OCR
RECOGNISING ACHIEVEMENT

GCE

Applied Science

Advanced GCE **A2 H575/H775**

Advanced Subsidiary GCE **AS H175/H375**

Report on the Units

June 2009

H175/H375/MS/R/09

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, GCSEs, OCR Nationals, 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 syllabuses 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 syllabus 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.

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

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

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)

REPORTS ON THE UNITS

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

General Comments

This session is the final awarding of the original specification of this Applied A Level qualification; a new 'revised' specification will be introduced for teaching in September 2009. This is just an amended version of the original. It is hoped that centres will find the new specification and assessment criteria improved and accessible to both staff and candidates. It is hoped that any of the amendments which have been made will support the teaching and learning of A Level Applied Science. For more information, please read the new specification and sample assessment materials found on the OCR website (www.ocr.org.uk). Centres should look at the revised specifications on the OCR website under 14-19 Applied A Levels.

Accreditation of centres is on going and will continue with the revised specifications in the same way. Accredited centres need to ensure that the necessary Centre Authentication form is sent to OCR for any assessment session in which they are entering candidates. It is also important that if there is any change in the nominated staff, that OCR must be informed.

Several new centres are now following this specification and it is evident from the type and quality of the work seen that many of the new candidates have previously studied some applied science. 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 on why the experimental work needs to be performed. Credit should be given to those staff and candidates who are using the assessment criteria appropriately and consequently work is being assessed at the correct level. Many centres are now accredited and a sample was moderated this session. Several centres were scaled however as work, especially at the higher mark band, did not reflect the quality needed for an A grade at AS level. Work submitted did not reach the necessary standards required by the assessment criteria ie work was not sufficiently detailed and accurate and evaluations were not at a high enough level for A grade work.

The portfolio units moderated this session were as follows:

- G620 Unit 1 Science at Work
- G621 Unit 2 Analysis at Work
- G624 Unit 5 Chemicals for a Purpose
- G625 Unit 6 Forensic Evidence
- G626 Unit 7 Physics of Sport.

Please note that for the next assessment session the G62- number will remain the same but any reference to Unit 1 Unit 2 etc will disappear. Centres tended to be responsive in returning scripts for moderation and moderators are very grateful to centres with low entries (less than 10 candidates) for sending all their portfolios directly to the moderator; this saved time and led to an efficient moderation exchange.

Moderators were concerned to discover many clerical errors this session where the marks on the MS1 forms were not the same as the marks on the URS cover sheets. Many of these could have had a significant effect on individual candidate's marks. It must be emphasised that it is the centre's responsibility to ensure that the marks submitted accurately reflect the work of their candidates and it is hoped that in the future, centres will ensure suitable checks are done to make sure that these are reduced to a minimum.

It was noticeable this session that the majority of centres returned the Centre Authentication form with the candidates' work which was appreciated. Where work was well organised and presented using treasury tags, the moderation process was well supported as moderators could easily read the work. Unfortunately, some centres are still not fastening their candidates' work together or including Candidate Numbers or Centre Numbers. This is essential as work often moves around the country. Where centres are writing comments and page references on the URS forms, this is really appreciated and again supports the moderation process. Centres can try and help moderators locate the work by indicating the assessment code eg AO1(a) or, even better, if they can indicate the mark band on the candidates' actual work.

Very few task sheets were seen again this session; it does help the moderation when moderators are aware of what the candidates were given to support their research or practical work. The majority of candidates' work was at an acceptable standard for AS level.

Work selected for moderation reflected coverage of all the units offered by this AS specification. A range of marks was seen. Candidates familiar with the specification are now showing a noticeable improvement in the use and selection of research material obtained from the internet. It is important that references to sources are included and are clear and sufficiently detailed to enable the reader to locate the source.

Again candidates familiar with the requirements are now including risk assessments with practical work as evidence of safe working but possibly more guidance is needed to ensure these are suitably detailed and not generic.

G620 Unit 1 Science at Work

The assessment requirements for this unit at present should include:

AO1 Record of 5 surveys of science-based organisations; 1 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 2 Practicals with a vocational context with recorded processed and evaluated results.

The revised specification will require only <u>4 surveys</u> but the rest will basically be the same with the inclusion of assessment of spelling punctuation and grammar requirements within strand AO1.

The survey work is intended to be an overview of science in the work place and candidates and centres familiar with the requirements produced some very good work. Centres need to be aware that the survey work is only meant to be an awareness of science used in a variety of organisations. The text of the surveys should be logically presented and not use just information downloaded from a company website. Some good work was seen where candidates had clearly selected relevant information and produced work that linked to the requirements of the specification ie

- 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.

Again the science used in the organisation was the weakest area, more focus is needed here to include more than just a generic statement and centres should try and give more guidance to improve the quality.

Independent work was more prevalent where candidates had visited organisations compared with work produced using internet searches, although some very good selection of work extracted from the internet was seen. There was also a lot of evidence of cutting and pasting, which included a lot of irrelevant information. Candidates from all centres both new and old need to ensure that the following guidance is used in their in depth study:

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

Work this session was still seen where too much detail had been covered in the surveys and there was no definite focus for the in depth study. Again for mark band 3 the additional guidelines indicate a comprehensive study is required for the in depth work and information should be selected and clearly and logically presented. Some evaluation and justification of the use of the material also needs to be included for the higher mark bands. It should also be noted that for mark band 3 evidence of relevant information selected from a range of sources should really be recorded. It is good practice to include the resources used as a bibliography and should be encouraged. Comments on the validity of the sources used must be included if mark band 3 is to be reached. There was minimum evidence of evaluation and justification of the research material. However some excellent work was seen with precise informative research.

The range of organisations included many easily accessible organisations eg zoos, (Twycross & Chester are very popular), garden centres, supermarkets (Tesco & Asda), bakeries, breweries (Shepherd Neame), pharmacists (Boots), power stations (Drax), health centres/gyms (David Lloyd Leisure, College Sports Centres) garages, colleges, universities schools as well as Pfizer, GlaxoSmithKline and Coca Cola Enterprises.

There did not seem to be any problems this session with candidates not including the specific laws and regulations for AO1c, even for mark band one candidates were showing awareness and a basic knowledge of health and safety laws and regulations. Higher marks were obtained by candidates who linked health and safety with their surveys and also made suitable links in their main study. Several centres had completed independent assignments for this strand, this is not mandatory. Contributions to this strand can come from evidence included throughout the unit.

The work for AO2a in the majority of scripts seen was included as part of the in depth study; it was useful where teachers had written comments on the URS form of where this evidence could be located within the unit. Where candidates had been given structured guidance such as in the headings given below:

- 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.

Evidence then reflects the requirements of the specification and higher mark bands can be accessed. A simple statement of the overall effect of the organisation to society is insufficient for mark band 2 and above. Evidence of an understanding of the core business of the organisation on the benefits to society will support the higher marks.

For AO2b more than one or two completed calculations are required to support mark band 3, even if the calculation is complex. The assessment guidance states that a number of complex and straightforward calculations should be completed. If the data produced for practical work does not allow candidates to fulfil the higher mark bands, then data can be supplied. Where centres provided the opportunity for candidates to complete a range of calculations, rather than just one example, and evidence of additional tasks to cover a range of mathematical work supported mark band 3. It should be noted that mathematical guidelines of straightforward and complex calculations are given in the appendix of the specification. For mark band 3, work should be correct and answers given to the appropriate degree of accuracy, and correct significant figures errors were still seen here.

Good practice was seen where centres are giving candidates the opportunity to link their practical tasks to a vocational context. An interesting range of research and up to date facts continued to be seen which linked to analysis and preparative work. Centres should not be just carrying out a standard titration of HCl and NaOH or investigating the properties of metals without any vocational link. It is also important that candidates including suitably detailed working risk assessments with their work. In addition, in order to support AO3a evidence that candidates had completed their practical activities is useful. This can either be in the form of a certificate or just comments on the candidates work.

Errors are still being seen for AO3b. Accuracy of recording needs to be watched. The recording of titration results should be to at least one decimal place and set out in a suitable format. All measurements need to show the required precision and include the relevant units. Omission of units was still widespread. Candidates are now showing the methods of processing of their results for higher mark bands and, in some cases, evaluation of accuracy of apparatus and method is being included for mark band 3. Processing skills in graphs and calculations were clearly evident in work seen. Many candidates are still omitting units from graphs and not choosing suitable scales; more guidance is needed on this.

G621 Unit 2 Analysis at Work

The assessment requirements for this unit at present should include:

AO1 Energy policy of an organisation with information on energy efficiency, economic and environmental impacts.
AO2 Energy transfer in electricity generation/data on calorific values and costs of fuels; calculations on fuel costs; comparison of large scale and small scale generation.
AO3 4 Practical analyses 2 physical 1 qualitative 1 quantitative, results processed and interpreted.

The revised specification has amendments in AO1 (the energy policy) in that evaluative work is needed for mark band 3. In AO1b and AO1c requirements have hopefully been made more accessible and AO2 content should now link more to the marking requirements. For AO3, three practical activities are now required and, again, the inclusion of spelling, punctuation and grammar assessments in AO1c.

Candidates are now providing suitable energy policies, with some of the best work seen where candidates have used their own establishments. There did not seem as much confusion this session between environmental and energy policies but where candidates had selected appropriately they gained high marks. Supermarkets (Sainsbury's, Tesco, Asda), colleges and universities (de Montfort, Manchester) and many local authorities have suitable information on energy and environmental work and this is now being fully researched.

There are still omissions for AO1b on energy efficiency for mark band 3. These need to include possible measures which need to be put in to place by companies in order to become efficient. Definitions of energy efficiency are now being seen. Centres should be guided by Section 2.2.5 Efficiency in the specification and link it to the requirements of AO1b.

Environmental issues are very topical and this issue is now being covered in a lot more depth and at a high level by several candidates. Candidates still need to ensure that they extract relevant information and relate it to their chosen organisation.

Energy transfers involved in the generation of electricity are now being seen in the majority of work moderated and where work is brief it is being assessed accordingly. Relevant data is now being provided by candidates and they are comparing the relative benefits and problems of large scale and small scale electrical generation suitably.

Care is still needed when awarding mark band 3 to candidates for the accuracy and correctness of answers for the mathematical requirements. Candidates need to be more careful and present answers more clearly.

The requirement for AO3 is two physical analyses (both chromatography and colorimetry), one qualitative chemical analysis (which can include investigative work on unknowns, forensic investigation, mummion, water and pollution analysis) and one quantitative analysis (examples seen included analysis of water, vinegar, iron tablets, bleach, ear drops, metallic solutions). Good practice was seen where practical work had a vocational link and, again, this was evident.

The candidates are now completing suitable practical work and are including detailed risk assessments. Reports do not necessarily need a rewrite of experimental methods but care needs to be taken that suitable detail is given on recording and processing of results. Care is needed in accuracy of calibration graphs for colorimetry as several errors again were seen.

Work seen generally reflected mark bands 1 and 2 but it should still be noted that work for mark band 3 needs to be suitably detailed, with evidence of vocational links. Evidence from the assessor that risk assessments have been produced and used, and equipment has been safely used should also be included. Suitable evaluation is needed and this needs to be focused on the method and outcomes of the specific experimental work completed, not just a generic statement of the success of the work.

G624 Unit 5 Chemicals for a Purpose

The assessment requirements for this unit at present should include:

AO1 4 examples of chemical compounds (2 organic, 2 inorganic) + formulae; uses and properties of compounds; research work on a polymer/detergent.
AO2 Information on 2 industrial chemical processes; use and understanding of catalysis.
AO3 Research and preparation of a chemical product: synthesis, purification and analysis, processed results and discussion of yield.

The revised specification has amendments in AO1 which hopefully will allow candidates to study their chosen compounds in more depth and the requirements of the assessment criteria will allow differentiation from mark band 1 to mark band 3. AO2 content should now link more to the requirements of the specification and the catalytic work is linked to the one industrial process which needs to be studied. For AO3 two preparations are now required. Spelling, punctuation and grammar requirements are assessed in AO1.

It is hoped that this unit will give candidates the opportunity to extend their chemistry knowledge and study the properties and actions of examples of chemical products used in consumer goods. Work presented for assessment is only that which is indicated by the assessment grid; candidates are not expected to submit their notes for the course.

It would be helpful to candidates in this unit if they were provided with suitable task sheets and assignments where they are given opportunities to select possible useful compounds.

Although candidates may be taught generally about organic and inorganic compounds they need to choose **4 compounds: 2 organic and 2 inorganic** for the evidence in their portfolio. A lot of cut and paste material was seen for this unit and there was evidence of candidates not really understating the work produced.

Candidates should be guided to choose compounds which will allow them to find information on both uses and properties of these compounds. It should also be noted that for the chosen compound for AO1c details are needed on how the structure and chemistry relates to its use. Haber Process, Contact Process, fractional distillation/cracking and reforming are suitable for AO2a. Centres need to note that two industrial processes are needed with conditions, raw materials and uses of the products. Care is needed on the accuracy of any equations given.

Work on catalysis generally reflected mark band 1 or 2 for mark band 3 an evaluation of the effect of the catalysts on the process and an understanding of the social and environmental impacts of the processes chosen are required.

Generally, aspirin was seen this session and care still needs to be taken that sufficient detail is given to the requirements of the assessment criteria to ensure suitable evidence is produced to enable higher mark bands to be reached. 19 marks are allocated to this section and, consequently, at least 20 hours of time should be allocated for this. Please can candidates be encouraged to draw diagrams to scale – more care is needed in this area. Two preparations will be required for the revised specification, which will hopefully allow candidates more access to the range of mark bands.

For AO3b, candidates need to record both observations and amounts of chemicals taken and products produced. The yield needs to be calculated correctly and for mark band 3 how the theoretical yield is calculated needs to be included to reflect suitable knowledge at this level. For AO3 b mark band 2, candidates need to record all mass results to the same number of decimal places; this is not evident in work seen. For AO3c, candidates need to show an awareness that the yield can be increased by changing conditions for mark band 1; much more detail is needed to support higher mark bands. Actual workable suggestions are needed for mark band 2 and a full evaluation of the method chosen with a possible comparison of the suggestions are needed for mark band 3. Candidates need to work on improvements for this section.

G625 Unit 6 Forensic Science.

The assessment requirements for this unit at present should include:

AO1 Evidence of the need to preserve and record the scene of crime; the chemical, biological and physical techniques used to collect and visualise forensic evidence; ethical issues involved in retaining sample or data.
AO2 Report on a case study giving the strengths and limitations of the forensic evidence; calculations using forensic data.
AO3 Practical forensic analysis to include visual/biological/chemical/physical; observations or measurements recorded, displayed, processed and interpreted.

The revised specification has amendments in AO1 in that evidence is now directed to three strands; chemical, biological and physical techniques. These link to the requirements of AO3. Spelling, punctuation and grammar requirements are again evident in AO1c.

The forensic work moderated indicated that candidates had produced a range of interesting work, both in the case studies and the experimental investigations and procedures. Candidates gave both interesting and informative work on methods of recording the crime scene through the use of photography, video methods and sketches. Suitable research was seen for AO1b which covered chemical, biological and physical techniques. Work on ethics is still quite patchy and some scaling occurred as candidates, who were given the higher mark bands, did not show an understanding of the need for an ethical code; information on ethical issues in forensic work was disappointing.

Case study work tended to be quite good but more discussion of the strengths and weaknesses of analytical techniques used and an understanding of the probability of guilt with a review of the evidence needs to be worked on.

Calculations are still focused on a range of Rf values for mark band 1, refractive index calculations and bullet projectiles for mark band 2 and 3.

Experimental work again included work on fingerprinting and taking footprints, measuring and use of photographs, a range of microscopic techniques, chromatography, qualitative and quantitative analysis. Refractive Index of glass was also commonly seen. Mark band 3 candidates need to ensure detailed processing and interpretation of their results. Centres need to take care that they give candidates opportunities in the practical work to access the full mark range.

G626 Unit 7 The Physics of Sport

The assessment requirements for this unit at present should include:

AO1 6 Short sport guidance leaflets linked to: Measurement; Seeing; Movement; Choice of ball material; equipment; techniques.
AO2 Selection of relevant principles used in: choice of ball material & equipment used; calculations linked to movement or techniques.
AO3 Plan of investigative work related to one or more of leaflets showing use of a range of equipment, collection of data, and interpretation of results and drawing suitable conclusions.

The revised specification has amendments in AO1 in that the evidence required will be only 4 leaflets: measurement, seeing, movement and technique. AO2 is linked to equipment and two investigations have been introduced to support AO3. Spelling, punctuation and grammar is assessed in AO2.

This session a lot of reports were seen rather than leaflets. Candidates should be producing guidance leaflets which indicate that they have used suitable research techniques and have selected the relevant information. Evidence should not include large amounts of cut and paste information, which again was quite evident. Mark band 3 work needs to show detailed knowledge written in candidates' own words with evidence on the linking of scientific knowledge to the chosen sport or equipment.

There was quite a lot of evidence on golf and tennis this session. Work on sports techniques should allow candidates the opportunity to complete suitable practical work. It should be noted that time spent on practical work should relate to about 20 hours of class time. For the coefficient of restitution, evidence of planning is needed and a range of measuring techniques should be included with evidence of the need to repeat. Safe working should include the completion of appropriate risk assessments. The practical work can be included as an additional piece of work and not just included within a leaflet. Candidates should take care to include suitable interpretation of data collected. The inclusion of additional practical investigations in the revised specification should give candidates more opportunities to access the higher mark bands.

G622: Monitoring the Activity of the Human body

1 General Comments:

This paper offered something to the vast majority of candidates. It was pleasing that most candidates knew the normal human values and had used or had a knowledge of the equipment used to measure these values. Most candidates also showed they had developed the skills to handle and use data in their answers. However, the spelling of some terms and equipment continues to be disappointing.

2 Comments on Individual Questions:

1 (a) (i) Many candidates missed marks as they failed to include combustion as well as respiration in their answer.

(ii) Generally well answered although some included heat as well as kinetic energy and this consequently prevented them receiving two marks.

(iii) Not all candidates knew ATP. Many thought it was glucose.

(iv) Very few correct answers. Oxidation or redox reactions rarely found.

(b) Not all candidates included the given words in a logical sequence. Many did not describe the transport function of blood or the needs of respiring cells for oxygen and glucose.

2 (a) (i) Recognised by most.

(ii) Not all candidates recognised the holding action of the atrium for blood and its consequent pumping action into the ventricle.

(iii) The main error here was in stating that the wall was thicker to cope with higher pressure rather than to create it.

(b) The role of the medulla, S.A.N. and sympathetic nerves was generally understood but less seemed to be known about blood pressure. Many assumed it increased with heart rate. Few considered vasoconstriction or increased stroke volume and the impact of force of blood flow.

3 (a) Candidates scored well here often gaining full marks.

(b) (i) The calculations and use of the graphs did not present a problem for most.

(ii),(iii) The extraction of valves and its relationship with relative fitness provided a problem for some.

(iv) Some lost marks as they failed to realise A was shallow and rapid and B was deep and slow.

(v) The calculation proved too hard for most. Indicates greater use of spirometer traces needed in preparation.

(c) (i) Most candidates aware of recreational and performance enhancing drugs.

(ii) Most unaware that blood samples are split; one tested and one kept in reserve. Some confusion over blood doping and testing for red blood cells without mention of EPO.

(iii) Some candidates did not appreciate that the question was based upon the handling and disposal of contaminated material.

4 (a) (i) 1 Sequence was well understood.
2 Many did not realise gravity affected the pointer.
3 Many thought average was needed rather than highest.

(ii) Many gained marks for appropriate comments and supporting data.

4 (b) (i) Most correct.

(ii) Most understood and explained *systolic* and *diastolic*.

5 (a) (i) Many good answers but some misunderstandings, eg bones reflect X-rays. Others explained procedure or safety issues which were not required.

(ii) Many creditworthy responses. Candidates who gave both sides of the argument did well.

(b) Generally well done although some misread and answered for the patient rather than the radiographer.

G623: Cells and Molecules

1 General Comments:

G623/01 Planning Exercise

A limited range of different methods to investigate the activity of papain during fruit ripening were seen in this task ie digestion of gelatine on exposed, developed photographic film; milk clotting assay. Candidates from some centres did not use the insert information; many of the planning exercises from these centres had evidence of 'copying and pasting' directly from websites, which was not appropriate to the task. Centres are asked to ensure that candidates read the instruction brief carefully to avoid misinterpretation. In future, it is suggested that centres provide students with a self assessment tick sheet to ensure that students address all the marking points in their plans before final submission.

It was pleasing to note that attendance registers for the planning component were included with the candidate scripts during this session. There are still anomalies in script packaging: 01/02 components arrive in single envelopes from some centres, whilst other centres send each component in separate envelopes as required.

The comments below summarise the major comments regarding the marking point criteria.

G623/02 Test

Each of the questions and the paper as a whole achieved good differentiation between candidates. There was no evidence of candidates failing to complete the paper due to lack of time. There were no common misinterpretations of the rubric.

2 Comments on Individual Questions:

G623/01 Planning Exercise

A This needs to be a working document relevant to the intended practical work. Often the risk assessment did not relate to the task. An appreciation of electrical (blender/colorimeter/water bath/centrifuge), glassware, sharps, relevant biohazard (enzyme allergy) and relevant chemical hazards need to be recognised. Level of risk and control measures need to be addressed.

B Prediction needs to be linked to the fruit ripening process; many candidates used changes in enzyme concentration as an alternative to enzyme activity.

C Justification of prediction needed using secondary sources and information on the accompanying OCR resource sheet.

D Students did consider preliminary work, although many referenced alternative proteases in their preliminary work. Where preliminary work was included it was not justified in many cases or related to the main method of the investigation in some cases. Preliminary work must inform the main method in future. Examples could include: how to prepare the enzyme extract; mass of tissue to use; source of enzyme within fruit; range and method of dilution series (re clotting times of milk); type of film; size of film.

H/I Many candidates listed at least two secondary sources. Candidates must ensure that full reference details are given and they must state how these sources have helped in the investigation.

J/K Many candidates achieved marking points J and K. Many candidates wrote in some detail regarding their chosen method to enable reasonable degrees of accuracy and reliability.

L/M Students need to give a comprehensive list of equipment for M with qualified names and quantities. Students in some centres failed to list the source material (papain/papaya).

N Students still fail to appreciate the importance of repeats. Evidence of this was apparent in work from many centres.

O/P Few candidates stated why it was necessary to include different 'subjective differences' (eg using colour) in ripeness or time intervals of ripening to complete the task and consequently O was rarely awarded. Many of those that did state the need to use fruit of different stages of ripening, used a range considered to be too narrow. Five degrees of ripeness were looked for.

Q/R Whilst many students stated variables as dependent, independent and controlled variables, very few students explained how these variables were to be controlled. Weaker students included control variables under dependent/independent headings.

S Many students planned to tabulate their data in a suitable format. However, tables must indicate what is being measured and units of measurements must always be included in the headers.

T Many students planned to display their results graphically: age of ripening against time taken to digest gelatine or clotting time of casein.

U Mean times for digestion were the most common calculations seen in scripts. Some candidates were awarded U for their use of estimating protein concentrations from calibration curves.

V Many students addressed possible conclusions. Those that did linked possible conclusions to confirm or reject their prediction.

W Some students were able to recognise one possible source of error in their equipment. Two are needed to award this marking point. Many students listed errors in basic laboratory equipment use for W, which is not appropriate for this marking point.

X Many candidates were able to suggest at least one possible method to improve the validity of their data (usually by suggesting alternative equipment to improve accuracy). The need for 'repeats' was commonly referred to. However, students need to distinguish the difference between the terms accuracy and validity to enable suitable improvements to be suggested in future.

G623/02 Test Exercise

1 (a) (i) Many candidates could access this question. A significant number gained full marks. Many scored 6 marks out of the seven marks while the great majority scored at least 3 or 4. It is still noticeable that weaker students cannot recall these basic food tests.

(ii) Answered well by some candidates who had clearly learnt about protein structure. Many candidates failed to indicate the significance of sequence or order of amino acids for 2. Some candidates failed to refer to 'helix' or 'sheet' in 3, whilst others confused 3 with DNA/RNA. Few could give accurate descriptions of tertiary structure. Those that did attempt answer 4 just wrote 'globular'.

(b) Answered quite well although many students wrote sucrose and maltose for (iii).

(c) Those students who had clearly learnt about the structure of the cell surface membrane had no difficulty in answering this section. It was evident that candidates from some centres had not covered this section of the specification and consequently very few marks could be awarded here.

2 Very well answered by the majority of students with many gaining the maximum of 5 marks in this section. Although the order was sometimes confused, the majority of candidates gained both quality of written communication.

3 (a) (i) This section was not answered well. Candidates had little idea on how to calculate the actual size of the *Cucubita* pollen grain. Most candidates were awarded marks for correct measurements taken from the photograph. Many candidates still cannot convert mm into *μ*m correctly.

(ii) This section was not answered well. Candidates had little idea how to calculate the magnification. One mark was awarded to candidates who provided, correctly, the relationship triangle between magnification, image size and object size. Candidates are advised to show the steps in their calculations in future.

4 (a) Many candidates were awarded 2 marks for correct use of the haemocytometer and micrometer.

(b) (i) Many students appreciated the larger nucleus in B. However, some candidates failed to identify the nucleus in their answer (ie 'dark blob') or make reference to the specific cell in question (ie 'the nucleus is larger' without referring to cell B) and consequently failed to score.

(ii) Many students could label the two cells. However, candidates are advised to use label lines in future. Some candidates missed this question altogether.

(iii) Some candidates were awarded the mark for use of stains. However, 'coulter counters' and 'electron microscopes' were common answers.

(c) This was not answered well. Whilst some candidates could correctly describe the ELISA test - using the diagram - many simply listing the components, very few answers could provide an explanation which was what the question demanded.

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

General Comments

This session is the final awarding of the original specification of this Applied A Level qualification; a new 'revised' specification will be introduced for teaching in September 2009. This is just an amended version of the original. All candidates, whether they are studying AS or A2, need to be using the revised specification from September 2009. This does include candidates who started their course using the original specification in September 2008. However, no candidates will be disadvantaged if they started any A2 units using the old specifications, as the moderation will support the work carried out by these candidates. It is hoped that centres will find the new specification and assessment criteria improved and accessible to both staff and candidates. It is hoped that any of the amendments which have been made will support the teaching and learning of A Level Applied Science. For more information, please read the new specification and sample assessment materials found on the OCR website (www.ocr.org.uk). Centres should look at the revised specifications on the OCR website under 14-19 Applied A Levels. There is now reference to assessing spelling punctuation and grammar in the portfolio units.

Accreditation of centres is on going and will continue with the revised specifications in the same way. Accredited centres need to ensure that the necessary Centre Authentication form is sent to OCR for any assessment session in which they are entering candidates. It is also important that if there is any change in the nominated staff, that OCR must be informed.

Candidates who are now studying at A2 level generally show that they are more experienced in research skills, and more selective in their use of the internet. However, although there was evidence of independent working, the cut and pasting of information was more evident than in previous sessions. Many centres are now accredited and several were sampled this session. In the majority of centres candidates' work was at an acceptable standard for A2 level**,** unfortunately, however, several centres were scaled, mainly due to generous assessment, at the higher mark bands; in these cases the work moderated did not reflect the standard required for A2 Advanced Level candidates.

The portfolio units moderated this session were as follows:

- G627 Unit 8 Investigating the Scientist's Work
- G629 Unit 10 Synthesising Organic Chemicals
- G630 Unit 11 Materials for a Purpose
- G631 Unit 12 Electrons in Action
- G632 Unit 13 The Mind and the Brain
- G633 Unit 14 Ecology and Managing the Environment
- G634 Unit 15 Applications of Biotechnology.

Centres again were very responsive in returning scripts for moderation and where there was low entry (less than 10 candidates) it was appreciated when centres sent all scripts directly to the moderator; this saved time and led to an efficient moderation exchange.

The majority of the work seen was well organised and clearly annotated with the assessment criteria codes. However, this session there was a high proportion of the work which was not clearly labelled and was presented in plastic pockets and lever arch files. It is advisable that candidates clearly label their work with their name, Centre Number, Candidate Number and number the pages. Several URS forms did not have any teacher comments and location of

work was not evident, many centres clearly annotated their candidates' work and included staff comments, this is appreciated and supports the moderation process. Centres are again asked to include the tasks sheets given to the candidates as this helps to support the moderation process, very few were seen.

G627 Unit 8 Investigating the Scientists' work

The assessment for this session includes:

AO1 A workable plan for one investigation linked to a vocational context, with aims and objectives plus deadlines; suitable research and health & safety.
AO2 Evidence of results from investigation suitably displayed and processed; some link to original aims and objectives; suitable associated calculations.
AO3 Evidence of experimental procedures/may include trials; record of monitoring plan; report showing outcomes of the investigation, interpretation of data and evaluation.

The only amendment for the revised specification is evident on the assessment grid. It is hoped that the requirements for AO1, AO2 & AO3 are now more selective and makes the assessment more logical.

Investigations chosen should build on work studied at AS level and centres need to ensure that if candidates are to access the highest mark bands their investigations do give them the opportunity to carry out a wide range of experimental techniques and procedures. Candidates for this A2 investigation should not be carrying out just one type of experiment several times. The candidates should be showing their skills by completing different types of experimental procedures. To help candidates with ideas for investigative work, once they have chosen a topic if they then ask a question about their chosen topic this should help to form the basis for an investigation
eg
Topic - aspirin; Question - 'which is the best method to prepare a pure sample and why?'.
Topic - useful materials in sport; Question - what properties are required for ….? Which materials have the best properties for….?
Candidates could decide on their own questions about a provided topic. This can encourage candidates to carry out a range of investigations on the same topic but with a different focus.

Further study was seen on enzymes which built on work studied for the biotechnology unit, this was good to see. However, care is needed to check that full holistic plans are used. These should provide detailed logs of the full investigation with suitable opportunities for the appropriate monitoring for AO3. AO1 needs to include evidence of both scientific principles and details of a range of experimental techniques. Further investigative work included properties of materials, investigative work on organic compounds, inorganic compounds and their uses, extensions of environmental investigations, redox investigative work which included potassium manganate(VII) titrations/Iodine thiosulphate titirations/the use of back titrations in the investigations of antacids, food analysis, vitamin C in a range of food products and drinks, yeast/sugar/fermentation, health and fitness, effects of stimulants, energy drinks, caffeine etc on performance. It is important that the standard of experimental work is AS/A level and that candidates have the opportunity to use equipment that will provide suitable accurate data for processing. Centres are encouraged to include evidence that candidates had actually carried out the practical work with further evidence that they had completed and used risk assessments. A statement written on the candidates' work is sufficient or alternatively, a certificate of completion of the practical.

Predictions are not needed for the investigation, although the aims, objectives and vocational links are required. AO1b Mark band 2 needs to show evidence of a range of relevant research with information on why this has been chosen with statements to support its validity. Mark band 3 needs to also include constraints that the candidates are working to with suitable contingency plans. A write up of the method is not evidence that the candidates have completed the practical. The report does not necessarily need the candidates to include

write-ups of methods. The standard procedure used can be attached. The report needs to show the outcomes of the investigation with suitable evidence of an understanding of the scientific concepts involved. Centres also need to ensure candidates relate the outcome to the original aims of the investigation. Evaluations need to focus on the whole investigation not just single experimental tasks. It was good to see work where candidates had thought out their own investigative and experimental requirements. It is not envisaged that candidates should just follow a number of set experiments provided by the Centre.

G629 Unit 10 Synthesizing Organic Chemicals

The assessment for this session includes:

AO1 Basic knowledge & understanding of functional groups, names of organic compounds and isomerism and reaction types. Summary of different drug types and their action.
AO2 Research into the manufacture of an organic compound; to include research of costs and benefits of compound; suitable calculations.
AO3 Practical work on two organic compounds; detailing preparation and purification methods; (to include some planning); make, record and display observations and measurements; evidence of processing results (to include % yield); suitable conclusions and evaluation included.

The revised specification has hopefully reduced the requirement to cover too many reaction types in AO1, in order to allow candidates time to explain the science in the different reaction types. AO2 has minimal revision with additional bullet points to support AO2b. The requirements for AO3 no longer expect the preparation of an anti-inflammatory drug.

Work for this unit is now showing evidence that candidates are building on organic chemistry researched and studied for the AS portfolio units. However, there is still evidence of downloads and careless use of formula and equations. Candidates need to check that they do understand the information they are including in their reports. It would help the moderation process if task sheets were included and a vocational link was supplied. Perhaps link assignment to research work needed for an organisation. Evidence for higher marks needs to show summaries of classification and identification of functional groups with evidence of understanding the different type of isomerism. The importance of isomerism linked to specific examples is really needed to secure mark band 3.

Candidates produced interesting work for AO1c and good practice is shown where candidates summarize their research and present it in tabular form. Suggested headings could be Type of drug/How it is used/example/importance in health care/further information. More detailed information however on therapeutic effects and the use is needed to support mark band 3.

AO2 work needs to show evidence of research work on a process used to manufacture an organic compound. Alcohol, several selected haloalkanes and medicinal drugs were chosen. AO2b needs to focus on costs and benefits to individuals, companies and society associated with the manufacture of the organic compound. Preparations of aspirin, ethanoic acid, benzoic acid, iodoform (triiodomethane) and paracetamol were seen. Candidates need to take care that for mark band 3, risk assessments are accurate and sufficiently detailed. Again risk assessments tended to be mark band 2 rather than mark band 3. Candidates need to be guided to ensure they record suitable observations for their preparations and that the processing of results is recorded and completed to a sufficiently high level. Evidence on calculations of theoretical yield is needed. Evaluation of the process again needs to be detailed and focused on the techniques used, sources of errors and reaction route. Centres need to note that a total of 26 marks is allocated to the practical work and hence between 25 to 30 hours should be allocated to AO3 work.

G630 Materials for a Purpose

The assessment for this session includes:

AO1 Information (poster/leaflet) on structure of a polymer/metal/ceramic or glass/composite.
AO2 Two case studies stating purpose of material; suggesting from published data. alternative materials with reasons; calculations to include tensile stress and strain, the Young's modulus and toughness by using graphical methods.
AO3 Evidence to show the following 4 sets of experimental work:
- a how the extension of a sample varies with tension/plan of work/results/graph;
- b design and use a testing device/plan/results;
- c results from tests on samples that have been work-hardened, annealed and tempered and control samples;
- d results from thermal conductivity, electrical conductivity; specific heat capacity.

The revised assessment requirements now only require one case study for AO2 and there is a reduction in the amount of practical expected in AO3. This will allow time for the higher mark bands to be addressed.

Much of the poster work seen reflected the requirements for AO1 and was assessed to the appropriate standard. However, some candidates need to check that for mark band 3, the physical properties are related to the structures. Centres also need to check that for AO2c higher mark band calculations reflect the requirements of the assessment criteria. Again, a wide range of practical work was seen, although some centres were quite harsh in the assessment where candidates had not completed all the practical work, marks should be given to reflect the work completed. In AO3c, recognised industrial standards need to be quoted. It is hoped that the revised specifications will allow candidates to complete all the practical work in the allotted time. 26 marks equates to about 25-30 hours in the classroom.

G631 Unit 12 Electrons in Action

The assessment for this session includes:

AO1 Investigation of redox, equilibria; including an outline of the applications of electrochemical changes; research into the production of electricity and production of metals.
AO2 Description of different types of commercial cells with some comparison; calculations to include the EMF of cells and quantity of charge.
AO3 Experimental work on the measurement of EMF of cells and mass of copper formed in copper plating;(to include changing conditions for each experiment);to record and display all observations and measurements; to interpret results and evaluate procedures.

The revised assessment requirements include minimal change for AO1 –just a rearrangement of the requirements. For AO2, clearer guidelines on the research requirements for the commercial cells and for AO3, experiments need to be planned.

Although this unit had limited entry some high quality work was seen which reflected a clear understanding of the physical chemistry involved. Good practical work was carried out which supported the understanding of redox reactions and the electrochemical series. Risk assessments need to be evident to support safe working. Candidates should be advised to read their work thoroughly before submission to avoid errors in spelling and grammar. For some candidates in AO1a, the fact that redox reactions are reversible should be discussed. In AO1b candidates should again take care that the generation of electrons and thus electricity is clearly stated. In AO3, the methods used to find the effect of changing conditions needs to be explained for the higher mark bands. Diagrams can be drawn to help explain the apparatus used. There was limited evidence of well drawn diagrams.

G632 Unit 13 Mind and the Brain

The assessment for this session includes:

AO1 Information on stress (implications on physical illness; measurement/intervention programmes/research statistics linked to stress related mental health programmes). Information on the structure and function of a healthy brain; (description of behavioural and cognitive effects associated with damage and how the brain deals with this). How various diseases affect the brain and treatment available.
AO2 Evidence showing methods & techniques in brain research (experimental & clinical) & invasive & non-invasive methods; experimental & generic techniques.
AO3 Reports to include research on studies needed to support experiments; information on cognitive function & memory loss; evidence of any trials and main practical work (based an a hypothesis); data collected, recorded and suitably displayed; outcomes of investigation; interpretation of data and evaluation.

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

This unit continues to grow in popularity amongst the candidates studying the Applied Science qualification. Although some interesting leaflets/fact sheets on stress and illness and the healthy and damaged brain were seen, several candidates presented their work as reports, candidates are expected to show the ability at this level to suitably select material; quality rather than quantity is required for AO1.

AO2a again allowed candidates to research the clinical methods of studying the brain and interesting work was seen. Diagnosis of brain diseases was generally well covered and some good illustrations supported the candidates' work, again care needs to be taken that work is selected and not 'cut and pasted'. AO2b moral and ethical implications of brain research still needs to show evidence of suitable discussion by the candidates, although some good arguments were given from some candidates. AO2c does ask for a fact sheet detailing statistical evidence and some candidates were producing these. However, candidates are using a wide range of statistical testing on their results, but suitable conclusions need to be drawn to reflect the calculations completed. Some of the work seen did not reflect understanding of these statistical tests.

Care needs to be taken that the appropriate time is spent on the experimental work. 26 marks are available for this section and therefore candidates need to spend 25-30 hours on this section. Centres need to ensure that the investigative work allows candidates to collect sufficient data for mark band 3 to be accessed.

Unit 14 Ecology and Managing the Environment

The assessment for this session includes:

AO1 Evidence of the relationship between the organisms, their physical environment and each other in ecological succession; research on the effect of agricultural practice, human habitation, and greenhouse gas production on ecosystems and biodiversity.
AO2 Information on scientific, moral and ethical reasons for preserving ecosystems and species diversity; descriptions of methods used to manage ecosystems and to preserve species diversity with information on the success of a project managing one ecosystem; calculations on ecological data.
AO3 A planned investigation of an ecosystem, with relevant observations made and recorded; data displayed, interpreted and results related to the occurrence and distribution of the species within the ecosystem.

The revised assessment requirements were simply minimal changes in the wording, the main assessment remains unchanged.

Candidates are now demonstrating an understanding of ecological succession and the effects of change on ecosystems and biodiversity. Care is needed to ensure that candidates do not include too much information downloaded from the internet; this was particularly evident this session. AO1b research on the effect of agricultural practice, human habitation and greenhouse gas production on ecosystems and biodiversity was suitably covered, especially where candidates had been given the appropriate guidelines. Some candidates are still not including all the requirements. It is important that all three areas are equally covered. Care needs to be taken that for mark band 3, evaluative work and justification on the choice of material needs is included; this was lacking in some of the higher level scripts.

Work on scientific, moral and ethical reasons for preserving ecosystems was not as good this session as seen in the past, although animal exploitation was a common topic discussed. Data was provided for AO2b and this was good to see. Calculations tended to be linked to data gathered from practical work carried out. Centres need to ensure that, if they are going to use this, suitable opportunities are given for candidates to collect quantitative data. Some good statistical analysis was seen this section.

Again some excellent and interesting practical work had been carried out by candidates, and those candidates who had been given the opportunity of field trip work, produced some high quality work. A range of experimental techniques were seen and it was again good to see photographic evidence of work carried out. Risk assessments in general this session seemed to be suitably detailed and are now including the risk out in the field as well as back in the lab. There also should be evidence that candidates are actually following these risk assessments. Comments from the staff would support AO3a. For AO3c, the displaying of data did show a range of different methods, kite diagrams were often seen to support data display. 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.

Unit 15 Applications of biotechnology

AO1 Booklet giving information about the science of genetic engineering; booklet giving information about 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; to construct a simple bioreactor and be able to produce and use an immobilised enzyme; make, record and display relevant observations and measurements; process results by calculating rates of reaction; interpret results and relate these to how enzymes work and enzyme immobilisation.

Moderated work indicated candidates produced work which showed good research skills for AO1 and investigative practical work for AO3.

The revised assessment requirements were simply minimal changes in the wording, the main assessment remains unchanged.

There was evidence this session that many candidates had used this unit as a base for the G627 investigation and some good work was seen.

A significant amount of information produced for AO1 this session did contain less selection than seen previously. The inclusion of suitable references supported evidence that a variety of sources have been used for mark band 3. Referencing throughout the document should be encouraged.

Again, for AO2c mark band 2 work on moral, ethical and environmental issues concerning the use of recombinant DNA technology in the production of GM plants needs an explanation of two types of controls placed on scientists that work in this field. However, Mark band 3 needs a more detailed report with additional explanations and evaluative work on the two types of controls placed on scientists and how effective they are.

For AO3, suitable practical work was generally seen but plans still need to be clearer. Preliminary work from candidates was included and in some scripts, there was good research work on enzyme activity. Care needs to be taken that suitable immobilised enzymes are prepared and used. Evidence of good displays of results need to be included for AO3c. Candidates need to check they spend the appropriate time on AO3c and AO3d to ensure sufficient coverage. For AO3d level 2, candidates need to check that as well as interpretation of results and basic conclusions, the advantages of using bioreactors and enzyme immobilisation are included.

G628: Sampling, Testing and Processing

1 General Comments:

The number of candidates taking this examination in the summer remained at about 500.

The total mark for the paper was 90 and, as on previous occasions, many papers showed a score between thirty and fifty five. The examiners noted that there were fewer very poor papers but papers gaining sixty or more were also uncommon. In general the paper seemed a little more accessible at the bottom of the mark range.

The number of irrelevant responses – provided without reference to the case study material, continues to decline.

Weak areas continue to be the ability to design and describe suitable experiments for a specified purpose. The ability to modify given experiments continues to be problematic also.

In some questions, candidates were content to give one word or phrase answers. At this level it is more appropriate to provide more detail so that the examiners can assess the answers provided with increased confidence.

The examiners felt that some candidates misinterpreted questions and provided answers that were correct in themselves, but did not answer what was required.

The responses given to question three were sometimes disappointing. This question was not based on case study material. It is pity that the general scientific knowledge of some candidates does not enable them to answer this type of question in a confident way.

The use of mathematics continues to cause problems – particularly in the substitution of figures into equations and subsequent rearrangement to give the desired answer. On balance the examiners thought that the paper had performed well and had given candidates the opportunity to show their knowledge and understanding and their ability to apply this to new situations

2 Comments on Individual Questions:

1 (a) (i) Most candidates gained full credit for considering three factors when collecting samples.

(ii) Most candidates used the case study to obtain the first mark but fewer then mentioned the need for comparability.

(b) (i) The need to remove contamination was well understood.

(ii) Most candidates realised that iodine is lost if the temperature becomes too high.

(iii) The need to heat for longer was not often given.

(iv) B was the correct answer and was often provided. Any additional reference to D was ignored.

(v) This proved to be a difficult question and few correct answers were seen.

(c) Many candidates stated that the quantity of water and the temperature were not given and gained two marks.

(d) (i) Nearly all candidates correctly stated that a risk assessment was necessary.

(ii) It was uncommon to award all four marks here. Most candidates commented about the open fire but fewer commented on the toxicity of the process as described. The transition from an industrial process to a laboratory situation was generally not appreciated.

(e) (i) The factors to be considered when collecting the seaweed were well documented.

(ii) The need to wash was often given but fewer candidates could describe a correct method for drying the sample without decomposing it, or could then continue and state the need for weighing to constant mass.

(iii) There were several acceptable answers here and most candidates could provide one to gain the mark awarded.

(iv) The reasons given for the use of a fume cupboard generally gained credit.

(v) Many candidates gave an alternative acceptable means of separation.

(f) (i) The variation of viscosity with temperature was well recognised.

(ii) A number of candidates thought that a thermometer would keep the temperature constant.

(iii) Most candidates were able to use the formula to complete the gaps in the phrase.

(iv) The correct answer, 1.65 N s m^{-2}, was generally given.

(v) Most candidates realised that viscosity is affected by the chain length of the polymer.

(g) The term *hydrophilic* was well known but few could adequately describe a *polymer*.

2 (a) Very few candidates used the case study to obtain the correct answer.

(b) The problem of collapsing tunnels was the commonest correct response.

(c) Most candidates did not obtain the two marks allocated.

(d) (i) The method of finding the volume of an irregularly shaped object was not well known. There was some confusion between volume, mass and density.

(ii) Some candidates found it difficult to use the table to estimate the percentage.

(iii) The advantages of presenting results in a graphical form was generally clearly understood.

(iv) This was a difficult question for many candidates, although clues were given in the case study.

(e) Although there were a number of alternative answers, most candidates only gained one out of two.

(f) Many candidates appreciated the toxicity of sulphur dioxide but fewer stated the problems of attaining high temperatures in the college laboratory.

(g) There were four marks for these series of calculations. Many candidates gained the first two marks but could then go no further.

(h) (i) The need to remove surface contamination was well understood.

(ii) Most candidates could state a missing feature from the instructions.

(iii) The need for adequate labelling was clearly stated.

(iv) Few candidates realised the relative inaccuracy/sensitivity of this colorimetric technique and many incorrect answers were seen.

(v) The need for a control was not appreciated by many candidates.

(i) There were many advantages in using XRF rather than 'wet tests' and many papers were seen where both marks were awarded.

(j) (i) The problems cause by impurities in tap water were well understood.

(ii) Remarkably, it seemed that many candidates had not made up a standard solution and few really good answers were seen.

(iii) Although many candidates could calculate the concentration of lead, few could then use this to find the concentration of lead in the paint sample.

(k) (i) The definition of an alloy was not always given precisely.

(ii) Candidates had no difficulty in calculating the mean diameter of the lead shot.

(iii) The sample that did not fit the requirement was usually recognised.

(iv) 'Altering the proportion of arsenic' was the usual correct answer, although some did not use the article in their response and gave improbable answers.

3 (a) (i) A number of candidates did not read the question correctly and did not refer to radon entering the building.

(ii) Some buildings have more ventilation than others. This was not appreciated in most responses.

(iii) 'More ventilation' was the commonest correct answer.

(iv) There is more ventilation in buildings in the summer but this obvious response was not always seen. Many candidates believed that radioactivity is affected by temperature.

(b) (i) Many candidates gained full credit when asked about the labelling of the detector.

(ii) Most responses indicated that candidates appreciated that the radon levels in the house would vary in different places but few then stated the need for the same time span so that results could be compared.

(iii) Some candidates thought that radon would escape from the detector after use, rather than the need to exclude extra radioactivity before developing the traces caused by the radon.

(iv) There were some good answers to this question but some candidates merely reproduced the question stem rather than writing their own set of instructions.

(v) Some candidates had difficulty in using the magnification given to calculate the size of each side.

(vi) This proved to be a difficult development from (i) and the correct answer, 4800, was rarely seen.

(vii) This numerical question was often calculated correctly.

G635: Working Waves

1 General Comments:

The quality of responses was higher than that previously seen.

Candidates were relatively very successful on items concerning concrete situations (for example, how to minimise the radiation dose to staff) but relatively weak on items concerning more abstract ideas (for example, the functioning of graded-index optical fibres).

Items requiring direct recall were well answered by a significant number of candidates, suggesting better preparation than previously.

However, the quality of expression was generally disappointing. Whilst examiners give credit where possible to correctly understood, but poorly expressed concepts, poor expression sometimes conceals the correct understanding. If candidates had avoided use of the passive voice in some instances their intended meaning might have been clearer. 'The grid stops the rays' is clearer than 'the rays were stopped.'

2 Comments on Individual Questions:

1 (a) (i)-(iii) Almost all candidates attempted answers, but even higher-scoring candidates often failed to answer correctly in parts (i) and (ii) Many of those who answered (iii) correctly supported their response by giving the value of the speed of light in a vacuum.

(iv) This was relatively well-answered. Most candidates supplied the correct formula and many substituted the values and rearranged the quantities correctly. Many omitted the powers of ten in their answer, possibly as a result of entering 10^{7} in their calculator instead of 10^{-7}.

(b) Many candidates demonstrated some understanding of polarisation, in some cases describing it without relating it to the question. Commonly candidates described Fig. 1.2 as more blurred than Fig. 1.3 rather than the sky being darker. Relatively few mentioned the polariser as being the agent of change for the light.

In part (ii), very few understood that rotating the polariser could brighten the sky.

(c)&(d)(i) Generally well answered. Common non-scoring answers were 'water waves' and 'transverse'.

(d) (i) Generally well answered. Common non-scoring answers were specific examples of electromagnetic waves and 'transverse'.

(ii) Very well answered. The most common incorrect suggestions were 'alpha', 'beta' and 'sound'.

(iii) Relatively few candidates gave both answers correctly.

2 (a) Most candidates answered correctly. Some of these identified slowing down or wear, this did not immediately focus their attention on the heating effect for subsequent sections.

(b) Most responses scored the first mark by giving examples of colours or shades of grey but, although the majority considered problem areas within the conveyor belt, few scored the second mark by **comparing** this or its temperature with elsewhere.

(c) This section was not well answered.

The majority of those who gained marks mentioned temperature difference (hotter or colder).

Candidates referred to the heating effect and infra-red radiation but few described variations in its intensity, frequency or wavelength. Some scored a mark by describing the image colours instead.

(d) A range of correct answers were seen, the most common referring to preventative maintenance. A tiny minority referred to testing the camera rather than testing the conveyor.

(e) (i) The great majority of responses correctly included the colour red, but few recognised that the emission spectrum had widened rather than shifted, suggesting instead that red was emitted instead of infra-red.

(ii) The great majority of responses correctly included 'white'. A minority recognised that this included the whole of the visible spectrum. The second mark was more commonly gained by describing 'greater intensity', usually by saying 'more radiation' or 'brighter'.

3 (a) (i) Very few candidates appeared to understand the term analogue. Some simply described it as older and, by implication, not as good.

(ii)&(b)(ii)Many candidates had learnt these. Others showed imagination.

(a) (iii) Only about half of those who knew what FDMA stands for could describe how it allows more users to make calls. A very small number gave good (but non-scoring) descriptions of TDMA or how using cells increased the number of users.

(b) (i) Far more candidates had some understanding of digital than they had of analogue. Most marks were gained by writing 'binary' or '0 or 1'. Very few scored the second mark by recognising that these levels are discrete.

(iii) A disappointing response to a question about an application that it was thought might have been of interest to candidates. A number scored a mark by stating that encoding prevents signals from becoming muddled. Answers which failed to score generally offered comments unrelated to the required ideas.

(c) (i) Most responses scored the first mark by referring to the large number of people using mobile phones. Some offered no further explanation. Others thought that the signal was weakened by the large number of users.

A small number referred to the stadium and other buildings blocking the signal.

(ii) Well answered. A minority suggested that the problem was due to the land being flat.

(iii) Very well answered. A minority suggested that the problem was that signals would not reach high up.

(d) (i) Well answered.

(ii) Very well answered.

(e) (i) Of those who failed to score, a very large proportion stated that the phone could be used in other countries. A tiny minority confused dual band with dual mode and wrote good but incorrect answers.

(ii) A large proportion guessed at 'uses two modes' or stated that the phone could be used in other countries.

(f) The most frequent creditable response was that the landline phone did not interrupt a broadband internet connection, and the second was that it was faster.

4 (a) The most common correct responses included the ideas of faster data transmission rate and lower costs.

Electrical isolation was an acceptable answer but immunity from electrocution did not score.

(b) (i) A minority of candidates incorrectly stated 'total internal refraction',

(ii) Most responses scored with answers such as 'scratches' or 'damage'.

Many answers, based on angular conditions, revealed imperfect understanding. The most common errors were to suggest refractive index values being unsuitable or 'angle of incidence greater than critical angle' or referred incorrectly to the angle of entry.

(c) The variations in answers suggests guessing in some cases.

(d) (i) Incorrect answers included square waves (some identical to the input), saw-tooth shapes, and very high frequency.

(ii) The weakest candidates did not understand the meaning of degradation and seemed to think it was desirable.

Other weak candidates wrote about a diminishing signal or interference.
Some candidates understood that the signal did not all arrive at same time but only the best fully explained this.

(iii) Many correctly identified applications such as endoscopy or decorative lighting. Others failed to answer the question by giving types of fibre that overcome the problem rather than applications where it is not a problem.

(e) Only the best-prepared candidates described the variation in refractive index.

Non-scoring candidates usually did not describe graded-index fibres.

Quality of Written Communication: Responses which scored well in 4(e) generally also scored the QWC mark

(f) The most common mark was gained by stating that the core is thinner. Of those who attempted to give the diameter, many did not give the correct unit. Many wrote 'mm'. Many candidates stated that the light travels in a straight line, without indicating that rays follow the same path. For example, many also suggested parallel paths. Some stated that light travels faster.

5 (a) (i) Non-scoring responses indicated two main misconceptions:

1 That 'irradiated' means having received a benign dose of radiation, but 'radioactive' means having received a harmful dose of radiation.

2 That 'irradiated' means having received radiation which has gone away, but 'radioactive' means having received radiation which is still there.

A minor but significant variation on these ideas of 'irradiated', is that it is a process which involves removing radiation from the body.

(ii) Although the question asked for treatments it was not the intention **on this occasion** to test understanding of the distinction between diagnosis and treatment. Examples of diagnostic techniques were therefore accepted as long as they clearly distinguished the terms being tested.

The most common examples were undergoing an X-ray or CAT scan; and being injected with ^{99m}Tc.

(b) Only higher-scoring candidates mentioned ionisation. Almost all responses included reference to cell damage, most also included cell death, cell mutations and cancer. Relatively few included chemical reactions.

(c) Most scoring responses referred to a film badge.

A minority of non-scoring responses made incorrect suggestions, such as routinely testing staff or using a gamma camera.

Another common error was to describe ways of minimising the dose to staff.

(d) Almost all correct responses included the use of lead shielding, but many omitted to mention the lead for the screen or for protective clothing.

Many answers included the need to leave the room. A few included reducing exposure times and a very small proportion referred to minimising procedures.

Some candidates described ways in which the dose to patients could be reduced, which could only score marks if they also applied to staff.

(e) Only a few candidates demonstrated thorough preparation for these techniques, many answers suggested confusion with other equipment such as image-intensifying screens.

Few responses to part (i) included the word 'scattered', but many referred to rays 'going in the wrong direction'. Only a small proportion indicated that the grid is made of lead, and even fewer indicated where it is placed. Mention of reduced contrast was rare.

In part (ii), the most common mark gained was that for a ‘clearer image’, only a small minority referred to the ideal beam from a point source, or how the beam size is reduced.

(f) The great majority of responses described a selection from rotation of the CAT scanner, taking many images, the idea of slices, producing a 3D image and better resolution of soft tissue.

A small minority mentioned the increased radiation dose. Very few indicated that more information is collected or the role of the computer software.

Quality of Written Communication: Only about a third of candidates answered with less than two spelling, punctuation or grammatical errors in this section.

Grade Thresholds

Advanced GCE Applied Science AS (H175, H375) and
GCE Applied Science A2 (H575, H775)
June 2009 Assessment Session

Portfolio Unit Threshold Marks (AS)

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G620	Raw	50	43	38	33	28	23	0	2004
	UMS	100	80	70	60	50	40	0	
G621	Raw	50	43	38	33	28	23	0	2240
	UMS	100	80	70	60	50	40	0	
G624	Raw	50	42	37	32	27	22	0	344
	UMS	100	80	70	60	50	40	0	
G625	Raw	50	43	37	32	27	22	0	261
	UMS	100	80	70	60	50	40	0	
G626	Raw	50	42	37	32	27	23	0	414
	UMS	100	80	70	60	50	40	0	

Examined Unit Threshold Marks (AS)

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G622	Raw	90	66	58	50	42	35	0	2101
	UMS	100	80	70	60	50	40	0	
G623	Raw	90	73	65	57	49	41	0	618
	UMS	100	80	70	60	50	40	0	

Portfolio Unit Threshold Marks (A2)

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G627	Raw	50	44	39	34	29	24	0	855
	UMS	100	80	70	60	50	40	0	
G629	Raw	50	43	38	33	29	25	0	360
	UMS	100	80	70	60	50	40	0	
G630	Raw	50	42	37	32	27	22	0	132
	UMS	100	80	70	60	50	40	0	
G631	Raw	50	44	39	34	29	24	0	109
	UMS	100	80	70	60	50	40	0	
G632	Raw	50	44	39	34	29	25	0	217
	UMS	100	80	70	60	50	40	0	
G633	Raw	50	43	38	33	28	24	0	334
	UMS	100	80	70	60	50	40	0	
G634	Raw	50	43	38	33	28	24	0	380
	UMS	100	80	70	60	50	40	0	

Examined Unit Threshold Marks (A2)

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G628	Raw	90	64	59	54	49	45	0	524
	UMS	100	80	70	60	50	40	0	
G635	Raw	90	72	64	56	49	42	0	605
	UMS	100	80	70	60	50	40	0	

Specification Aggregation Results

Uniform marks correspond to overall grades as follows.

Advanced Subsidiary GCE (H175):

Overall Grade	A	B	C	D	E
UMS (max 300)	240	210	180	150	120

Advanced Subsidiary GCE (Double Award) (H375):

Overall Grade	AA	AB	BB	BC	CC	CD	DD	DE	EE
UMS (max 600)	480	450	420	390	360	330	300	270	240

Advanced GCE (Single Award) (H575)

Overall Grade	A	B	C	D	E
UMS (max 600)	480	420	360	300	240

Advanced GCE (Double Award) (H775)

Overall Grade	AA	AB	BB	BC	CC	CD	DD	DE	EE
UMS (max 1200)	960	900	840	780	720	660	600	540	480

Cumulative Percentage in Grade

Advanced Subsidiary GCE (Single Award) (H175):

A	B	C	D	E	U
1.5	8.2	25.0	52.8	77.5	100.0
There were 1423 candidates aggregating in June 2009.					

Advanced Subsidiary GCE (Double Award) (H375):

AA	AB	BB	BC	CC	CD	DD	DE	EE	U
0.0	1.9	4.5	10.5	23.3	36.7	53.0	66.1	75.7	100.0
There were 339 candidates aggregating in June 2009.									

Advanced GCE (Single Award) (H575):

A	B	C	D	E	U
2.2	11.4	36.9	70.6	92.3	100.0
There were 609 candidates aggregating in June 2009.					

Advanced GCE (Double Award) (H775):

AA	AB	BB	BC	CC	CD	DD	DE	EE	U
0.0	0.6	4.9	11.9	26.0	43.4	64.8	82.3	93.3	100.0
There were 345 candidates aggregating in June 2009.									

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/exam_system/understand_ums.html

Statistics are correct at the time of publication.

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

OCR Customer Contact Centre

14 – 19 Qualifications (General)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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