GCE

Applied Science

Advanced GCE **A2 H575/H775**

Advanced Subsidiary GCE **AS H175/H375**

OCR Report to Centres

January 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

CONTENTS

Advanced GCE Applied Science (Double Award) (H775)

Advanced GCE Applied Science (H575)

Advanced Subsidiary GCE Applied Science (Double Award) (H375)

Advanced Subsidiary GCE Applied Science (H175)

OCR REPORT TO CENTRES

Content	**Page**
Overview	1
G620, G621, G624, G625, G626 AS Portfolio Units	3
G622 Monitoring the Activity of the Human Body	9
G623/01 Cells and Molecules – Planning Exercise	12
G623/02 Cells and Molecules – Test	14
G627, G629, G630, G631, G632, G633, G634 A2 Portfolio Units	16
G628 Sampling, Testing and Processing	21
G635 Working Waves	25

Overview

AS & A2 Applied Science January 2013

The specification continues to attract new centres as well as maintaining those whose candidates have been studying this applied science A Level course for many years. Several pleasing and interesting scripts and portfolios have been produced by candidates this series. Centres who are continuing to maintain their accreditation should be congratulated as they are applying the assessment criteria appropriately and consequently work is being assessed at the correct level.

The majority of the portfolio work moderated reflects both interest and enthusiasm from the candidates. Generally, most experimental work is now showing a vocational link but care still needs to be taken to ensure that the level and complexity of practical work offered is sufficient to give candidates opportunities to access the higher level marks. The outcomes of the practical work also needs to be supported with adequate scientific knowledge and understanding at the required level. For AS Level units, practical work offered needs to show suitable progression from GCSE and for A2 units, practical work offered needs to allow candidates the opportunity to access procedures and techniques that show their progression from AS to A2. Candidates need to ensure that both recording and processing of results is accurate and correct.

Centres need to take care that they are not over-assessing their candidates' work as several centres were scaled this series. Assessment at the higher mark bands needs to be reviewed in many cases to ensure that the level of the work presented by candidates reflects detailed understanding of both the assessment criteria and the content of the specification at the required level. Details of performance descriptors for both AS and A2 are available in Appendix A of the specification.

Centres are thanked for their support of the moderation process. There was efficient turnaround of portfolios and minimal clerical errors were seen. Centres are reminded to ensure that OCR's URS cover sheet is fully completed for each candidate, with the centre and each candidate's name and number. Teachers' comments enhance the moderation and support the assessment and centres are encouraged to include these with their candidates' work.

There was an increase in the number of candidates taking G622 *Monitoring the Activity of the Human Body* this series, with the level and quality of the work exhibited by the candidates being maintained. A good range of answers was seen; however, candidates are still unfortunately struggling to cope with the application of arithmetic and the recall of appropriate units of measurements. A few candidates produced excellent responses for the longer answer 'level of response' questions although many longer answers were seen that were at a much lower level. Candidates' scripts showed evidence of knowledge of a good coverage of the specification.

For G623 *Cells and Molecules*, a limited number of centres submitted work this series and candidate entries were lower as a consequence of this. For G623/01 marks ranged from 2 to 20 and some interesting and innovative plans were seen. Many candidates, although they were providing useful preliminary work, were not linking it to their main investigation. Care needs to be taken by centres to ensure they do not guide their candidates too much and in so doing reduce any independent thinking from their candidates.

For G623/02, it is still a concern that candidates from some centres clearly had not covered all the learning objectives in the specification prior to completing the examination. Where this was the case, candidates from these centres failed to attempt whole questions or parts of questions. Each of the questions and the paper as a whole achieved satisfactory differentiation between candidates.

The number of candidates taking both the A2 papers this January has increased. For G628 *Sampling Testing and Processing*, there seemed to be a greater number of candidates scoring 25 marks or less and as noted in previous examinations, questions that test candidates' ability to design an experiment for a particular purpose scored low marks. Calculations involving simple arithmetic manipulation and the determination of percentages are important features of this paper and, in general, candidates had difficulties with many of the questions involving calculations and often gave quite unrealistic values. On the positive side, candidates seemed well-prepared when answering the questions that were involved with the pre-release material, and there was also evidence of sound revision work from past papers.

It was good to see an increase in candidate numbers for G635 *Working Waves*. Candidates performed similarly to previous years, again with a tendency to write what they knew about a subject, rather than directly answering the questions set. There were several instances where some candidates had not fully read the question but repeated the answer to questions set in previous years.

Centres need to note that these A2 papers do contain some part-questions that include 'Stretch and Challenge' marks that test the ability of the candidates to demonstrate a deeper knowledge and understanding of the subject and to show the ability to present a clear, logical development of ideas, in addition to applying their knowledge to unfamiliar contexts.

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

General Comments

Work selected for moderation of the AS specification covered all the units listed below; however, for the optional units numbers moderated were very low.

- **G620 Science at Work**
- **G621 Analysis at Work**
- **G624 Chemicals for a Purpose**
- **G625 Forensic Science**
- **G626 The Physics of Sport**

Credit is given to those staff and candidates who are using both the specification and assessment criteria appropriately. Consequently work is being assessed at the correct level and some high quality work was seen by these centres.

As in the June series, many centres continued to over assess their candidates' work and several centres were scaled. Where scaling occurred work did not reach the necessary standards required by the assessment criteria i.e. work was not sufficiently detailed and accurate and evaluations were not at a high enough level for 'a' grade work. Candidates' work submitted for the higher mark bands need to show high level science that is both well presented and suitably targeted to the audience specified. Quality, not quantity, needs to be reviewed in many cases and although candidates had certainly worked hard, selection of research and accuracy of scientific facts were not always evident at the required standard. Candidates also need to ensure that the level of the work they present in their portfolios reflect detailed understanding of both the assessment criteria and the content in the specification. Assessment does include the use of accurate terminology and correct spelling, punctuation and grammar; this needs to reflect the standard of the reports at all levels of assessment. Centres also need to take care that when giving full marks at mark band 2, all the criteria in that strand are met at the appropriate level. In several instances work was covered, but at quite low levels.

Comments and page references on the URS form support the moderation process and aid moderators in locating the appropriate work. Annotations using the assessment code e.g. AO1(a) on the candidates' work support the assessment. The more detail and information that teachers include on the portfolio work, the more this helps the moderator support the assessment decisions made by the centre.

The portfolio work seen continues to reflect the interest and enthusiasm of many of the candidates. Most of the practical work now shows a vocational link with suitable reasons for why the experimental work needs to be performed but care still needs to be taken by candidates to ensure both recording and processing of results are accurate and correct. Risk assessments again are showing improvements but more work is still needed by candidates at all levels to ensure they are suitably focused on specific hazards with risks and controls clearly stated. All risk assessments need to be clear working documents. Many centres were still very generous in the assessment of their candidates' practical work, it is essential that practical work shows progression from their level 2 course. Those centres where scaling has occurred need to review their practical provision to ensure candidates can access the full range of the assessment criteria. Work needs to be suitably referenced and presented. Centres are advised to spend time with candidates teaching research, presentation and recording techniques.

The moderation process this series was efficient and centres were very good in returning coursework to moderators, which was appreciated. Centre Authentication Forms were received from most centres and clerical errors were minimal, although some centres still did not record candidate and centre numbers on the portfolio work.

OCR offers a free coursework consultancy service to support the assessment; details are available on the OCR website.

G620 Science at Work

The assessment requirements for this unit 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

AO1
Candidates need to complete four surveys with one of these used as a base for the more detailed in-depth study. A wide range of interesting organisations were seen - from football clubs and health centres to high-level chemical manufacturers. Whichever is chosen, the specification clearly gives guidance on what needs to be included in both the surveys and the in-depth study, and candidates need to ensure that their work does relate directly to the requirements of the specification. Centres are advised to refer candidates to both the requirements of the specification and the assessment criteria for their surveys and in-depth study, as they are not required to produce four detailed studies. Excessive information on the history of organisations and job opportunities, although interesting, it is not required in reports. Work should not include excessive 'cut and paste' material and the text of both the surveys and in-depth report should, where appropriate, use candidates' own words or suitable referenced selections from their research.

For mark band 3, a comprehensive study is required with information selected and presented clearly and logically. Some evaluation and justification of the use of the material needs also to be included and supported by comments on the validity of the sources. There was minimum evidence of evaluation and justification of the researched material. Assessment tended to be over generous at the higher levels. Work needs to show understanding of both the science involved and the other factors involved in the chosen organisations.

For the health and safety work for AO1(c) 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. Pages of researched laws and regulations do not automatically reflect the higher mark bands. Candidates may have found interesting and useful information, but relevant information needs to be selected and linked to the chosen organisations.

AO2
Candidates can link AO2(a) with their in-depth study and, again, centres need to ensure their candidates are aware of what needs to be covered. For mark band 3 it is not only the coverage but the level of discussion and selection that is needed to reflect the mark awarded.

The assessment guidance states that a number of complex and straightforward calculations should be completed for AO2(b). Appendix C (page 129 of the specification) gives guidance on the range of mathematical skills that 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 AO2(b) 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 were linking practical activities to a vocational context, consequently giving a reason for the completion of the practical work. Centres are also advised to give their candidates two different types of practical work to ensure they widen the skills they are learning. It is not advisable to do two titrations or even two practicals involving the same techniques. It is also important that practical work is reflective of AS standard and consequently should show a step up from practical work covered in their Level 2/GCSE courses. Simple flame tests or paper chromatography will not enable candidates to access the higher mark bands.

All candidates should be aiming to record all relevant observations or measurements in an appropriate format and they need to be building on the skills they gained in their Level 2 courses. Mark band 3 work needs to be accurate and precise with no errors in significant figures or omissions of units. Candidates also need to work on ensuring their processing skills in graphs and calculations are accurate and include units and appropriate scales. Evaluation assessed at mark band 3 needs to reflect 'a/b' grade work, which includes appropriate scientific discussion. Many evaluations seen were not adequately discussing strengths, weaknesses etc. to the appropriate level.

G621 Analysis at Work

The assessment requirements for this unit 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

AO1
Some very good work on energy policies of universities was seen with work selected and evaluated. Well done to these candidates; however, several candidates still need to ensure work is suitably selected on the energy policy rather than environmental policies, and is clearly presented at the beginning of their reports. In several cases it was difficult to find the actual policy and information was really not suitably extracted from the web sites used. Candidates need to use their research to put together a report that logically reflects the requirements of AO1. 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. Accurate use of terminology and correct spelling, punctuation and grammar are all assessed within this strand.

AO2
Describing and comparing large scale and small scale electrical generation from two chosen sources is showing improvement and work is now much more selective 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. Some good examples of calculations and researched data were seen.

AO3
Centres need to take care that they are not over assessing their candidates for this strand. Practical work needs to be a step-up from that studied at level 2 / GCSE, linked to a vocational context and supported with good quality observations and accurate processing. Centres need to work on the presenting of results in both volumetric analysis and in the detail needed for observations required in qualitative analysis. Also, it is not necessary to include pages of provided data on generic tests for anions and cations. Higher mark band work should be supported by correct balanced equations where appropriate. 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 this unit include:

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

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

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

Work seen in the moderation process this series was limited. The following general guidance is given.

AO1
This unit gives candidates the opportunity to extend their chemistry knowledge and study the properties and actions of examples of chemical products used in consumer goods. Sodium chloride, sodium carbonate, sodium hydroxide, ammonia, sulfuric acid, hydrochloric acid, methane, ethene, ethanol and ethanoic acid, are compounds that have been used in the past. Care needs to be taken that when mark band 3 is awarded, work is accurately presented and candidates are showing a full understanding, rather than just the ability to find the appropriate chemical data and then 'cut and paste' it from a suitable web site. Candidates also need to work on showing how the properties of their chosen compounds depend upon the structure and how the uses depend upon the properties. Eleven marks are allocated to AO1(c) 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. Again, coverage of the bullet points does not automatically lead to a mark band 3 mark. Work needs to be accurate and appropriate and show understanding from the candidate. Candidates could do research and practical work to support the understanding for this section. 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 are suitable industrial processes that can be used. When candidates are aiming for mark band 3, understanding needs to be demonstrated by linking the use of the catalyst to the process chosen and not just researched information 'cut and pasted' into the report candidates. A discussion on the consideration of energy costs, waste product availability and sustainability of raw materials are required for mark

band 2 and further understanding of the social, economic and environmental impacts of the product are also needed to support the basic research of the industrial process for the higher mark bands.

AO3
For AO3(a), candidates need to show evidence that they have researched, prepared and completed analysis on their two chosen compounds. Risk assessments should be included and should be detailed and accurate usable documents. For mark bands 2 & 3, evidence that candidates had both prepared and analysed both products is needed. A basic preparation with no analysis will not allow candidates to gain mark band 2. Centres need to work on the presentation of observations and results obtained from these preparations. Initial and final weighings and accurate recording of melting points need to be included**.** 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 and 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.

G625 Forensic Science

The assessment requirements for this unit 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 visualize forensic evidence, including ethical considerations

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

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

Work seen in the moderation process this series was limited. The following general guidance is given.

AO1
For AO1(a), research work needs to show selected information of a range of techniques explaining the need to record and preserve a crime scene. This can either be incorporated with AO1(b) or in a case study but where this occurs, candidates need to check that work is suitably detailed and explained. AO1(b) needs to show suitably selected work to cover chemical, biological and physical techniques. Candidates need to be selective of the work used and referencing of work taken from internet sources helps to indicate work that is not the candidates' own. For AO1(c) 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 AO2(a), good case study work should include relevant information linked to the ways in which forensic scientists ensure the quality of evidence collected and analysed is objective, the limitations of the evidence, the strengths and weaknesses of the analytical techniques used and a discussion to show an understanding of the probability of guilt and of a need to review evidence. For AO2(b), standard calculations can include a range of Rf values for mark band 1, or refractive index calculations and bullet projectiles for mark bands 2 and 3.

AO3
For AO3, experimental work can include fingerprinting and taking footprints, measuring and the use of photographs, a range of microscopic techniques, chromatography, qualitative and quantitative analysis, and the measurement of refractive index of glass. Care needs to be taken so that candidates suitably process the outcomes of their practical work to a sufficiently high level where the higher mark bands are to be accessed. Chemical and spectroscopic analysis can often raise the level of some of the practical work offered. 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 this unit include:

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

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

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

Work seen in the moderation process this series was limited. The following general guidance is given.

AO1
This unit gives candidates the opportunity to research the science involved in a range of sporting activities. Work for AO1 needs to be presented in the form of guidance leaflets. Centres are directed to the assessment criteria information on the Assessment Evidence Grid regarding the target audience for these leaflets. Candidates should be selecting suitable material for their leaflets and using the specification as a reference for the content. Work must be suitably referenced. Mark band 3 work needs to show detailed knowledge written, where appropriate, in candidates' own words with evidence of the linking of scientific knowledge to the chosen sport or equipment.

AO2
AO2 gives candidates the opportunity to produce a presentation linked to sporting equipment. 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 that 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 level 2 / GCSE. The choice can be determined by the centre but candidates should be showing some planning.

G622 Monitoring the Activity of the Human Body

Comments on Individual Questions
(Mark range 3 to 82)

1 **(a)** Many candidates responded well to this item and tended to identify 'less harmful' and 'no surgery' as advantages of X-ray radiography.

(b) Although some candidates gave a realistic account of the journey of X-rays with regards to dense and less-dense materials in the body, responses were often difficult to follow. A number of candidates used the image shown in Fig.1.1 to good effect.

(c) **(i)** The use of a CAT scanner was generally understood but some candidates referred to good resolution of tissues without the inclusion of soft tissues or named examples of such tissues.

(ii) The involvement of magnets in MRI scanning was appreciated by many candidates and so they were then able to link this to potential problems, with particular reference to the metal implants in the patient.

(d) The risks associated with X-ray radiation were known by many and a significant number of candidates already realised that the radiographer should wear a lead apron or stand in a different room. Some unfortunately referred to lowering the dosage of radiation.

2 **(a)** **(i)** The key feature of this item was mucus. Mucus was not included in responses to both parts of the item. Some candidates were aware of the removal of dust particles and bacteria but were unsure of the direction of movement out of the trachea.

(ii) The majority of correct responses stated cartilage and the function was clear. Some correctly chose muscle in the wall of the trachea but others linked this item to part (i) and described cilia etc.

(b) This item was answered with confidence by many candidates but some described the process of gaseous exchange at the alveoli.

(c) **(i)** A number of candidates struggled with this item and obtained one mark for the calculation of the breathing rate. Some appeared to complete the calculation without any difficulty. A specific pattern of candidate errors could not be identified.

(ii) Most candidates obtained the mark for this item but some gave 6 as the answer.

(iii) Many candidates understood the changes taking place in breathing during exercise.

(d) **(i)** This item did not present a challenge to most candidates but some stated 'thin' without mentioning the wall.

(ii) Whilst some candidates gave a good and detailed explanation of events at the gaseous exchange surface of the lungs, some struggled to articulate an answer. The key involvement of diffusion was overlooked by many candidates.

3 **(a)** The majority of candidates were aware that 9.0 mmol dm^{-3} is the critical value for blood-glucose concentration.

(b) Some candidates were challenged by this item but many were able to complete the table successfully. No specific pattern of candidate errors could be identified but some unfortunately considered that the features related to both types of diabetes.

(c) **(i)** Most realised that glucose would be found in the food eaten.

(ii) Candidates struggled to respond correctly to this item. Some did, however, realise that the baseline gives a point of comparison or that it enables the observer to see change.

(iii) The correct answer of 84 g was calculated by most candidates.

(iv) (1) to (3) This set of items was challenging for a number of candidates. They struggled to identify the key features of the lines on the graph in Fig. 3.1 and occasionally described events in the body of the people, without referring to the data provided.

(d) **(i)** Most correctly linked the collection/sampling of blood to the use of the biosensor.

(ii) Many candidates realised that the results would enable the diabetic to know when to inject insulin. The less-responsive change in diet was not recognised as an appropriate response for this particular item.

(iii)(1) It was unfortunate that some candidates referred to the risks rather than the hazards. Many correctly included contamination and the use of needles/sharps.

(iii)(2) Correct response to part (1) often led to correct responses to the precautions needed. Discarding contaminated needles was not accepted as an appropriate response unless the candidates referred to a safe process in some way.

4 **(a)** Responses were often incorrect but within a realistic range outside of the correct values. Some candidates did recall the values correctly.

(b) Although exact blood pressure values may not have been recalled correctly, many candidates were aware of systole and diastole.

(c) A small number of candidates described the use of a digital sphygmomanometer but most correctly referred to the manual type. The majority of candidates realised that the patient should be relaxed and/or sitting down. The use of the cusp or band was also fairly well-understood but details of taking readings and the involvement of the stethoscope were generally not included in responses.

(d) This item was challenging for most candidates. They found it difficult to describe the differences between the trace in Fig. 4.1 and that of a normally-functioning heart. Correct responses focussed on the pattern or shape of the trace and the frequency of beats.

(e) **(i)** The item was generally answered well. Although many realised that the sound waves enter the body and that they reflected back, some did not link this to image formation.

(ii) Many had a realistic understanding of the advantages of ultrasound scanning. Most correct responses included real-time images and stating that the technique is non-invasive. Some referred to 'no radiation' without stating that such radiation is ionising.

(iii) Most candidates knew that the monitoring of the foetus uses this technique. It was unfortunate that some candidates wrote 'pregnancy' without any further explanation.

(f) Some good explanations of advantages and disadvantages were given in answer to this item. The principle was generally well-appreciated and expressed.

5 **(a)** The majority of candidates were not aware of the sites for aerobic and anaerobic respiration or may not have been able to interpret the muscle cell shown in Fig. 5.1. Some did correctly identify C (mitochondrion) for aerobic respiration.

(b) This item was completed correctly by many candidates. No pattern of incorrect responses could be identified.

(c) Many realised that diffusion was involved in the transport of oxygen and glucose. The link between oxygen and the RBCs was often correctly identified but sometimes confused with the transport of glucose.

(d) **(i)** Although most candidates realised that athlete 3 showed different results in Table 5.3, many struggled to describe the difference. The most important feature missing from responses was the relevance of before and after exercise.

(ii) The impact of a difficulty in taking in sufficient volumes of air into the lungs was frequently linked to low levels of oxygen in the blood and therefore at the muscle cells. This was understood by many candidates. The effect of this on aerobic versus anaerobic respiration in such cells was not as well understood.

(e) The use of thermometers was appreciated by many candidates with a number selecting tympanic types. The relevance of keeping the thermometer in place for a period of time and the method of taking the reading was not included in the majority of responses.

(f) **(i)** Most candidates are very confident about this topic and gave correct responses. No pattern of candidate errors could be identified.

(ii) Many responses correctly referred to increased oxygen levels transported in the blood. Some added further links to more ATP/energy being available to the athlete. Some candidates incorporated words from the stem of the item into their responses without referring to the athlete being active for longer or being less subject to fatigue.

G623/01 Cells and Molecules – Planning Exercise

General Comments

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 compare water quality before and after filtration using a range of filters made with different burnout materials by comparing the change in microbial counts, water turbidity, mass of suspended particles or arsenic concentrations.

Centres are asked to make certain that candidates read the instruction brief carefully to avoid misinterpretation. A few candidates failed to make specific reference to burnout materials and how the quality of water might be measured before and after filtration, despite the information provided in the original insert. Whilst it was pleasing to note that many candidates had considered the need for preliminary work in their plans, it is essential that preliminary work is relevant to the task and must inform the planning process. It was pleasing to see that the trend of not incorporating irrelevant background information continued and that all investigations were of an appropriate length.

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, where possible. Limited guidance is anticipated from subject staff and this should occur during initial discussions of the task before the planning process begins. Centres must ensure that by signing the authentication clause that the work submitted is that of the candidate. Plans from too many centres had evidence of heavily guided and assisted work, particularly in the collection and presentation of preliminary work data, which should have been reported using the necessary paperwork provided. It is also very important that centres adhere to submission deadlines for all assessed work.

Marks ranged from 2 to 20 out of 25.

A Surprisingly few candidates gained this mark. Many listed general safety measures and failed to link them to their investigation. At least three different potential hazards from glassware / electrical / biohazard / chemical / allergies could have been identified. A few centres used standard forms which cued candidates into identifying relevant hazards, risks and control measures. The risk assessment has to be a working document, related to the plan.

B Awarded if a relevant statement was made with reference to filters made with different burnout materials and a comparison of microbial counts / water turbidity / mass of suspended particles / arsenic concentrations.

C Most candidates scored this mark for making a comparative statement related to changes in flow rates and or the pore sizes of filters created from the burnout materials used.

D-G Almost all candidates included evidence of preliminary work, normally gaining at least 2 marks although **E** and **G** were rarely awarded due to lack of sufficient detail. Some candidates included preliminary work that bore little or no relation to the main investigation and consequently marks could not be awarded in this section.

H-I Many candidates achieved marking point **H** although the range of secondary sources cited was limited in some centres. There is an expectation that candidates should use the

stimulus material within the OCR insert to extend their research to include at least two other credible sources, which help to inform the planning process. Wikipedia is not recommended. Weaker candidates failed to explain the benefit or relevance of their sources in the development of the plan. It is important that candidates reference their sources correctly by giving full web addresses and date of access in their plan. A full description of a named text (title, author, publisher and ISBN number) is expected.

J-K **J** was awarded to almost all candidates; many did not gain **K** – normally by omitting detail of how a comparison of the filters would be achieved.

L-M Marking point **L** was awarded to the majority of candidates; many also gained **M**. One common omission was that of naming at least three specific materials to be used as burnout filters in their list. Frequently, candidates still failed to indicate the numbers of each item or specific volumetric sizes required, which precluded the award of marking point **M**.

N The majority of candidates appreciated the need for repeats.

O It was pleasing to note that a significant proportion of candidates gained marking point **O** this series (higher than 'normal') by stating the need to compare the changes in water quality using their chosen method with different burnout materials in the filters.

Q-R Relevant variables were generally listed although few candidates could state how these would be controlled for **R**. Some 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 is presented in a clearly defined box and not as a 'list' and that appropriate units are given in the headers of the table. Graphs were included by many of the candidates although marks were lost for incorrectly labelled axes and/or lack of relevant units.

U This was well answered. For those candidates who included the need for repeats in their plan, many calculated the mean or average.

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 changes in water quality and the burnout materials used.

W Sources of error were often vaguely described. Human errors e.g. inaccurate reading of instruments or repeats of techniques already used in the investigation were common responses. **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 since many candidates included credible ways of improving or extending their investigation.

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

General Comments

Marks ranged from 4 to 35 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 2(b)(ii), 2(b)(iii), 2(b)(iv), 2(b)(v), 3(d)(iv) and 4(b). Question 2 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. Most candidates scored a higher proportion of marks for question 4 than for the other three questions. It was disappointing to note that many candidates had little understanding of the process of osmosis and could not explain how cells maintain their correct water balance as required in question 2(b).

It is still 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.

Comments on Individual Questions

1 **(a)** Of the four labels on the diagram, 'cell wall' was given correct by approximately half of candidates. 'Nucleolus' was least well known.

(b) Few candidates gave a satisfactory explanation of the need for a vacuum in an electron microscope.

(c) Many candidates attempted this question and scored at least one out of the two marks. RER, Golgi and ribosomes were the most popular answers. A significant number of candidates failed to describe an appropriate function to gain the second available mark. Some weaker candidates misread the question stem and included mitochondria in their answer.

(d) This was well answered by the majority of candidates.

2 **(a)** Many candidates achieved 3 out of the 4 marks. Unfortunately, an equal number displayed little or no knowledge of membrane structure.

(b) **(i)** The use of Benedict's reagent was correctly identified but 1 mark was often lost by failing to recognise that heat is needed or by adding inappropriate 'extra' chemicals such as hydrochloric acid.

(ii) & (iii) Few candidates correctly named both sugars; many offered multiple responses.

(iv) The vast majority of candidates showed little or no understanding of osmosis. Very few gained 2 (or exceptionally) more marks. Coverage of this area of the specification is a point for development in the future.

(v) Correct responses were very rare.

3 **(a)** This was well answered by many. Some confusion arose in weaker candidate responses which included reference to biological compounds such as lipids and carbohydrates.

(b) Approximately half of candidates showed the elimination of water. The position of the glycosidic bond was often known but not drawn with sufficient clarity to gain a mark.

(c) Most candidates appreciated the difference between saturated and unsaturated lipids, normally referring to the absence/presence of double bonds etc.

(d) **(i)** Less than half of the candidates recognised the effect of producing an alkaline environment on the addition of sodium carbonate solution.

(ii) The need to control the temperature was not generally appreciated; there were numerous references to 'body temperature' and 'optimum temperature', which did not gain the mark.

(iii) 'Green' was a common, incorrect response.

(iv) A number of candidates correctly identified 'yellow-orange' as the colour and many of these appreciated that lipase had digested/hydrolysed lipids. The third available mark 'decrease/lowering of pH', (due to the presence of fatty acids) was rarely awarded.

(v) Again 'green' was often given rather than 'blue or green-blue'. In the explanation, some candidates referred to enzymes as 'died' (not credited) rather than denatured.

(vi) This was generally poorly answered; very few candidates mentioned the 'changes in the active site' or 'changes in bonding'.

4 **(a)** This was well answered by the majority of candidates.

(b) Many candidates accurately calculated the diameter of cell B.

(c) Again, this question was well answered by most candidates.

(d) Most candidates scored all four available marks.

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

General Comments

Work selected for moderation of the A2 specification covered the units listed below; however, for some of the optional units, numbers moderated were very low.

- **G627 Investigating the Scientist's Work**
- **G629 Synthesising Organic Chemicals**
- **G630 Materials for a Purpose**
- **G632 The Mind and the Brain**
- **G633 Ecology and Managing the Environment**
- **G634 Applications of Biotechnology**

Where centres had completed URS cover sheets accurately and in detail, with page number references, which enabled easy location of the relevant work, this was appreciated by moderators. Good practice was also seen where assignment sheets were included with candidates' work.

Credit is given to those staff and candidates who are using both the specification and assessment criteria appropriately. Consequently, work produced by these centres is being assessed at the correct level and some high quality work was seen. However, several centres were over generous with their assessment and these centres were scaled. Centres are advised to refer to Appendix A (page 93 of the specification) for the performance descriptions for A2 work. Researched work needs to be suitably focused on the requirements of both the assessment criteria and the specification and used by the candidates to enable them to show both their understanding and knowledge of the higher level science required for A2 qualifications.

It is essential that centres do follow guidance given in the moderators' reports supplied in previous series to ensure assessment decisions are made to the correct level. This is essential if standards are to be maintained and scaling is to be avoided in future submissions. Portfolio work at A2 needs to show suitable progression from the AS work studied in year one 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.

Work assessed with full marks at mark band 2 needs to be at the appropriate A2 Level. This should cover all the requirements of the assessment criteria and suitably cover the specification. Generous assessment was seen at mark band 2 and several centres were scaled.

The moderation process this series was efficient and centres were helpful in returning coursework to moderators promptly and this is appreciated. Centre Authentication Forms were received from most centres and clerical errors were minimal, although some centres still did not record candidate and centre numbers on the portfolio work.

OCR offers a free coursework consultancy service to support the assessment; details are available from the OCR website.

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 OCR is informed if there is any change in the nominated staff. It should also be noted that centres need to be accredited separately for the AS and A2 qualification.

G627 Investigating the Scientists' Work

The assessment requirements for this unit 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 where assessment was supported had provided their candidates opportunities to extend the work studied from AS or other A2 units and offered investigations that allowed a wide range of experimental techniques and procedures to be demonstrated by their candidates. Some high level work was seen linked to aspirin, organic preparative work and biotechnology investigations. Good practice was seen where candidates had shown independent working with suitable guidance from the centres. The investigations are not intended to be a set of experimental practicals set by the centre and followed by all candidates.

'A' grade work 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.

Candidates need to be working towards producing work that shows evidence of vocational links that have been fully referenced and validated. Experimental work needs to include a range of both different procedures and techniques. Risk assessments should be suitably detailed and focused on the whole investigation and need to be used by candidates in their practical work. The report of the investigation needs to give clear reasoning on how the aims and objectives were achieved, suitably supported by a discussion of the reliability of the work carried out. Reports need to be both accurate and logical, with conclusions and evaluations focusing on the complete investigation not just individual practical work.

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 this unit 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 seen in the moderation process this series was limited. The following general guidance is given.

For AO1 evidence needs to be focused on the requirements of the specification, which is linked to the bullet points of the assessment criteria. Candidates need to check accuracy when writing organic formulae and equations, and explanations of reaction types need to be specifically linked to the reactions stated. Research work on the drug types need to include both usage and mode of action. Mark band 3 work needs to demonstrate a full understanding.

For AO2 mark band 3, work needs to show both detailed and selective research on the process to manufacture the chosen organic compound. Candidates need to demonstrate full understanding of any explanations given. Work assessed at the higher levels should not just be 'cut and pasted' from various websites. The candidates' interpretation of all selected information needs to reflect A2 standard. Evaluation and justification again should show candidates higher levels skills in discussion work. Alcohol, esters and medicinal drugs allow good vocational links and the opportunity for candidates to consider the safety and economics of manufacturing the product.

For AO3, preparations of aspirin, antifebrin, ethanoic acid, benzoic acid, iodoform (triiodomethane) and paracetamol or 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 of the preparations and the processing of results should be accurate and easy to follow. Evidence on calculations of theoretical yield is needed. Evaluations need to be detailed and should focus on the techniques used, sources of errors and the reaction route. Centres need to be aware 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 this unit 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 in the moderation process this series was limited. The following general guidance is given.

For AO1, sets of fact sheets or leaflets need to be produced which should be suitably targeted as a public awareness document designed to raise mental health awareness. These should be supported by suitable illustrations and appropriate detailed and referenced information needs to be evident.

AO2(a) allows candidates to research information on the clinical methods of studying the brain. Diagnosis of brain diseases is generally well covered but work should be supported by labelled illustrations.

For AO2(b), moral and ethical implications of brain research for mark band 3 need 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) requires a factsheet detailing statistical evidence. Candidates tend to use a wide range of statistical testing in the practical work but additional information is needed to support the requirements of the assessment criteria.

Candidates aiming for the higher mark bands need opportunities to extend research on participants for their practical work as a wide range of data needs to be collected. Ten students from their class is insufficient, both a range of ages and gender are required for any reliable statistical evidence to be based. Participants need to be fully aware of the tests that they are completing and the reason for the research. Candidates also need to provide evidence of the risk assessments used.

G633 Ecology and Managing the Environment

The assessment requirements for this unit 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

AO1 requires candidates to show understanding of the effects of change on ecosystems and biodiversity, by describing ecological succession and researching the effects of agricultural practice, human habitation and greenhouse gas production. Work assessed with top marks at mark band 3 should be showing independent research skills supported by high level evaluation and justification of the work selected. Care needs to be taken that where material is assessed at higher levels, the quality of the discussions are at an appropriate high level and there is full coverage of the higher mark band criteria. Quality is needed rather than quantity.

For AO2(a) mark band 1, candidates need to identify moral and ethical reasons for preserving ecosystems and species diversity. For mark bands 2 and 3, candidates need to know how to explain and evaluate the reasons given. For AO2(b), candidates need to be able to describe methods used in the management of ecosystems and interpret quantitative data relating its success. Care needs to be taken that data is clearly presented and suitably interpreted. This was not always evident.

Candidates' work for the practical required for AO3 generally showed both enthusiasm and interest in this unit. Evidence of field trips was seen and the inclusion of labelled photographic evidence indicated sampling procedures being carried out by the candidates. Care does need to

be taken to ensure final reports clearly summarise the outcomes of the investigative studies. Candidates need to include risk assessments that are detailed workable documents with evidence that they were used. For AO3(c), the displaying of data needs to show a range of different methods. 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 this unit 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

General guidance as follows:

Overall, centres need to take care that where full marks are awarded in mark band 3 strands, all parts of the required assessment criteria are fully completed to a high level. Candidates need to show independent research skills and an understanding of the higher level science when aiming to reach mark band 3.

For AO1, evidence on the science of genetic engineering and the use of recombinant DNA technology needs to be in the form of booklets that contain language and explanations suitable for use as public information booklets. Work should not be pages of 'cut and paste' information presented as reports. The presentation and explanation of this information will demonstrate candidates' understanding of this topic.

For AO2(a) 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 AO2(b), 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 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.

For AO3, care needs to be taken that suitable immobilised enzymes are prepared and used, and that appropriate practical work is carried out to ensure quantitative results are obtained. For AO3(a), candidates need to produce a clear plan of their practical work, in addition to detailed risk assessments. Detailed plans linked to secondary sources showing practical work choices were not always evident where 5 marks were awarded. For AO3(c), good displays of results are generally produced but for AO3(d), candidates need to work on improving conclusions and the interpretation of results. The advantages of using bioreactors and enzyme immobilisation should be included for mark band 2 and for mark band 3, care should be taken that the assessment criteria are all fully covered at the appropriate high level.

G628 Sampling, Testing and Processing

General Comments

There were around 500 candidates this examination series, which was a similar number to January 2011 and January 2012. Many candidates scored in the 25 to 45 range (out of 90) and this followed the pattern of the last two January series. There were fewer candidates scoring 50 or more when compared to January 2012 and there seemed to be a greater number of those who scored 25 marks or less this series.

In the past the examiners have commented that a weak area seems to be in the design of experiments that test candidates' practical skills. This continues to be a problem and the marks scored in question 2(g), where candidates were asked to test the clay absorption of arsenic from arsenic-contaminated water, was done particularly poorly. Only simple laboratory separation procedures were required, but the result was disappointing.

Calculations involving simple arithmetic manipulation and the determination of percentages are one important feature of this paper. In general many of the questions involving calculations were done poorly – often giving quite unrealistic values.

On the positive side, candidates seemed well prepared when answering questions that were involved with the pre-release material and there was evidence too, of sound revision work from past papers.

There was some evidence that this paper was a little long. There was, necessarily, a measure of reading material as candidates had to assess new situations. As a result, some candidates worked a little too slowly and did not have sufficient time to give full measure to some parts of question 3.

Comments on Individual Questions

1 (a) (i) The examiners were looking for a 'representative sample' or similar words, this was not often provided.

(ii) Most candidates stated the need to monitor pest attack during the whole growing season.

(iii) This was well answered by nearly all candidates, who showed a clear appraisal of each method of fruit collection.

(iv) The article stated that pomegranate trees were susceptible to fungal attack after prolonged rain. A number of candidates could not find and provide this information.

(b) (i) Giving the advantages of a concentrated dispersion of the insecticide when compared to the dry powder proved to be challenging for many candidates, although only a simple response was needed.

(ii) Many candidates gained both marks for two disadvantages of a contact insecticide when compared to a systemic insecticide. Removal by rain and the need for the insecticide to 'touch' the insects were the most popular answers.

(iii) Candidates needed to state that the insecticide was not present in the air before workers could return. This was not often stated clearly.

(c) **(i)** The questions asked for the conditions to be 'room temperature'. A number of candidates read this wrongly and used an oven or other form of heating. A sunny window sill or hanging them up was all that was required.

(ii) The answer was 0.21 kg but a number of candidates could not do this simple sum.

(iii) The response was similar to (c)(ii) but some candidates became confused by the need to give units in their answer.

(iv)(I) The most popular correct answer was 'more concentrated'.

(iv)(II) The responses to this question were quite good with 'quicker / easier' and 'no extra equipment is needed' as the most common correct answers.

(v) The word 'synergist' was in the article. Many candidates had researched a definition of this word but equally it was apparent that a number had not done this work.

(d) Candidates were asked to design an experiment to prepare pure clear pomegranate juice from the fruits. This involved simple separation techniques. Most candidates scored some marks but really good responses were rare. Some candidates used a titration to assess the acidity of the juice (which was not a required part of the question), rather than concentrating on obtaining the juice.

(e) **(i)** Most candidates obtained the correct range from the graph. A range was required, not just a simple number.

(ii) This was a challenging question and few gave a correct value of less than 22.5 cm^3.

(f) **(i)** This was a simple subtraction sum but a number of candidates subtracted the wrong figures.

(ii) Despite many poor subtractions in (f)(i), candidates were able to substitute their values in the given formula. However, the question asked for the answer to be given to 3 significant figures and a number of candidates did not carry this out.

(iii) A number of candidates wrote that an advantage was that repeat determinations could be carried out and that a disadvantage was that errors would increase when smaller quantities were used.

(iv) Many candidates realised the need to avoid contamination but fewer washed out the pipette with the new pomegranate juice.

(g) Most candidates realised that manufacturers were adding Vitamin C to the pomegranate juice.

2 **(a)** Most candidates stated that his body contained traces of arsenic and that he would therefore have been a coppersmith. Some candidates stated that copper contains arsenic. This is chemically wrong – 'copper ores contain arsenic' should have been the correct statement.

(b) The question asked candidates to show that 6 pints of the contaminated beer contained 51 mg of arsenic. An awkward change in units was required but nearly all candidates obtained at least one of the two marks available.

(c) Most candidates gave the correct value of 108, as the relative molecular mass of arsenic(III) acid.

(d) The answer was 0.0032g (or 3.2×10^{-3}g) and a number of candidates obtained this value. The examiners felt that candidates are becoming more familiar in using standard form.

(e) **(i)** The examiners expected that a flask of at least 700 cm^3 would be needed and nearly all candidates agreed with this idea.

(ii) How much 'arsenic' to add was a common response given by many candidates.

(iii) 'Arsenic (fumes) are poisonous' was a popular correct answer.

(iv) The word 'precipitate' is a common laboratory term but a number of candidates were unaware of its meaning.

(v) Scheele's Green was washed with distilled water to remove **soluble** impurities. The word 'soluble' was essential but seldom given.

(vi) The answer to this percentage calculation was 80% but very few candidates could manipulate the figures supplied to reach this number.

(vii) If the Scheele's Green had been damp when weighed, then the actual mass of Scheele's Green would have been smaller and so would the percentage yield. This was a challenging point and both marks were only in a few cases.

(f) **(i)** The need to avoid contamination was well understood by nearly all candidates.

(ii) Very few candidates realised that the insoluble material might contain arsenic and would therefore affect the analysis.

(iii) This question was well done with many candidates correctly calculating the mean and then stating that the water from test **D** should be tested again or the result ignored.

(iv) This question proved difficult for many candidates but a number gained at least one of the two marks for stating that Well 2 was further away from the arsenic-containing material than the other two wells.

(g) This was the second question where candidates had to design an experiment. It proved challenging for a number of candidates, with a score of 2 out of 6 being common. A number of candidates thought that clay was soluble in hot water.

(h) This was a more challenging percentage sum. Although many candidates could obtain 3.77 g, few could then proceed further and find that the percentage of arsenic in the spoil heap was 1.41%.

(i) **(i)** Many candidates gained both marks for giving an advantage and a disadvantage of the GF-AAS method compared to colorimetry.

(ii) Although a number of candidates gave 20.9 mg as the answer to part (I), they could not then gain the marks in part (II).

3 (a) (i) Nearly all candidates gave a correct value for the boiling point of water at a pressure of 0.3 atmosphere.

(ii) Many sound answers were given to this question. The most popular was 'quicker'.

(iii) Very few realised that one major cost was the equipment needed to sustain a reduced pressure.

(iv) There were four marks for this question, which was generally answered well. 'Taste' and 'toxicity' were two of the popular choices given by candidates.

(b) (i) This gained full credit for many candidates. The normal choices were stir and warm.

(ii) Chromatography seemed to be poorly understood and inadequate descriptions were often provided in this question.

(iii) Very few could correctly calculate the R_f value from the diagram. Many candidates had clearly not done this type of work and did not realise that R_f values must always be less than 1.

(iv) Many candidates realised that other dyes could have the same R_f value as annatto.

(v) This mark was seldom gained. Only a few candidates realised that the fragmentation pattern is an important part of identification when using mass spectrometry.

(c) (i) The piece of apparatus labelled **A** was a condenser. It was disappointing to see that so few candidates knew either its name or its function. Those who described the condensation of steam were penalised as this cannot occur in this experiment.

(ii) A number of candidates gained both marks for realising that a naked flame cannot be used for flammable liquids and that there is more control when an electric heater is used.

(iii) This proved to be a challenging question. The easiest correct response was to suggest finding the density of the liquids but this was seldom seen.

(iv) Only a few candidates knew that infrared spectroscopy is concerned with the vibration of covalent bonds.

(v) A minority of candidates suggested that the temperature used for refractive index measurements is a reference temperature or is (near) room temperature.

(vi) The refractive index shown in the question was not accurate enough for assessing purity as it was given to two decimal places, in place of the normal four. Only stronger candidates provided this response.

G635 Working Waves

General Comments

The candidates performed similarly to previous years.

In previous years some candidates demonstrated confusion between different devices included in the specification. This year, this was particularly evident with regard to image intensifying screens, which some candidates thought selectively absorbed scattered radiation or radiation at particular frequencies.

There were several instances where some candidates had not fully read the question but repeated the answer to questions set in previous years. 3(d)(ii), 4(b) and 8(b) are examples of this.

Comments on Individual Questions

1 (a) Around half of candidates scored at least one mark, suggesting some knowledge of the arrangements of nodes and antinodes but lack of ability to apply it to this particular case. Only around a tenth gave fully correct answers. Many incorrect answers gave too many letters, candidates presumably not being aware of the meaning of the term 'fundamental'. The nearest incorrect answer - with the Ns and As reversed - had been expected from candidates who had recalled the cases of strings or closed pipes, but was only seen occasionally. A minority marked N and A at the same point along the tube.

(b) Less than half of candidates knew the answer to this fairly basic item of knowledge. '½' was a common and understandable wrong answer but other attempts were many and varied, as this small sample indicates: '0.3', '.33', '¾', '1.9', '2.2', '2.5', '4', 'N', 'higher', '4 cm'.

(c) This section followed on from 1(a) and 1(b). Although 'error carried forward' was allowed for incorrect arrangements of nodes and antinodes, only slightly over a quarter of candidates gave the correct answer.

(d) Many candidates attempted incorrectly to apply v=fl , or multiplied instead of dividing.

(e) Most knew v=fl , but few correctly converted cm to m.

(f) **(i)&(iii)** Candidates commonly confused the answers to these two subsections. Some attempted to describe the waveform rather than the sound.

(ii) Rather less than half the candidates achieved at least one mark for 'maximum displacement'. Some omitted the 'maximum', or referred to the distance between peaks. Few addressed the second marking point by describing the movement of the air.

(iv) Only about a quarter knew this basic term relating to waves. Incorrect answers varied widely. Some omitted the reference to time or confused frequency with speed.

1 (g) & 2(a) Many incorrect answers, some confused longitudinal and transverse, but many chose 'b' or 'd'.

2 **(b)** Descriptions were vague.

(c) **(i)&(ii)** Candidates commonly confused the answers to these two subsections. Part (i) was more often correctly answered, but some suggested that a bigger area of the screen was illuminated. In response to part (ii), some described the effect on wavelength, which is not an effect on appearance and some failed to indicate in which direction the colour changed.

3 **(a)** This was well answered. The few incorrect answers tended to fail to indicate a change or variation in colour, so that their answer could be interpreted as a blank screen of uniform colour and brightness.

(b) Most recognised the advantage of a technique involving no ionising radiation. Well over half answered correctly and this would have been even higher if '**less** radiation' had been condoned as an answer.

(c) **(i)** Although only about a third answered this correctly, this was an improvement on previous examination series indicating that candidates are now studying this 2009 introduction to the specification. Incorrect answers either referred to the quality of the image or the temperature range for which the instrument is designed. Correct answers often appeared to be in the candidates own words rather than a definition learnt by heart.

(ii) This subsection tested application of the knowledge from 3(c)(i) of thermal resolution. A similar proportion scored at least one mark, suggesting possibly that those who knew what thermal resolution means were able to apply the knowledge. Many others answered that fire fighters operated at higher temperatures.

(d) **(i)** About 2/3 of candidates scored at least one of these marks. Those who did not, failed to recognised that, although the camera does not detect colour, the red cheeks are also associated with a rise in temperature. The second mark required the application of basic biological knowledge about increased blood flow, learnt at AS level and was correctly answered by the best candidates.

(ii) Some candidates had apparently failed to read the question closely enough and focused on the workings of the thermal camera.

4 **(a)** Generally well answered. Incorrect answers omitted the word 'all', referred only to light, or to all <u>types</u> of radiation.

(b) Candidates who answered the question set achieved most marks. The question required explanation of the colours of visible light, so answers referring to intensity did not score. Candidates who used the information on the graph, as instructed, scored more marks. Conversely those who presented the answer to questions set in previous years, and described the progressive change in colour as the bar is heated, did not score well. They failed to explain the red appearance of the metal bar shown. Few candidates recognised that the grey bar indicated the visible part of the spectrum.

5 **(a)** Most candidates scored one or two marks. Most recognised that the angle of incidence should be greater than the critical angle. Not all expressed this well and although some latitude was allowed, answers where, for example, 'refractive index' was substituted for 'critical angle', indicated very muddled understanding that was not worthy of credit. Some scored a mark for indicating that all the light is reflected and none refracted but many did not express this well. Few candidates recognised

the difference between partial and total internal reflection. Many repeated the phrase 'total internal reflection' without clearly stating what it is. Few mentioned the difference in refractive index between the glass and air. Although most candidates gave diagrams, in general these did not gain marks.

(b) **(i)(1)** Most candidates understood that monomode has a smaller diameter but the values were often either not given or well beyond the examples suggested in the specification.

(i)(2) Good responses seen.

(i)(3) Most candidates scored one or two of the marks. A common error for the first point was to say that multimode paths are longer rather than stating that they vary in length. Some, nevertheless, phrased their answer to the second point in such a way as to state that the light arrives at different times, but if they simply stated 'longer times' they did not gain this mark. Answers to the third point commonly just stated that quality was better or worse, which was fairly obvious from the question. Some indication of what is wrong with the quality was required.

(ii) Most candidates scored some points and the question discriminated well. Most correctly drew curved paths for graded index fibres. Many knew that the signals following different paths arrive at similar times although a few suggested that the fibres themselves were arriving. A few gave answers related to fibre bundles throughout. The variation in refractive index was generally well described but a few lost the marks by referring to it as 'density' ('Optical density' was acceptable but only seen occasionally).

(c) **(i)** A relatively easy question, very well answered. The most common incorrect 'T' was placed in the middle of the horizontal ray.

(ii) Candidates were asked to 'explain' as well as 'state' and many omitted the importance of the angle of incidence compared to the critical angle. Fewer noted the refraction of ray B onto PQ, although some scored the point by drawing it on the diagram.

6 Most candidates scored very well on this question although a wide spread of marks was seen. Common errors were 'satellites' for 'base stations', '20-50 miles', and confusion between 'uplink' and 'down link'. 'Full duplex' and 'Half duplex' was seen in a variety of places.

7 **(a)** A majority of candidates scored some marks, if only for mentioning binary as an example of digital, but few scored all four. Slightly more candidates used the terms 'discrete' and 'continuous' than previously. A minority had little idea of the meaning of the term 'digital', despite its common use.

(b) **(i)** Only a very small minority gave correct answers. 'Binary', '0 and 1' and examples such as '11001' were among the better incorrect answers, but many, apparently random, numbers were also seen. It would appear that even those candidates with some functional understanding of the binary system have limited knowledge of the underlying concepts.

(ii) In contrast to (b)(i), about 2/3 of candidates answered correctly. Incorrect answers included 'ASCI code', 'Morse code', 'FDMA', and 'Pulse code modulation'.

(c) A majority of candidates made a reasonable attempt at this question with marks spread over the range. The better answers tended to start with a diagram clearly indicating sampling at regular and, generally, frequent intervals. This was often reinforced in the text. Some of these went on to mention or describe quantisation. Weaker candidates were able to score the AVP by stating that the result was a binary number.

(d) **(i)** Less than a quarter of answers gained even a single mark. Where a mark was scored, this was usually for mentioning 'higher frequencies'. Many incorrect answers referred to the use of fibre optics. Presumably these candidates were unaware that broadband can be delivered over copper cables.

(ii) Again, less than a quarter of answers gained this mark. Some thought that the phone and internet used completely different cables or even 'different satellites'. Others had the right idea but gave answers that were too vague.

8 **(a)** **(i)** Many failed to score because they gave 'improved image quality' as the reason (the converse is likely to be true). Most of the minority who successfully scored one mark recognised that a lower radiation dose was received by patients. Unfortunately, some of these thought that the dose was reduced because the screen absorbed unwanted X-rays. Hardly any candidates scored a mark for mentioning the inefficiency of film in detecting X-rays.

(ii) Most of those who scored marks wrote above or below but not both, a lot answered 'between the patient and the film'. Few recognised the need to place the screen close to the film.

(iii) Few gave correct answers. Some appeared to be describing other devices in the specification by, for example, mentioning absorbing unwanted X-rays.

(iv) The many wrong answers included 'expense', and 'increased radiation dose'. Some suggested <u>improved</u> image quality as a <u>disadvantage</u>.

(b) **(i)** Only about a fifth gave correct answers to this question. 'Radiation' was a common response. Other answers seen on a number of occasions included 'technetium', 'iodine', and 'heat'.

(ii) This required a slightly more detailed understanding of the topic, so only a fraction of those who correctly answered (b)(i) also got this right.

(iii) Some of the minority who recognised that the final stage was the production of an image thought that it was produced on a screen. It is likely that they had not fully read the stem of part (b).

(c) Some answers were in reverse order. Most knew the order of bone, fat, and air but did not know where to place barium meal.

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

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553