderation process and aids Moderators location of the work. Annotation using the assessment code eg AO1 (a) on the candidates' work, again, supports the Moderators.

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 shows a vocational link with suitable reasons for why the experimental work needs to be performed, but care needs to be taken that candidates are recording their experimental results in a suitable way, to the required level of precision and accuracy. Risk assessments, again, are showing improvements but they need to be suitably focused on the specific hazards and risks of the experimental work carried out by the candidates and are used as working documents. Many Centres were very generous in the assessment of their candidates' practical work; it is essential that practical work shows progression from GCSE. Those Centres where scaling has occurred need to review their practical provision to ensure candidates can access the full range of the assessment criteria. OCR offers a free coursework consultancy service to support the assessment; details are available from the OCR website.

Credit should be given to those staff and candidates who are using the assessment criteria appropriately and, consequently, where work is being assessed at the correct level.

Scaling again was mainly at the higher mark band. Work submitted in these cases did not reach the necessary standards required by the assessment criteria, ie work was not sufficiently detailed and accurate, and evaluations not at a high enough level for A grade standards. Centres need to be aware of this for future submissions. Care needs to be taken by the candidates to ensure that the level of the work reflects a full and detailed understanding of both the assessment criteria and the content in the specification. Assessment does include the use of accurate terminology, correct spelling, punctuation and grammar; this needs to reflect the standard of the reports, especially where mark band 3 is awarded.

Centres also need to take care that when giving full marks at mark band 2 all the criteria in that strand is met at the appropriate level. In several instances work was covered but at quite low levels. Work at grade A standard should be accurate and show understanding of researched material taken from the internet. Work also should be suitably referenced and presented. Centres should be advised to spend time with candidates teaching research, presentation and recording techniques.

G620 Science at Work

The assessment requirements for the specification now include:

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

This unit gives candidates the opportunity to carry out independent research on a range of organisations and to be aware of the importance of science, and to carry out practical activities which can be chosen by the Centre. Centres are advised to refer candidates to both the requirements of the specification and the assessment criteria for their surveys and in-depth study. Practical tasks chosen should show progression from GCSE and have a vocational link.

General guidance is as follows:
AO1

- Candidates need to complete four surveys with one of these used as a base for the more detailed in-depth study.
- Each survey 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.
- Surveys should not include excessive 'cut and paste' material.
- The text of the survey should, where appropriate use candidates' own words or suitable selection from their research. Lengthy detail is not required as this work is intended to be an overview of different organisations.
- Centres should try and give candidates more guidance to improve the quality of the selection, presentation and the level of the science identified, especially where candidates are aiming for mark band 3.
- The in-depth study needs to include:
  - explanation of what is produced or details of the service offered
  - information about the organisation including the number and range of staff employed
  - further details on the scientific job roles specifically related to the chosen organisation
  - some explanation and detail of the science involved in the organisation
  - any further specific detail on research, quality control
  - details and specific links of health and safety laws and regulations which can be used for the requirements of AO1c.
- For mark band 3, a comprehensive study is needed where information is selected and clearly and logically presented. Some evaluation and justification of the use of the material needs also to be included supported by comments on the validity of the sources. There was minimum evidence of evaluation and justification of the research material. Assessment tended to be over generous at the higher levels.
- For AO1c mark band 3 candidates need to produce evidence that they understand how their chosen organisations comply with the necessary laws and regulations, so specific links need to be targeted, assessment was often generous for these higher mark bands.

AO2

- Candidates can link AO2a with their in-depth study.
- Work for this strand needs to be focused on the following bullet points:
  - 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.
- The assessment guidance states a number of complex and straightforward calculations should be completed. Reference Appendix C Page 129 of the specification gives guidance on the range of mathematical skills which may be covered during this A level course.
- If the data produced for practical work does not allow candidates to fulfil the higher mark bands then data can be supplied, however it is not advisable to produce a number of stand alone calculations. This could be in the form of a task sheet which perhaps would be completed by a technician in the workplace.
- For AO2b, mark band 3 work should be correct and answers given to the appropriate degree of accuracy with correct significant figures. Errors were commonly seen here.

AO3

- Good practice was seen where candidates are linking practical activities to a vocational context, consequently giving a reason for the completion of the practical work.
- It is important that practical work is reflective of AS standard and consequently should show a step up from practical work covered at GCSE.
- 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.
- Candidates need to spend more time in ensuring accuracy of their work; many careless mistakes and omissions were commonly encountered.
- 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.
- Evaluation assessed at mark band 3 needs to reflect A/B grade work, which includes appropriate scientific discussion.

G621 Analysis at Work

The assessment requirements for the specification now include:

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

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

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

Work on energy policies was very varied this session. Some reports on the consumers of electricity were far too general and wide-ranging so that it was very difficult for the candidates to focus on what the specification was asking for.

General guidance is as follows:

AO1

- Candidates need to ensure work is suitably selected on the energy policy rather than environmental policies. Although this is quite difficult in some organisations, as website information can be extensive, candidates will not be penalised if the energy policies of their chosen organisation is quite brief as long as they accurately record and suitably select the relevant information
- Mark band 3 work needs to not only include a detailed description of an energy policy but also an evaluation of how energy consumption is limited.

AO2

- Describing and comparing large scale and small electrical generation from two chosen sources is showing improvement and work is much more selected and relevant. Care still needs to be taken to ensure that mark band 3 work reflects candidates' own understanding as well as covering the requirements of the assessment criteria.
- Evidence of energy values and fuel/energy costs are now being given with candidates carrying out appropriate mathematical calculations using this data. This is now better than in previous sessions.

AO3

- Enthalpy of combustion was seen from several Centres, in addition to a range of quantitative and qualitative analysis exercises.
- Practical work needs to be a step up from that studied at GCSE, supported with good quality observations and accurate processing.
- Higher mark band work should be supported by correct balanced equations where appropriate.
- Observations for qualitative analysis are still quite weak in both detail and accuracy. Just crosses and ticks are insufficient for observations at this level.
- Evaluation needs to be focused on the method and outcomes of the specific experimental work completed, not just a generic statement of the success of the work. The inclusion of an evaluation does not automatically indicate candidates can gain mark band 3, the level of discussion needs to be reflective of A/B grade work.

G624 Chemicals for a Purpose

The assessment requirements for the specifications now include:

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

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

AO3 A sample and account of the preparation of two products that have been synthesized, purified and analysed.

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

AO1

- Sodium chloride, sodium carbonate, ammonia, sulfuric acid, boric acid, ethene/polyethene, ethanol, ethanoic acid, are compounds which have been seen this series.
- For mark band 3, details are needed on how the properties depend upon the structure and how uses depend upon the properties. Assessment was generous as candidates were not using their researched material appropriately.
- Eleven marks are allocated to AO1c which involves candidates producing a detailed account of two chosen compounds one of which is made from oil. It is advisable to choose two different compounds from those used in AO1.
- Candidates could do research and practical work to support the understanding for this section, and this could link to AO3 if required, but where this occurs candidates need to ensure that the bullet points in the assessment criteria are fully covered.

AO2

- Manufacture of ethanol, polyethene, sulfuric acid and ammonia were industrial processes seen this session

AO3

- For AO3a candidates need to show evidence that they had researched, prepared and completed analysis on their two chosen compounds.
- Risk assessments should be included and must be detailed usable documents.
- For mark bands 2 and 3, evidence that candidates had prepared and analysed both products is needed. A basic preparation will not allow candidates to gain mark band 2.
- For AO3b some good work was seen where candidates had included detailed observations, which followed through their preparations.
- Initial and final weighings and accurate recording of melting points are still not always seen.
- Work should involve calculations on theoretical, actual and percentage yields. For mark band 3, evidence of how the theoretical yield is calculated should be included to reflect suitable knowledge at this level.
- For AO3b mark band 2, candidates should record all mass results to the same number of decimal places.
- For AO3c candidates need to show an awareness that the yield can be increased by changing conditions. Actual workable suggestions are needed for mark band 2 and a full evaluation of the methods chosen with a possible comparison of the suggestions is needed for mark band 3. This is still not adequately covered.

G625 Forensic Science

The assessment requirements for the specifications now include:

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

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

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

Good practice was seen by Centres where work was selected, referenced and directly linked to the coverage of the assessment criteria. Evidence showed understanding of candidates' research work by either summarising in their own words or suitably referencing the work within the text.

General guidance is as follows:

AO1

- For AO1a, research work needs to show selected information of a range of techniques explaining the need to record and preserve a crime scene. This can be incorporated with AO1b but where this occurs candidates need to check that work is suitably detailed and explained. Work was generously assessed for this strand.
- AO1b needs to show suitably selected work to cover chemical, biological and physical techniques. Candidates need to be more selective in the work they include in their portfolios. Some interesting but not relevant information is often included in this section.
- Spelling, punctuation and grammar need to be assessed within the requirements of AO1b.
- For AO1c mark band 3, candidates' work needs to include the need for an ethical code, as well as a range of relevant information on ethical issues in forensic work.

AO2

- For Strand AO2a, good case study work should include relevant information linked to the following bullet points:
  - the ways in which forensic scientists ensure the quality of evidence collected and analysed is objective
  - the limitations
  - strengths and weaknesses of the analytical techniques used
  - an understanding of the probability of guilt and of a need to review evidence.
- For AO2b standard calculations can include a range of Rf values for mark band 1, refractive index calculations and bullet projectiles for mark band 2 and 3.

AO3

- For AO3, experimental work can include fingerprinting and taking footprints, measuring and use of photographs, a range of microscopic techniques, chromatography, qualitative and quantitative analysis, and the measurement of refractive Index of glass. Some interesting work was seen on blood splatters and chemical and spectroscopic analysis.
- Mark band 3 candidates need to ensure detailed processing and interpretation of their results and a discussion of their significance.

G626 The Physics of Sport

The assessment requirements for the current specifications now include:

AO1 A series of 4 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.

This unit gives candidates the opportunity to research into science involved in a range of sporting activities. Work for AO1 needs to be presented in the form of guidance leaflets and AO2 gives candidates the opportunity to produce a presentation linked to sporting equipment. Practical work again needs to show progression from GCSE and candidates should be showing some planning.

General guidance is as follows:

AO1

- For AO1 leaflets and not reports are required. Centres are directed to the information on page 106 of the assessment criteria regarding the target audience for these leaflets.
- Candidates should be suitably selecting material for their leaflets and using the specification ref: page 33 for the content.
- Mark band 3 work needs to show detailed knowledge written where appropriate in candidates' own words with evidence on the linking of scientific knowledge to the chosen sport or equipment.

AO2

- For AO2a, presentation work is needed; reports are not suitable for this strand. It is useful if Centres record the outcomes of the actual presentation given by the candidates. If candidates complete PowerPoint presentations which include limited information, these should be supported with additional notes to indicate their knowledge and understanding.

AO3

- For AO3, candidates need to show that they can plan two investigations. Centres are directed to the information on page 36 of the specification. Practical work needs to show a progression from GCSE but the choice can be determined by the Centre.

G622 Monitoring the Activity of the Human Body

The paper was accessible to the majority of candidates. The free-response items have continued to be challenging for many candidates. The most able candidates provided clear responses, presented in a logical order. The number of candidates using the space below the dotted lines provided for answers appeared to be less than previously observed. This is encouraging. In general, candidates showed a sound knowledge and understanding of many of the topics covered.

The majority of questions did not appear to generate errors due to the misinterpretation of instructions or rubric. The candidate scores ranged from 10 to 79 out of a maximum of 90 marks, demonstrating a wide range of performance according to candidates' knowledge and understanding. Many candidates appear to have been well-prepared for this paper and completed all questions. Some candidates changed their responses by crossing out initial attempts. This was generally clear, however, and did not prevent candidates from obtaining marks. Candidates did not seem to run out of time and the number of 'nil responses' was limited. The 'level of response' questions presented a challenge to a number of candidates. However, some were able to use the information provided within the stem of such questions to good effect, supported by knowledge from prior learning.

1(a) Many candidates struggled to identify a clear risk and to provide appropriate explanation. It appears that candidates were unable to express key features such as high voltage, accumulation of ionising radiation, non-invasive features and the quick turnaround of results.

1(b)(i) This question did not present a challenge to most candidates. The principles of 3D imagery and real-time were frequent responses.

1(b)(ii) The concept of combining the results of different imaging techniques was appreciated by many candidates. However, the link between diagnosis and treatment was not generally appreciated.

1(c) The risk for claustrophobics was, unfortunately, repeated as the hazard by some candidates, rather than referring to the small space. The general reference to damage to cells, without mention of DNA, was not credited.

2(a)(i) While many candidates understood that type 1 diabetes was linked to a lack of insulin production, some stated that diet caused type 2 diabetes. This was insufficient in the context of this question.

2(a)(ii) It was reassuring to note that most candidates realised that insulin must be injected, rather than given as a tablet. The dietary control of type 2 diabetes was also frequently described correctly.

2(b) This question presented problems for many candidates. The sequence of events involved was not fully appreciated. References to the intake of glucose were often not related to a drink.

2(c) Most candidates correctly identified that the biosensor must be put in contact with the blood.

2(d) The topic of obesity and associated diabetes does not appear to be appreciated. Responses tended to focus on the cause of the obesity, rather than the under-production of insulin and/or reduced sensitivity to insulin that is delivered to cells.

3(a) The structure of the heart was well-understood by many candidates. It was good to see the correct identification of right and left-sided structures within the heart.

3(b) It was unfortunate that some interesting responses referred to valves closing and opening without naming the valves. This prevented a number of candidates gaining full credit for their answers.

3(c) Almost all candidates realised that the valves in veins stop the backflow of blood. Many did not refer to the low blood pressure; others described the deoxygenated condition of the blood.

3(d) Many appreciated that the hormone increased the heart beat rate but few noted the effect on stroke volume. A few candidates obtained full marks due to a clear reference to increased cardiac output.

3(e) Response varied greatly for this question. No clear pattern of alternatives could be identified.

3(f)(i) The use of an ECG is generally well-understood.

3(f)(ii) The calculation presented problems for a number of candidates but some were able to use the trace to good effect.

3(f)(iii) Some sensible comparisons were made between the two traces. Good descriptions of increased heart rate were presented. Candidates often found it hard to describe the spikes but others extended their responses with the use of the PQRST phases.

3(f)(iv) Candidates coped well with this question; many stated fibrillation.

3(f)(v) Candidates coped well with this question; many stated death.

3(g)(i) Many candidates did well with this question. They were able to describe the process fully and in a logical order. Unfortunately, some slipped into a description of a manual version of the equipment and this prevented them from achieving full credit for their answers.

3(g)(ii) Most candidates knew about the systolic and diastolic values.

4(a) This table is familiar to the candidates. Few failed to obtain at least two out of the three marks. It is reassuring to observe the effective recall of this information.

4(b) Although some candidates correctly stated diffusion, some repeated the stem topic and gave the response of ‘gaseous exchange’. This item did present a problem for some, leading to crossing out of earlier responses.

4(c) Many candidates struggled with this question. It appeared to be challenging because it required the step from principles of diffusion to the scenario presented. No clear pattern of errors emerged across the scripts.

4(d) The completion of sentences is a useful objective tool appearing in many GCSE papers. This was clearly familiar to many candidates and they obtained full marks or at least three out of four.

4(e)(i) Many candidates knew the exact values, rather than the ranges, for this table. This was very reassuring and indicates that the important list of values and units is generally well-understood.

4(e)(ii) Candidates were not challenged by this straightforward item but few correctly referred to the reliability of data obtained.

4(e)(iii) Many candidates were able to describe the two stages of this process but some found it difficult to identify the 'deep' breathing needed.

4(f)(i) It was impressive to observe that so many candidates could recall the correct values but few obtained the mark for units. The unit of dm^3 was often quoted.

4(f)(ii) Many candidates could note that the value was lower than the normal value but failed to describe by how much. Units were correctly used in some cases.

4(f)(iii) Candidates continue to struggle with the definition of maximum speed of expiration. Some candidates repeated the name of the equipment when describing its function.

4(f)(iv) Many candidates obtained full marks for this item. Answers were often expressed in a very clear and logical manner.

4(v) Although a number of candidates correctly quoted the range or a value within the range, many struggled to express the units, $dm^3\ min^{-1}$.

4(vi) It was unfortunate that some candidates considered that the levels of both gases would increase in the blood. Some candidates did, however, fully understand the principle behind this question.

5(a)(i) Few candidates were able to cope with this calculation. It was not possible to identify a common error in responses.

5(a)(ii) Only some candidates used the units provided in the table. This prevented them for obtaining marks for the change in levels. However, a number of candidates gave good descriptions of anaerobic respiration linked to the generation of lactic acid/lactate.

5(c) Many candidates did well with this question and recalled nerve impulse transmission or, more commonly active transport. The range of examples for metabolic reactions was great although the use of energy for the swimming of sperm was particulary frequent. This was a correct marking point.

5(d) This question did not present a problem for many candidates. It was unfortunate that some mentioned red blood cells without a reference to their levels. Some also incorrectly included glycogen in their response.

5(e) The principle of risk appeared to confuse some candidates. This was a problem because they were required to give an appropriate example such as needle stick injury. For this particular example, some candidates stated only the needle, without a description of the risk associated with using the needle, to the physiologist. Safety precautions were often well-appreciated but they had to link to a correct risk.

G623/01 Cells and Molecules – Planning Exercise

Task: Investigation to determine the effect of temperature on the leakage of betalains as an indicator of nitrate ion loss from beetroot cells.

A limited number of Centres submitted work for this examination series and candidate entries were lower as a consequence of this.

Many candidates chose to use colorimetry to investigate the effect of temperature on the leakage of pigments from beetroot cells. Although it is recognised that information regarding this technique is widely available from published secondary sources, Centres are asked to make certain that candidates read the instruction brief carefully to avoid misinterpretation, ie to ensure that the effect of temperature is linked to the leakage of betalain pigments as an indicator of nitrate ion loss in their plan.

Few candidates made reference to possible nitrate ion loss in their work and too many candidates failed to adapt information from secondary sources to fulfil the task. However, it was pleasing to see that some Centres had investigated the effect of temperature quantitatively using standard curves and, with few exceptions, candidates did not include lengthy and unnecessary facts of 'background' information.

Whilst there is no requirement for candidates to carry out the investigation, some of the assessment objectives are more easily accessed if candidates do so. Only limited guidance is anticipated from subject staff during initial discussions of the task. Where additional guidance is provided to candidates this must be reported to the moderator using the appropriate paperwork to avoid any suggestion of malpractice.

Marks ranged from 8 to 20 out of 25.

A = this was achieved by candidates who could identify at least 3 different potential hazards from glassware/electrical/biohazard/sharps in this low risk investigation. Few candidates included three appropriate points to gain the mark. Many simply listed general safety comments without considering the actual procedures or equipment involved in this experiment. A few Centres used standard forms which cued candidates into identifying relevant hazards, risks and control measures. A few candidates had copied and pasted generic risk assessments which were not specifically related to the task and some candidates had difficulty identifying risks from the hazards. The risk assessment has to be a working document, related to the plan.

B = awarded if a relevant statement was made with reference to changes in temperature related to loss of betalains and nitrate ions. Many candidates described the effects of temperature on pigment loss but few referred to the movement of nitrate ions and consequently B was not credited.

C = awarded if the prediction was clearly justified. Common justifications made reference to changes in structure of the phospholipid bilayer and associated globular proteins, leading to increases in membrane fluidity as well as diffusion.

D–F= evidence of relevant preliminary work was needed to award 'D' and the majority of candidates gained 'F' with a reasonable justification. However, weaker candidates still lack clarity about the role or purpose of supporting preliminary work. Preliminary work MUST inform or develop the main investigation. Approximately half of the candidates described their preliminary work to score E, but rarely 'G' for doing so in sufficient detail.

H–I = many candidates achieved marking point ‘H’, although the range of secondary sources cited was limited in some centres (eg Wikipedia and Google images). There is an expectation that candidates should use the stimulus material within the OCR insert to extend their research to include other credible sources, which help to inform the planning process. Weaker candidates failed to explain the benefit or relevance of their sources in the development of the plan and the inclusion of large quantities of downloaded material from the internet was not creditworthy. It is important that candidates reference their sources correctly by giving full web addresses and date of access in their plan.

J–K = marking point ‘J’ was achieved by the majority of candidates, whose methods indicated basic practical skills and reasonable accuracy. However, marking point ‘K’ was not awarded often since many candidates had lifted work directly from published sources, without stating reasons for carrying out the procedures involved in their method, eg ‘quenching the beetroot in cold water after heat treatment’.

L–M = the majority of candidates were awarded marking point ‘L’ for a generic list of the main items of equipment and materials. Frequently candidates omitted essential items, or failed to indicate the numbers of each item or specific volumetric sizes required, which precluded the award of marking point ‘M, This remains an area for development in future examination sessions.

N = the majority of candidates appreciated the need for repeats.

O = very few candidates achieved this marking point. Candidates must appreciate the need for a range of measurements to show if there is a change in the leakage of betalain pigments (as an indicator of nitrate ion loss) over a range of temperatures.

P = the majority of candidates stated an appropriate range of at least 5 different temperatures, based on their prediction or research.

Q–R = relevant variables were generally listed although there remains some misunderstanding between independent, dependent and control variables by some candidates in some centres. However, the majority of candidates could state at least two control variables although few could state how these would be controlled for R. 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 not awarded very often.

S–T = tables were usually drawn for 'S' although lack of appropriate headings and/or units in the header(s) lost the mark. Candidates must ensure that tabulated data are presented in a clearly defined box and not as a ‘list’ and that appropriate units are given in the headers of the table. Graphs were included by many of the candidates although marks were lost for incorrectly labelled axes and/or lack of relevant units on axes.

U = well answered. For those candidates who included the need for repeats in their plan, many calculated the mean % absorbance/transmission.

V = it was disappointing to note that few candidates linked their expected observations to confirm or reject their original prediction in this series. A conclusion was very rare and if present, it failed to refer to loss of nitrate ions.

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

X = this was awarded if candidates could suggest ways for improving accuracy and/or validity. X was often awarded for the use of a thermostatically controlled water bath, if not used in the main method, or for using a narrower range of temperatures to measure pigment loss.

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

G623/02 Cells and Molecules – Test

Marks ranged from 2 to 32 out of a total of 45.

Each of the questions and the paper as a whole achieved satisfactory differentiation between candidates. Questions that targeted the A/B grade boundary were Q1c(ii), Q1c(iii), Q3c, Q3e, Q4c(i) and Q4c(ii). Question 4 revealed few high marks due to the demographics of the cohort.

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

The overall performance still 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 the actual length of the mitochondrion, given the magnification, in Q3(b).

It is a concern that candidates from some Centres clearly had not covered all the learning objectives in the specification prior to completing the examination this series. Candidates from these Centres failed to attempt whole questions or parts of questions where this was the case.

Q1(a) This section was not well answered. Surprisingly, very few candidates correctly named all three elements required, nitrogen being the most common incorrect response.
(b) Approximately 30% of candidates identified glycerol in (i). A similar proportion offered 'covalent/ester' bond in (ii) and 'water' in (iii).
Few candidates were able to describe an appropriate test for lipids in (iv). It is still a concern that many candidates have had a limited practical experience of performing food tests.
(c)(i) The hydrophobic region of the membrane was not generally known. Common mistakes included hydrophilic chains or phospholipid bilayer.
(c))(ii) None of the candidates successfully explained the impermeability of the membrane.
(c)(iii) Only the best candidates displayed relevant knowledge of the term 'fluid mosaic' to gain at least 1 out of the 2 available marks.

Q2 (a) The structure and function of enzymes was in general, well known.
(b)(i) This was generally well answered.
(b)(ii) Descriptions from candidates usually scored 2 out of the 3 available marks by referring to an increase in rate of reaction as fat concentration increases and using an appropriate data quote to support their argument. Reference to the rate slowing down at higher concentrations was rare. Too many candidates gave brief descriptions and explanations of these, which was not required.
(c) The majority of candidates drew correct and labelled lines on the graph in Fig. 2.1 and gained 2 marks, while most also started both lines at 0^{o}C. Weaker candidates misread the rubrics of the question and attempted to draw lines on Fig. 2.2, which was not appropriate.
(d) A peak at pH 8 was shown by almost all candidates. However, few scored the second available mark as they did not appreciate that enzymes work over a limited pH range (even though values of pH 5-11 were acceptable).

Q3 (a) Well answered by the more able candidates, with rough endoplasmic reticulum generally being better known than Golgi apparatus/body. Smooth endoplasmic reticulum was frequently offered as an alternative.
(b) The length of the mitochondrion was in almost all cases measured accurately. However, although many candidates gained a second mark for their attempt at the calculation (conversion to µm or division by 5000), few gave the correct answer.

(c) This was poorly answered since candidates failed to make the link between cytoplasmic RNA and transcription of proteins.
(d)(i) Most candidates made a reasonable attempt at the calculation, with approximately half giving the correct answer.
(ii) Few candidates related the study to a change or improvement in performance of the athlete.
(iii) Anaemia was generally well known.
(e)(i) There were some encouragingly good descriptions of the Coulter counter, gaining 3 or 4 marks. However, far too often, many candidates showed little, if any knowledge of its use.
(ii) This was well answered. The most common response was failing to distinguish between dead and live cells.

Q4 (a) Most candidates were able to identify at least one appropriate symptom of the disease.
(b). At least one implication was successfully identified by most candidates. However, religious issues, if given as an alternative valid point, must be qualified in candidates' responses.
(c)(i) Explanations were generally not sufficiently clear to gain more than 1 out of the 3 available marks. Responses which had correctly used the information in Fig. 4.1 were creditworthy in this section.
(c) (ii) Correct answers were very rare is this section. Few candidates appreciated the need of the blue line in the small window to confirm that the urine or free ‘mobile monoclonal antibodies’ had moved to the top of the strip.

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

General Comments

Work selected for moderation of the A2 specification reflected coverage of the units listed below. A range of marks was seen overall, however some units tended to be generously assessed. The portfolio units moderated this series were as follows:

- G627 Investigating the scientist's work
- G629 Synthesising organic chemicals
- G630 Materials for a purpose (limited entry)
- G632 The mind and the brain
- G633 Ecology and managing the environment
- G634 Applications of biotechnology

Good practice was seen in Centres where staff had supplied relevant task and assignment sheets and where URS cover sheets were fully completed, with clear teacher comments which supported the marks awarded. Page number references also enabled easy location of the relevant work and supported the moderation process.

It is important that Centres encourage their candidates to follow the guidance given in the moderators' reports supplied in previous series. This is essential if standards are to be maintained and scaling is to be avoided in future submissions. It is also essential that portfolio work at A2 shows suitable progression from the AS work studied in Year 1 of this course. 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, due to generous assessment of the higher mark bands. Centres are again advised to refer to Appendix A, Page 93 of the specifications, for the performance descriptions for A2 work. Scaling of the higher mark bands was due in the main to candidates not demonstrating the necessary standards required by the assessment criteria, ie work was not sufficiently detailed and accurate, with insufficient data at a high level of precision and reliability.

Work at grade A standard needs to be detailed and accurate. All researched information should be suitably selected and referenced. Centres need to be aware 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 content and understanding.

Risk assessments written and used by candidates need to be suitably detailed and focused on the particular experiment, and not generic – giving only basic laboratory safety rules.

Care also needs to be taken when assessing work at mark band 2, that where full marks are awarded, work covers all the requirements of the assessment criteria and suitably links with the specification at this level. Some work seen this series was generously assessed, especially where there was a range of marks, eg from 3–5. Five marks was often awarded when work was only just mark band 2 and part of the assessment criteria was either not covered or at a lower level.

Moderation Manager, which is an electronic means of requesting and selecting the portfolios for moderation, is now used to select the portfolios. This makes the moderation process much more efficient and Centres have been very responsive in returning scripts for moderation and returning

the Centre Authentication form with their candidates' work. There is now no necessity to send MS1 forms to moderators or to include these forms with the sample. Accuracy seemed much better this series with fewer clerical errors. It is important, however, to ensure Centre numbers and candidate numbers are recorded on the URS attached to the candidates' work.

Many Centres are now accredited and are sampled over a three-year period. Accredited Centres need to ensure that the necessary Centre Authentication form is sent to OCR for each 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 qualifications.

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.

Centres need to check that the investigation chosen allows candidates to progress from AS level and that the chosen topic offers a range of experimental work. Investigations should, wherever possible, allow candidates to develop their work independently and not just follow set practicals.

Vitamin C and aspirin investigative work was again amongst the most popular. However, where candidates have used G622 as a base to work from, Centres need to ensure they are not just repeating basic experiments studied at AS, extension work is needed. Care also needs to be taken that where candidates are using questionnaires for their research, they do evaluate and discuss the outcomes at A2 level. Conclusions should be suitably supported with scientific reasoning.

Good practice was seen where candidates were given the opportunity to investigate topics further and carry out different experimental techniques and procedures, eg different types of preparative work, quantitative analysis, qualitative analytical techniques, research and questioning techniques. 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 where centres had clearly indicated the routes the candidates had taken and the opportunities available.

Higher band work needs to show evidence which includes:

- Vocational links, which are fully referenced and validated.
- Experimental work, which includes a range of techniques and different procedures.
- Health and Safety guidance which is detailed, clear and focused.
- Clear reasoning on how the investigation achieved its aims and objectives, supported by a discussion of the reliability of the work carried out.
- A written report, which is accurate and suitably detailed.

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 Synthesizing 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.

Work was seen from candidates which was well structured and showed good individual research. Work for AO1c clearly indicated candidates had an interest in this aspect of organic chemistry.

General guidance is as follows:

AO1

- Evidence needs to be focused on the requirements of the specification.
- General notes do not need to be included.
- Information on all bullet points for AO1a is needed, ie naming and identification of functional groups with structures, as well as an explanation of isomerism (even for mark band 1).
- Candidates need to check accuracy when writing organic formulae and equations.
- Explanation of reaction types needs to link to the specific organic compounds and not be generic.

AO2

- Research work on a process used to manufacture one organic compound needs to be suitably selected and clearly recorded.
- For AO2a and AO2b, work on brewing and alcohol allows a good vocational link and the opportunity to consider safety and economics of manufacturing the product. Other examples could include haloalkanes, esters and medicinal drugs.
- AO2b needs to focus on costs and benefits to individuals, companies and society associated with the manufacture of the selected organic compound.

AO3

- 26 marks are allocated to the practical work and hence between 25 to 30 hours should be allocated to AO3 work.
- Preparations of aspirin, ethanoic acid, benzoic acid, iodoform (triiodomethane), paracetamol, and various esters can be used.
- Risk assessments need to be workable documents that are accurate and sufficiently detailed.
- Detailed observations need to be recorded for both preparations.
- Processing of results includes calculations of actual and theoretical yields.
- Evaluation needs to be detailed and focused on the techniques used, sources of errors and reaction route.

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.

Work seen indicated that candidates had clearly worked with interest to research and produce the information on stress and illness and the healthy and damaged brain. A good range of resources was accessed and reference information was particularly informative where candidates had reviewed the websites used.

General guidance as follows:

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.
- References are supported with information on how they have been used.

AO2

- Relevant information is selected to produce information giving the clinical methods of studying the brain. Diagnosis of brain disease is generally well covered but work could be supported by labelled illustrations.
- For AO2b mark band 3 work, comprehensive discussions are required.
- For mark band 2, work on moral and ethical implications of brain research needs to reflect the statements given in the assessment criteria, a comprehensive discussion and conceptual considerations are needed. This section is often quite brief and centres are advised to spend time with candidates in discussion work on this topic.
- AO2c 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.

AO3

- 26 marks are available for AO3 and therefore candidates need to spend the appropriate time on their experimental work (25–30 hours).
- Candidates aiming for the higher mark bands need opportunities to extend research for their practical work to ensure a wide range of data can be collected.
- Participants of the investigations need to be fully aware of the tests that they are completing and evidence needs to be provided of risk assessments used.

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.

Candidates are continuing to produce work that demonstrates their skills in both research and practical work, however, those being assessed with top marks at mark band 3 should be showing independent research skills and a high level of individual evaluation work.

General guidance as follows:

AO1

- Research work assessed for 5 marks needs to show a thorough knowledge and understanding demonstrated by independent research skills.
- Work is suitably selected and accurately referenced.
- AO1b evaluations are at an appropriate high level to reflect A grade A2 work, with suitable justification included.

AO2

- For AO2a mark band 1, candidates need to identify moral and ethical reasons for preserving ecosystems and species diversity; where mark band 2/3 marks are given, candidates need to know how to explain and evaluate their reasons.
- Where high marks are awarded, reports need to clearly show a range of methods used to manage ecosystems and preserve species diversity.
- For AO2b, candidates need to be able to describe methods used in the management of ecosystems and to interpret data relating its success.

AO3

- Candidates need to include risk assessments that are detailed workable documents.
- Practical work needs to provide candidates with the opportunity to carry out a range of experimental techniques and the opportunity to make both measurements and observations.
- Photographic evidence can be included as evidence of work carried out.
- For AO3c, the displaying of data needs to show 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.

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:

AO1

- 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.
- For mark band 3, work needs to have been suitably selected from a variety of sources, clearly and logically presented and with correct spelling, punctuation and grammar.

AO2

- For AO2a, mark band 3 candidates need to select the relevant information and give comprehensive evaluations of how successful recombinant DNA is in solving problems associated with food production.
- For AO2b, a summary of the moral, ethical and environmental issues concerning the use of DNA technology in GM plant production should be seen for mark band 2, as well as an explanation of two controls placed on scientists. A fluent explanation is needed for mark band 3 in addition to an evaluation of the controls chosen.

AO3

- 26 marks are available for AO3 and therefore candidates need to spend the appropriate time on their experimental work (25-30 hours).
- 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.
- Candidates need to produce a clear plan of their practical work, in addition to detailed risk assessments. Detailed plans linked to secondary sources used to show practical work choices need to be evident for 5 marks.
- Contingency work allowing selected repeats, with reasons, could also support top marks being awarded.
- For AO3d, candidates need to use their findings from the experimental work to produce suitable conclusions and interpretation of results.
- For 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.
- Centres also need to ensure candidates are spending the appropriate time on AO3c and AO3d to produce sufficient in-depth coverage.

G628 Sampling, Testing and Processing

There were around 500 candidates sitting this examination, which was a similar number to the January 2011 series.

As in previous examinations, many candidates scored marks in the range 25 to 45 out of 90. There were fewer scripts showing disappointing scores of less than 20. However, the number of candidates scoring more than 50 was smaller than in previous sessions.

Questions that test ability to design experiments continue to be difficult for many candidates. It was unusual to see a high level answer for the two questions that explored this area. As noted in recent examinations, a number of candidates still struggle with questions that include an element of calculation. The examiners felt that candidates should always look at their answer and judge whether the response is realistic.

The answers to the questions based on the pre-release case study material generally indicated that candidates had worked hard at this material and were well equipped for the questions. However, a few candidates seemed not to have prepared themselves for questions on reverse osmosis.

There was little evidence that the paper was too long and the examiners felt that all candidates had been given an opportunity to demonstrate and apply their knowledge. It was disappointing in some cases to see that a few candidates had not availed themselves of that opportunity.

1. (a) This was an easy starter and most candidates recognised that the mineral was magnetic.

(b) There was a wide variety of acceptable answers and most candidates gained both marks.

(c) Not all candidates realised that problems of contamination would occur or that the stream might have been swollen by flooding.

(d) Few candidates realised that the samples had been there for a very long time and that deterioration or attack by oxygen was now unlikely to occur.

(e) The question stated that the answer was required to three significant figures. A number of candidates failed to respond to this aspect of the question.

(f)(i) In many cases the correct figures (43.8 and 47.3) were given, together with an adequate explanation.

(f)(ii) The various uses of graphs generally gave candidates the mark.

(g) The Examiners were looking for problems with attaining/maintaining 1000 ^{o}C and the toxicity of the gases. Although many candidates gained both marks, the examiners though that ‘unavailability of equipment’ was not a response worthy of a mark.

(h) It was surprising that many candidates could not adequately state the meaning of a ‘batch process’ or to make a comment on the less economical nature of this process when compared to a continuous process.

(i)(i) Many candidates realised that the % of titanium was increasing and that a dip had occurred in previous years.

(i)(ii) A bar chart was the most popular correct response.

(j)(i) Nearly all candidates knew the need for a risk assessment before using the sulfuric acid.

(j)(ii) This was meant to be an easy question, but many candidates failed to state that it was to make the mixture homogeneous, or words to that effect.

(j)(iii) Very few candidates knew the reason for using a complimentary coloured filter.

(j)(iv) The examiners were looking for statements such as 'the graph should be a straight line' and 'the graph should go through the origin', but few candidates gained two marks here.

(j)(v) Questions concerning percentages and dilution factors have caused many candidates problems in the past and this trend, sadly, continued.

(k) The information for this question was given in the case study but many candidates chose to ignore the information given.

(l) Most candidates did not realise that when more absorption occurs, transmission will be less.

(m) Most candidates could describe 'in vivo'.

(n) This was the first of the questions that asked candidates to design an experiment. The question produced a range of marks but it was unusual to read a well-constructed and logical answer.

2. (a)(i) Answers were generally correct and the Examiners thought that candidates were becoming more competent at using standard form.

(a)(ii) Not everyone realised that the statement assumed that all the oceans must be of the same depth.

(a)(iii) This proved to be a difficult question and few candidates obtained more than one mark. Those that gained a mark generally commented on the continuous process of evaporation and condensation.

(b)(i) Nearly all candidates gained one mark but fewer then went on to state that the relationship between pressure and boiling point was not linear.

(b)(ii) Surprisingly some candidates could not read the correct figure from the graph.

(b)(iii) The most common correct responses were 'it uses less energy' but fewer people could then give an adequate reason for that answer.

(c)(i) A number of candidates failed to state the *function* of the condenser and merely stated its name.

(c)(ii) This was a more challenging question and only stronger candidates realised that the water bath may have cooled and that the concentration of the salt water had increased.

(c)(iii) Most candidates gave an adequate answer based on safety.

(d)(i) Those candidates who had revised reverse osmosis gained a number of marks here, but it was plain that some other candidates were guessing.

(d)(ii) The calculation of a simple percentage continued to cause many candidates difficulties.

(e)(i) There were three straightforward marks here that were gained by many candidates.

(e)(ii) An easy mark on contamination.

(e)(iii) Most candidates realised that the bottles needed to be cleaned or sterilised.

(e)(iv) The details needed for clear labelling were well understood.

(e)(v) Most candidates realised that chlorine remains in the water and continues to deal with pathogens.

(e)(vi) 'Time' and 'intensity' were the two most common correct responses.

(e)(vii) This was the second question that required candidates to design an experiment. This was a variation on the sand and salt water experiment. It was very disappointing to see how many candidates lost a number of marks for either no response or for a totally irrelevant answer.

3. (a)(i) The need for labelling was often given but the other alternatives were uncommon.

(a)(ii) The need for cleaning was any easy mark for many candidates.

(a)(iii) This proved to be a difficult question and few candidates gained more than one mark.

(a)(iv) The need for cleaning of the machine before its next use was well recognised.

(a)(v) Many people gained the mark for 6%.

(a)(vi) This proved to be a challenging question and it was unusual to see both marks being gained. The commonest correct response was ‘climate’ or ‘age’.

(a)(vii) Many candidates gained a mark for compost but there were a number of other acceptable alternatives for which candidates gained a mark.

(b)(i) Only a few candidates knew that infrared spectroscopy is concerned with the bonds in a molecule.

(b)(ii) ‘For comparison’ gained most candidates the mark.

(b)(iii) Most candidates gained a mark for stating that the time in the water needed to be a constant factor.

(c)(i) This calculation involved the use of square roots. Most candidates gained a mark for the correct substitution into the formula but fewer could then work out the answer.

(c)(ii) If the answer was workable, then the candidate gained a mark.

(c)(iii) This proved to be a very demanding question and only the strongest candidates obtained any credit.

G635 Working Waves

This examination performed in a manner similar to previous years. The vocational contexts continue to motivate weaker candidates.

Questions on newer areas of the specification, such as resonance and spatial/thermal resolution, were not well answered by some candidates. Some answers referred to details such as FDMA/TDMA, which were dropped at the 2009 amendment to the specification.

1 (a) Max displacement: Many failed to convert to cm. Some measured from the axis to the top of the slinky getting 0.11 m instead of 0.10 m. This was condoned.
Speed: Few correctly wrote down distance measurements, even among the minority who got the value correct.
Periodic time and frequency: Many failed to get the mark because they recorded measurements, in some cases contradicting themselves by writing NA in the value column.

(b)(i) Many placed ticks correctly in at least one column.
(ii) Some candidates clearly did not understand the term 'phase' and wrote about amplitude and frequency. Some of those who understood lost marks by giving the phase lag as '1' or '1 s' instead of '1 μs'.
(iii) Most candidates did give correct units here. Although many gave correct answers, a wide variety of incorrect answers were also seen.
(iv) Many scored at least one or two marks, but struggled over the reciprocal of 10^{-6} or the use of MHz. '0.25' Hz was a common incorrect answer. Completely incorrect answers often involved attempts to use $v = f \lambda$.

(c)(i)& (ii) Although most candidates correctly identified the antinodes, many lost both marks by contradicting themselves by marking other antinodes with an 'N'.
(iii) & (iv) About a quarter of candidates omitted these completely. Some correct answers to (iii) were seen and others might have scored with more careful drawing. Correct answers to (iv) were very rare, many drawing a wave shifted sideways by 1/4 cycle.
(v) A large number and variety of completely incorrect answers were given. Those answering to 1 significant figure and giving the answer 0.6 or 0.7 had presumably either only measured one cycle or truncated or rounded 0.666.

(d) Although most attempted an answer, few mentioned variation in pitch and even fewer mentioned nodes or antinodes. Most wrote of variations in amplitude due to the sound escaping through the open end.

2 (a)&(b) Candidates are getting better at mentioning the difference in temperatures rather than simply temperature. Most mentioned false colours or shades of grey, but fewer noted the variation in infrared emissions. Incorrect answers sometimes referred to the absorption of radiation and the proximity or otherwise of the clouds and the earth to the satellite.

(c) About half the candidates, spread across the ability range, recognised the limitations of a visible light camera after dark.

(d) (i)& (ii) About half the candidates gave the correct answers, (ii) being slightly better answered than (i).

(e) (i)& (ii) Candidates who were better prepared knew these terms which were introduced with the 2009 version of the specification. Others omitted the answer or apparently guessed.

3 Candidates found this question challenging. Some thought that wavelengths changed from daylight to darkness. Others answered 'shorter' or 'longer' without saying which was which.

4 (a) Few candidates had learnt the answer to this question. About a fifth gave no answer. Many suggested various other instruments covered in the specification such as infrared camera or endoscope. 'Camera', '[unspecified] light detector', 'computer', and 'data logger' were all suggested by a number of candidates. Some ignored the word 'electronically' in the question and wrote 'eyes'.

(b) Generally well answered and a good discriminator. As in previous examinations, some weaker candidates wrote 'refraction' instead of 'reflection'.

(c) Able candidates stated that the angle of incidence is greater than the critical angle, weaker answers gave 'equal' or failed to clearly identify the angle of incidence eg 'the ray' or 'the angle'. Fewer candidates identified that this occurs at the interface or that the cladding must have a lower refractive index than the core.

(d) Core and cladding were often identified, but more was required. Very few identified the uniformity of refractive index within the core (in contrast to graded index). Some who correctly gave the size diameter of the core omitted to say that the measurement was of the diameter. The protective sheath and the variation of refractive index from core to cladding were alternative ways in which some candidates scored marks.

(e) (i) As in part (d) some candidates stated that the core was smaller than in the case of step index and/or correctly gave the diameter of the core but omitted to say that the measurement was of the diameter. Other incorrect answers discussed the function rather than the construction.
(ii) Weaker candidates listed a set of apparent guesses such as cost. Many scored at least one mark by describing the path in monomode. Good candidates scored all three marks by discussing the causes of distortion in step index fibres and/or how monomode overcomes this.

(f) (i) Well-answered especially by the better candidates.
(ii) Candidates who clearly stated that incoherent bundles were arranged randomly were awarded the mark. Some candidates who described the arrangement of coherent bundles sometimes lost marks if they did not make clear that the arrangement was the same throughout or at both ends.
(iii) Many candidates were able to describe the resulting signal as 'mixed up' or an equivalent statement.

(g) It was evident that most candidates had seen or carried out this experiment, but the recall of detail and experimental quality was more limited. Most candidates described the method using a ray box or laser and a rectangular glass box. Some described the method using a semicircular glass block to find the critical angle. A number confused the two methods. Many drew rays bending in the wrong directions and at the wrong place. Many omitted to clearly describe or draw angles *i* and *r,* commonly giving angles between the ray and the surface or giving the angle of emergence as *r*. Many omitted to mention the measuring instrument. Very few repeated readings. The expression sin *i* / sin *r* was given by many of the better candidates.

5 (a) (i)& (ii) Many correct answers were seen. A few transposed the answers to (i) and (ii). Other incorrect answers included AM, FM, sound and radio.

(b) (i) Many correct answers were seen. '**Post** code modulation' was seen in a number of scripts.
(ii) & (iii) When attempted, these questions were generally well done, but were omitted by around 20 - 25% of candidates. Appropriate diagrams were enough to score both marks in part (ii) for many candidates, but a few drew sampling lines that reached well above their curve.
(iv) This was omitted by around 25% of candidates, but correctly answered by about half of those who gave an answer. 'Amplitude modulation' was a common incorrect response.

6 (a) This was attempted by almost all candidates and most scored at least one mark. Many lost the second mark either by choosing the centre of cells rather than the intersections, or by choosing intersections that were not alternate.

(b) In previous examination sessions, many candidates failed to recognise frequency re-use as the purpose of mobile phone cells. It was therefore pleasing to see that about three quarters were able to correctly respond to this question.

(c) About a quarter of candidates scored both marks, usually for 'population density' and 'obstruction'. A further group of about half the candidates scored 1 mark, often giving high population in some areas and low population in others as their two answers.

7 (a) This was attempted by almost all candidates and over 80% scored at least one mark, with a spread of scores above this. Many candidates referred to the higher 'density' of bone which was accepted although reference to atomic mass would be preferred at A2.

(b) (i) & (ii) Grey and black were identified by many candidates.

(c) This was omitted by about a quarter of candidates and a little under half gave correct answers. Technetium-99 was a common incorrect response, suggesting confusion with the use of the gamma camera.

(d) (i) This was poorly answered. A substantial proportion of the minority who scored the mark did so with an incomplete mention of focussing. Most candidates thought that scattering was involved.
(ii) & (iii) Very few correct answers were seen.

(e)(i) (ii) & (iii) This was also poorly answered. Candidates often confused filtration with other devices such as image intensifying screens, lead grids or collimators. A few of those who knew that removal of low frequency X-rays was involved wrote this in answer to (i) or (iii) rather than (ii).

(f)(i) This should have been an accessible question as it builds on AS work, but an alarming number of candidates gave the answer 'gamma rays'
(ii) Most candidates scored at least one mark for mentioning rotation but few scored all three, commonly omitting to state that both source and detector rotate.
(iii) Although many candidates scored a compensatory mark for giving one of the advantages of CAT scans such as 3D images, few recognised that the problem with conventional X-rays is that the intensity at a point on the image is determined by the aggregate of all the points through which the X-ray has passed.

8 Although most candidates were able to score at least some marks by mentioning dial-up and broadband, a significant minority wrote about mobile phone systems such as 2G/3G or FDMA etc. Of those who started off on the right track, most knew that broadband was better for downloading, but fewer linked the high frequency of broadband signals to higher data transfer rate, and fewer still correctly articulated the very large data transfer rate offered by fibre optics.

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