OCR
RECOGNISING ACHIEVEMENT

GCSE

Applied Science (Double Award)

General Certificate of Secondary Education **J649**

Examiners' Reports

June 2011

J649/R/11

Oxford Cambridge and RSA Examinations

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This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

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General Certificate of Secondary Education

Applied Science (Double Award) (J649)

EXAMINERS' REPORTS

Chief Examiner's Report

General Comments

In the examinations, candidates were appropriately entered for the Foundation tier paper, with most showing knowledge across all question areas. At this level, candidates made good use of time, and few questions or part questions were left unattempted.

There was evidence to suggest, however, that once again, a significant number of candidates were inappropriately prepared for the Higher tier paper. In particular, many appeared unfamiliar with specification content required at this level. Please note also that the Higher tier paper is designed to differentiate between higher grades and many of the questions require knowledge and understanding specific to this tier. Here, many questions require candidates to analyse information and describe and explain the science involved at a much higher level.

It is expected that candidates on both tiers are able to give appropriate definitions or explanations of scientific terms in the specification. This continues to be a general weakness; centres need to work on improving candidates' knowledge and understanding of 'key' words and facts and be able to assign labels to key scientific diagrams, all of which define the most important learning objectives on the specification.

In the portfolio units, centres should ensure that OCR's URS form is completed for each candidate, with the centre and each candidate's name and number. It would also assist in the moderation process if centres recorded assessment information on OCR's recommended tracking grid, which can be found in the appendices of this report. Please present portfolio work in envelope folders or cut-flush files, or tied together using treasury tags, and *not* in plastic wallets.

Practical activities selected by many centres were often in the true spirit of the course, being applied in nature and often excellent examples of work-related learning. Experienced centres should, however, not become complacent, and review constantly opportunities for assessment that they are providing, and standards to which they are marking. For those centres that are less sure in their development of practical activities, please refer to the appendices of this document, where a list of assignments illustrating best practice in this session is provided.

A major issue in both portfolio units continues to be candidates' recording, display and processing of data. Candidates must **not** be awarded a Band 3 if key features such as correct table headings and units are missing, or there is no consideration of a use of significant figures in calculations. The attention of Centres needs also to be drawn to conclusions and evaluations at Bands 2 and 3. Note that in B481, *simple* scientific knowledge should be used to explain findings at Band 2 (*detailed* knowledge and understanding is required at Band 3). In this unit, *all* candidates should attempt evaluations in addition to conclusions (otherwise the strand cannot be awarded), and appropriate scientific terminology must be used to procure Band 3. In B483, please note that all criteria must be completed for candidates to be awarded a Band 3 mark.

B481: Developing Scientific Skills (Portfolio)

General Comments

In this session, the majority of centres are to be commended for the way in which this unit has been implemented and delivered. Administration has, on the whole, been efficient, with fewer arithmetical errors and clerical errors evident. Though marking was largely consistent in this session, quite often, limited documentary evidence of internal standardisation was supplied.

Some centres, in particular those new to the course, must make careful checks on the way the assessment criteria are being translated into marks, and guidance on this from the specification is reproduced in Appendices II and III. Any centres that might remain unsure of how to apply the assessment criteria accurately should seek further guidance from OCR.

For B481, it was apparent that most centres had ensured thorough coverage of the criteria in the assessment evidence grids, but it should also be noted that due consideration should be paid to fulfilling the requirements of the Assessment Objectives of the unit (centres should refer to page 97 of the specification), and Performance Descriptions (pages 114 and 115). One important issue observed in write ups of standard procedures by higher ability candidates was that in many instances, only a limited attempt had been made to relate experimental findings to scientific principles (AO2).

The most successful implementation of the specification has been observed in centres that have taken a holistic view of the course. The course rationale, highlighted in the specification, involves candidates obtaining and developing the necessary knowledge and understanding of science (Unit 2), developing and carrying out underpinning practical skills in Unit 1, and then *applying* practical skills and a knowledge and understanding of science in Unit 3. Several centres were seen to develop further themes begun in previous sessions.

Centres should also take particular note of the presentation of candidates' portfolios. While this was often exemplary, it would greatly assist the moderation process if candidates' portfolios were presented in cardboard wallets or cut-flush folders, or bound with treasury tags; please *do not* enclose portfolio material in plastic wallets.

Comments on activities chosen

Many centres, in particular those who are becoming more experienced with Applied Science, have adopted a truly vocational approach, linking in with local industries and thereby enabling candidates to compare their methodologies with professional techniques. A few centres are still using activities from the 2002 Teacher Guidance materials, or those developed a few years previous, and it is suggested that these centres should now perhaps take a different approach and attempt to develop activities that are more innovative. Please refer to the appendices, where a list of the most successful activities this session, is provided for guidance, if required.

Particularly successful has been the industrial involvement in the section on **Working Safely in Science**, with a number of centres laying on visits or speakers and some giving candidates opportunities to undergo a range of general Health and Safety, Fire Safety and First Aid courses leading to certification. Candidates from some of these centres have used very commendable, excellent photographic records to embellish their portfolios.

Practical activities seen were varied and usually enabled candidates' achievement at the appropriate level, but were not always applied in nature. The converse was also true; some of the centres developing more innovative assignments had not always appreciated opportunities to stretch more able candidates or tailor tasks carefully to the assessment criteria.

For inexperienced centres, whose approach does not yet have a truly applied feel, a list of suitable practical activities that have been implemented successfully is attached in Appendix I.

Comments on assessment

The vast majority of centres are applying the assessment criteria appropriately. Some are not, however, apportioning marks to each skill area using the method recommended by OCR, while others are not recording these in a manner conducive to candidate assessment or beneficial to the Moderator.

As indicated in the specification, in strands a, b and c, and in certain instances in other strands, eg, the calculations in strand d, assessor annotation of candidate portfolios is essential in the endorsement of the mark band attained. It should be noted that a mark band should be clearly indicated on candidates' work in *each* of the strands b-e for *each* practical activity. Attachment to each portfolio of a completed OCR-recommended grid greatly speeds up the moderation process.

It was of note this session that the centres supplying copies of assignments undertaken to their moderator has become fewer in number (though this was often compensated for by information provided in a covering letter). Note that the provision of copies of the assignments greatly assists the Moderator in judging the degree of guidance given to candidates. It is recommended that *all* centres do this in future to help to facilitate the moderation process.

Centres' attention is also drawn, in particular, to the fact that candidates working towards a Band 3 score must now have a full complement of practical activities at a minimum of Band 1. Candidates working towards Band 3 should be recording and processing data and observations independently, and writing conclusions and evaluations without the aid of writing frames or very prescriptive questioning.

A small minority of centres still continues to undertake more than the required number of practicals and also include superfluous material and notes in candidate portfolios, along with, in some instances, more than one draft of assignment work. While the latter shows the evolution of a candidate's work, it is unnecessary and can impede the moderation process. Centres should only submit that work which is necessary for inclusion, clearly labelled as each of the designated areas for practical activities.

Strand a
A report on research into working safely in science, including hazards and risks, first aid and fire prevention

In this strand, many candidates' portfolios have been of a very high standard indeed. In some however, centres have been very generous in their apportionment of marks.

Candidates are assessed on their use of information sources and the quality of the report.

To confirm the range of information sources used, candidates should be encouraged to reference sources in-text (in particular, visual material) and compile a References' List. At Band 3, this should be written with appropriate detail according to an accepted convention. There should also be some justification as to why each source was used. The use of 'copy and pasted' material should be discouraged, but if included, information from respective sources should be linked together with appropriate text, and credited appropriately.

Candidates are also assessed on the quality of the report, which must contain textual *and* visual material (which is often lacking or limited) at the appropriate level. Those working at Band 3 are expected to demonstrate an in-depth understanding of Health and Safety; arguably this is best

demonstrated by the application of the principles of Health and Safety to new situations, for instance reviewing Health and Safety provision on workplace visits.

Strand b
Carry out Risk Assessments

It is recommended that centres provide appropriate proformas for Risk Assessments and give guidance to the less able candidates so that *all* candidates should produce a workable Risk Assessment. The level of guidance given should then be indicated by teacher annotation. Caution should, however, be exercised in the use of some of the Risk Assessment proformas in published materials. Those listing potential hazards will necessarily limit candidate performance to Band 1.

Risk Assessments were frequently given too generous a mark by centres. They were often too simplistic and generic; a common fault was to list many generic hazards and their associated risks.

Centres awarding Band 3 for a Risk Assessment should note that it should be *'full'* and *'appropriate'*. For a Risk Assessment to be full, candidates working at higher levels should not be omitting specific hazards to be considered, such as microscopical stains, reagents in qualitative tests, or an indicator in a titration. Candidates working at higher levels could also be stretched by encouraging them to consider, for instance, the hazards on completion of the Standard Procedure followed; for instance, the products of a chemical reaction, or those from an incubated agar plate. A Risk Assessment that is 'appropriate' refers, for instance, to a correct match between the concentration of a chemical used and its hazard and associated risk.

Strand c
Follow standard procedures involved in practical tasks using scientific equipment and materials

In some centres, the confirmation of the competence of the candidate in the selection of equipment and the carrying out of each standard procedure was clearly indicated. Centres had used OCR's 'Certificate of Practical Skills' or simple annotation of candidates' portfolios. A very few centres, however, are still giving just a single, overall mark of candidate performance, without designating how this is made up. This needs to be addressed by centres so that moderators can endorse fully the Strand c mark awarded.

Centres should also pay due consideration to Strand d performance when assigning levels to practical competence. Some centres are awarding high levels for Strand c, when data recorded do not support this, eg, for titration readings.

Strand d
Make observations and obtain and record measurements

Centres are, in general, assessing this strand accurately, though there are some anomalies. Candidates are assessed on the recording and display of observations and measurements, commenting on or carrying out repeats, and on appropriate calculations.

For candidates working at Band 3, all tables and graphs should be appropriately labelled, and units should be included. At this level, data should be recorded to an appropriate and equivalent number of decimal places. For titration readings, for instance, volumes (ideally) should be recorded to the nearest 0.05 cm^3 (or 0.1 cm^3) and all data expressed to two (or one) decimal places.

Writing frames should be used with caution. While blank tables and axes of graphs are appropriate for lower ability candidates, their use will preclude achievement of Band 3, and unless the data recorded are particularly complex, eg the counts from cells of a haemacytometer, at Band 2 also. When awarding high levels for microscope diagrams, centres should ensure that candidates are producing these accurately, and also, not simply replicating textbook versions.

Graphs should also be drawn for practical activities *where they are appropriate*. Centres have acknowledged that this is not possible in all areas, but equally, some are not looking sufficiently hard for opportunities. Teachers should also check carefully mark bands awarded to graphs. Some candidates, having confused the plotting of dependent and independent variables, or having omitted units, were nevertheless awarded Band 3 by centre marking.

To achieve Bands 2 and 3, candidates must make appropriate calculations:

'Simple' calculations at Band 2 include means, percentages, magnifications (eyepiece x objective lenses) and simple substitution in equations, such as calculation of density.

Manipulating data at Band 3, includes calculations involving the rearrangement of equations (for instance, for titration calculations or V = IR for calculations of electrical resistance), scales on cell diagrams, dimensions of cells and other microscopical observations; cell counts using haemacytometers; calculations of the concentrations of solutions from titrations and the tensile strength of materials.

Centres should annotate candidates' work, indicating the formulae given to make their calculations. Note also that at Band 3, it is essential that candidates have an appreciation of the use of significant figures.

At Band 2, candidates should at least comment on the use of repeats, even if they do not think that they are required. At Band 3, candidates should carry out 'repeats' whenever it is practicable to do so. Should it not be practicable – for instance in destructive testing – class results could be pooled. This is, of course, the very purpose of carrying out Standard Procedures, so that data are comparable.

Strand e
Analyse and evaluate data

Some centres are awarding marks too generously in this strand. All students should be encouraged to make, at the very least, rudimentary conclusions *and* evaluations of calculations where these are appropriate, to achieve a mark for this strand.

At Band 3, and to a lesser extent at Band 2, candidates should be relating their findings to relevant scientific knowledge and understanding in Unit 2, eg explaining, using particle models, why metals are better conductors of heat than polymers. Higher level candidates should also compare, where possible, their findings with those reported in the scientific literature, eg values of the densities or resistivities of different materials.

For candidate evaluations, comments relating simply to how successful the standard procedure was are credited with no more than Band 1. At Band 3, candidates should comment on strengths and weaknesses of the procedure, and be using the terms, 'accuracy', 'precision' and 'error', along with perhaps introducing ideas of 'repeatability' and 'reproducibility' of techniques and data. Suggestions for improvements should be included and explained at this level.

Appendix I Practical activities undertaken

Microscopy
Preparing temporary slides of banana cells; onion cells
Preparing temporary slides of cheek cells
Examining prepared slides of plant and animal tissues
Yeast cell counts (using haemacytometers)
Comparing fibres
Forensic examination of hair
Examination of stomata

Microorganisms
Antiseptic and disinfectant sensitivity testing
Investigating the effects of antibiotics on *Escherichia coli* (could also extend to Unit 3)
Producing and evaluating yogurt

Qualitative analysis
Identification of unknown salts
Forensic science investigations (testing for anions and cations)
Chromatography of ink

Quantitative analysis
The concentration of ethanoic acid in vinegar
Determining the concentration of citric acid in carbonated drinks
Determining the concentration of sodium hydrogencarbonate in eardrops
Estimating the amount of aspirin (acetylsalicylic acid) in aspirin tablets

Electrical properties
Determining the resistance of a wire (material used, length, diameter)
Testing wires for their suitability as a heating element
Testing wires for their suitability as electrical cables

Other physical properties
Properties of food packaging materials
Properties of polymers labelled as biodegradable
Properties of insulating materials
The thermal conductivity of materials
Investigating the properties (compressive strength, porosity, density) of mortar made to different specifications
Investigating the viscosity of different oils

Appendix II Awarding of marks

Unit 1: Awarding of Marks

Strand a:

Working Safely in Science (12 marks)

A report on research into working safely in science including:

- Hazards and Risks
- First Aid
- Fire Prevention

Marks should be awarded as follows:

Band 3:	12 marks for **three** areas at band 3
10-12 marks	11 marks for **two** areas at band 3; the other areas at least band 1
	10 marks for **one** area at band 3; the other areas at least band 1
Band 2:	9 marks for **three** areas at band 2
7-9 marks	8 marks for **two** areas at least band 2
	7 marks for **one** area at least band 2
Band 1:	6 marks for **three** areas at band 1
0-6 marks	3, 4, 5 marks for **two** areas at band 1
	1 or 2 marks for **one** area at band 1

Laboratory notebook

A candidate's laboratory notebook needs to include records of six practical activities – one in each of the following:

- Microscopy
- Culturing organisms
- Qualitative analysis
- Quantitative analysis
- Electrical properties
- Other physical properties

In each strand, for each activity, marks should be awarded as follows:

Strand b:

Produce Risk Assessments (6 marks)

Band 3:	6 marks for **six** completed risk assessments at band 3
5-6 marks	5 marks for **four or five** completed risk assessments at band 3; one at least band 1
Band 2:	4 marks for **six** completed risk assessments at, at least band 2
3-4 marks	3 marks for **three, four or five** completed risk assessments at, at least band 2
Band 1:	2 marks for **six** completed risk assessments at, at least band 1
0-6 marks	1 mark for **two, three, four or five** completed risk assessments at, at least band 1

Strand c:

Follow standard procedures involved in practical tasks using scientific equipment and materials (8 marks)

Band 3:	8 marks for **six** completed activities at band 3
7-8 marks	7 marks for **four or five** completed activities at band 3
Band 2:	6 marks for **five or six** completed activities at, at least band 2
4-6 marks	5 marks for **four** completed activities at, at least band 2
	4 marks for **three** completed activities at, at least band 2
Band 1:	3 marks for **five or six** completed activities at, at least band 1
0-3 marks	2 marks for **three or four** completed activities at, at least band 1
	1 mark for **one or two** completed activities at, at least band 1

Strand d:

Make and record observations and / or measurements, present and process data (12 marks)

Band 3:	12 marks for **six** completed activities at band 3
9-12 marks	11 marks for **five** completed activities at band 3; the other activity at least band 1
	10 marks for **three or four** completed activities at band 3; the other activities at least band 1
	9 marks for **one or two** completed activities at band 3; the other activities at least band 1
Band 2:	8 marks for **five or six** completed activities at band 2
6-8 marks	7 marks for **three or four** completed activities at band 2
	6 marks for **one or two** completed activities at band 2
Band 1:	5 marks for **six** completed activities at band 1
0-5 marks	4 marks for **five** completed activities at band 1
	3 marks for **three or four** completed activities at band 1
	2 marks for **two** completed activities at band 1
	1 mark for **one** completed activity at band 1

Strand e:

Draw conclusions and evaluate data (12 marks)

Band 3:	12 marks for **six** completed activities at band 3
8-12 marks	11 marks for **five** completed activities at band 3; the other activity at least band 1
	10 marks for **three or four** completed activities at band 3; the other activities at least band 1
	9 marks for **two** completed activities at band 3; the other activities at least band 1
	8 marks for **one** completed activity at band 3; the other activities at least band 1
Band 2:	7 marks for **five or six** completed activities at band 2
5-7 marks	6 marks for **three or four** completed activities at band 2
	5 marks for **one or two** completed activities at band 2
Band 1:	4 marks for **six** completed activities at band 1
0-4 marks	3 marks for **five** completed activities at band 1
	2 marks for **three or four** completed activities at band 1
	1 mark for **one or two** completed activities at band 1

Appendix III Recording of marks

Candidate					
Developing scientific skills					
	a	**b**	**c**	**d**	**e**
	Working safely in science	**Risk assessment**	**Follow procedure**	**Record display process data**	**Conclusion and evaluation**
Hazards and risks					
First Aid					
Fire Prevention					
Microscopy					
Culturing organisms					
Qualitative analysis					
Quantitative analysis					
Electrical properties					
Physical properties					
Mark for strand					
TOTAL for unit					

B482/01: Applied Science: Double Award, Foundation Tier

General Comments

The Foundation tier paper is designed to test the knowledge and skills of candidates performing at grades GG to CC. In this session, candidates were appropriately entered for the Foundation tier paper; most showed knowledge across all question areas. Candidates made good use of time and very few part questions were left unattempted.

Comments on Individual Questions

1 (a) Most candidates gained at least one mark for understanding the nature of composite materials. A common incorrect choice was the idea that composites contain only synthetic materials.

(b) Most candidates knew the stainless steel is a metal; the ceramic nature of pottery was less well known.

(c) The ideas that thermoplastics both burn and change shape when heated were both well known. However, most candidates only made a single point, implying that they did use the mark allocation for the question (two marks) to guide the detail in their answer.

(d) (i) Most candidates gained some credit. A common one mark answer was to give liquid and gas in the wrong order.

(d) (ii) Most candidates gained at least one mark for giving a safety precaution when handling bleach. Those who failed to score tended to give laboratory, rather than household, precautions, for example 'wear goggles' or 'wear protective clothing'.

2 (a) Most candidates found this question easy and gained two marks for correctly identifying the purpose of each agrochemical.

(b) Almost all candidates knew that fertiliser increases growth.

(c) Most candidates identified the nucleus and cell wall correctly. There was often confusion between the cytoplasm and chloroplast labels.

(d) Most candidates gained two marks for correctly linking the cell parts with their functions. This is a well understood area of the specification.

(e) Commonly, two marks were scored. Most candidates knew at least one feature of intensive farming.

3 (a) (i) Candidates did not know the percentages of gases in the air. Most did not gain any marks for this part question. Many thought that carbon dioxide was a major gas, with values of 21% and 78% regularly being chosen.

(a) (ii) About two-thirds of candidates identified carbon dioxide as being the gas responsible for increasing the Earth's temperature.

(b) (i) Almost all candidates knew that forest fires and hurricanes are not caused by plate movements.

(b) (ii) This question was not well answered. The main problem was that many candidates gave examples of changes that do not directly affect the Earth's surface, for example weather changes such as flooding.

(c) Almost all candidates could identify correctly recent astronomical discoveries.

4 (a) Most candidates correctly extracted information given in the stem of the question to explain that face masks do not function well owing to their small holes and the fact that they get wet in use.

(b) Candidates found this question difficult because they did not link their answers to the underlined advice, as the question asks. Vague answers that were not linked to the advice such as 'the germs would not spread' were not given credit. Better answers linked each action to an outcome; for example, that burning kills microorganisms.

(c) (i) Most candidates identified at least one, and often both, of the microorganisms that cause health problems.

(c) (ii) Again, most candidates were able to identify health problems that are caused by microorganisms.

(c) (iii) Most candidates knew that antibiotics and beer are made using microorganisms, but a significant number of candidates thought that microorganisms were involved in making artificial fertiliser.

5 This is the first of the 'overlap' questions in common with the higher tier paper. These last questions proved difficult for most Foundation tier candidates and the marks scored were generally lower.

(a) (i) Few candidates gained marks for completing the equation. Less than a third knew that H_2 is hydrogen or that the symbol for iron is Fe. Almost no candidates on the Foundation tier knew the formula for sulfuric acid. There is an appendix (Appendix D) in the specification which has a list of formulae that candidates are expected to know.

(a) (ii) Almost no candidates were able to identify all four chemicals as elements, compounds and mixtures. The commonest error was to classify dilute sulfuric acid and iron sulfate solution as compounds rather than mixtures.

(b) (i) About one-third of candidates recognised the correct portion of the graph where the reaction rate was fastest.

(b) (ii) Slightly more candidates recognised that the reaction ends when the graph levels out and were able to read off the correct time.

(b) (iii) Nearly all candidates could read the vertical axis of the graph correctly to give the volume of gas at the end of the reaction.

(c) This question was very demanding. The reaction rate is slower, but the volume of gas is also lower. Most candidates suggested changes that would lead to a lower rate but would not affect the final gas volume, eg use a lower temperature or larger pieces of iron.

(d) This part question was well answered. Most candidates know the stages that involve the safety of medicines.

6 (a) The commonest incorrect choice was to say that a scientific definition of insulation is that it 'keeps things warm'.

(b) Most candidates did not score any marks for linking the method of heat transfer to the feature of the duvet. This area of the specification is not well understood.

(c) (i) Over half the candidates correctly calculated the Tog value for the duvet using the information in the question stem.

(c) (ii) This calculation was much more demanding and was beyond the abilities of most foundation tier candidates. Many multiplied, rather than divided, the two values, giving an incorrect response of 40 $^{\circ}$C.

(d) (i) Very few foundation tier candidates knew the formula that links power, voltage and current.

(d) (ii) Some candidates carried out a correct calculation, but very few knew that the units of power are watts.

(e) Some candidates discussed the idea that duvets with a higher Tog rating are better insulators, but almost no candidates explained the importance of the difference in temperature outside of the duvet in the winter compared with in the summer.

B482/02: Applied Science: Double Award, Higher Tier

General Comments

The Higher tier paper is designed to test the knowledge and skills of candidates performing at grades CC to A*A*. There was evidence to suggest that a significant number of candidates were inappropriately prepared for the Higher tier paper. In particular, many appeared unfamiliar with specification content specifically identified as Higher tier. This is an on-going problem that seriously disadvantages candidates.

Candidates made good use of time with very few part questions left blank.

Comments on Individual Questions

Question No. 1 Common with Foundation
For **a**(i), 'Hydrogen' and 'Fe' were often answered well, but few were able to recall correctly the formula for sulfuric acid. Very few gained full marks in **a**(ii); most confusion was with 'iron sulfate solution' and 'dilute sulfuric acid'. The majority correctly chose 2 or 3 out of 4.

In **b**(i), the most common correct response was to place the cross at 30 s. Most mistakes were made by placing the cross towards the end of the reaction, where the curve flattens off. Many candidates lost marks in **b**(ii) by forgetting the units or by taking the end of the graph as being the end of the reaction. **b**(iii) was answered correctly by most candidates

In **c**, the majority of candidates put a change/reduction in temperature, failing to notice the reduction of products formed and therefore failing to conclude that there must have been a reduction in the reactants.

Most candidates gained full marks in **d**, with some losing marks by choosing the 'monitoring factory waste' and/or 'packaging' options

Question No. 2 Common with Foundation
Part **a** was mostly answered well, although the most common mistakes were choosing 'increase the flow of energy' and 'keeps cold out'

In **b**, few candidates where familiar with the mechanisms for reducing specific types of heat transfer.

The majority correctly calculated the Tog value in **c**(i). Candidates coped less well with the calculation in **c**(ii), with a variety of numerical answers offered, but with little indication as to how they were arrived at.

Only a minority of candidates recalled the equation power = current x voltage for **d**(i). In **d**(ii), as is often the case, candidates could do the calculation correctly without recall of the formula, or indeed in some cases, in spite of an incorrect formula. Units were rarely given as watts. Candidates quite often put joules as the unit, or wrote part of the numerical answer in the section where the unit should have been written.

In **e**, candidates often used absolutes in their answers instead of comparing, eg 'stores heat', rather than 'stops heat escaping'. The most common correct response was 'more insulation'. Very few candidates gained the second mark for comparing the change in room temperature in the different seasons. Weaker candidates simply talked about keeping warmer because it is colder in winter.

Question No. 3
Knowledge of the heart was weak. Very few candidates correctly answered **a**(i), with the majority putting A (aorta) or B (left atrium).

a(ii) Seemed to be answered rather better than the previous part of the question, but all incorrect options appeared to be selected fairly equally.

In **a**(iii) Few candidates knew that the valve prevented flow of blood back into the ventricle. Most incorrect answers said that part e had a role in pumping blood.

Most commonly, marks were awarded for the 'blood being pumped at high pressure' and 'round the whole body' in **a**(iv). Often, answers just stated that that side 'worked harder,' while weaker candidates referred to the side being thicker for protection.

The most common error in **a**(v) was the idea of a double circulatory system being needed for oxygenated and deoxygenated blood.

Many candidates scored reasonably well in part **b**. Most errors related to the function of the blood vessels.

In **c**, very few candidates recalled the reversible reaction symbol; in most cases, a normal right-handed arrow was seen. There was a variety of answers for the product, with few coming up with oxyhaemoglobin.

Question No. 4
a(i) was answered well; the majority of candidates got the idea that the continents were once joined. Many also scored well in **a**(ii); the most common error was no evidence of a land bridge.

In **b**(i), very few candidates were able to describe what a tectonic plate is. Credit was given here for stating that the plates moved. Most marks in **b**(ii) were obtained by drawing correctly the arrows for the direction of the plate movement, although often, arrows were drawn to represent gravity and convection currents. They were not labelled as requested in the question and so the marks were lost. Marks were often lost by 'gravity' down arrows not being vertical.

Question No. 5
Some candidates managed to gain a mark in **a**(i), for more than one type of material making up a composite, but not many elaborated on that by stating that they were bonded together.

a(ii) was generally answered well; most candidates commonly stated that the material is hardwearing and stronger. Many incorrect answers mentioned environmental advantages.

For **b**(i), few candidates came up with the idea that there were cross-links between the molecules, and even fewer stated that the chains would not be able to move. Candidates often simply described the pattern in picture and how the structure was compact. In **b**(ii), thermosetting was often seen; common incorrect responses included 'melamine' and 'polymers.'

In **c**, many candidates gave the best responses of nitrogen and water vapour, while a smaller group included either carbon dioxide or carbon monoxide. Only the weakest candidates included oxygen.

As in part **b**(i), most answers to **d** described the picture rather than the similarities and differences in the bonding. Where candidates attempted to refer to the molecular structure, they did not often refer to **long** chain molecules/cross-links, or make it clear if they were referring to melamine **or** sealant.

Question No. 6

'Active transport' was very rarely seen in answer to **a**; in the second part, 'photosynthesis' was seen far more often than the correct answer, 'respiration'.

In **b**, knowledge and understanding of minerals and their functions was relatively poor. However, the majority of candidates did gain one or two marks. There was no pattern apparent in the incorrect responses.

Quite a few of the weaker answers in **c** went down the lines of genetic modification. Often, candidates lost marks by not specifying a characteristic and/or by simply repeating the stem of the question in their answer.

B483: Science at Work (Portfolio)

General Comments

In this session, most centres are to be commended for the way in which this unit has been implemented and delivered. Administration has, on the whole, been efficient, with fewer arithmetical errors and clerical errors evident. Though marking was largely consistent in this session, quite often, limited documentary evidence of internal standardisation was supplied.

Some centres, in particular those new to the course, must make careful checks on the way the assessment criteria are being addressed, and the way in which assessment criteria are translated correctly into marks; this was particularly apparent in this unit. It is also recommended that mark bands for each criterion, for each strand, are also indicated appropriately for the benefit of the Moderator. Guidance on this, from the specification, is reproduced in Appendices II and III. Any centres that might remain unsure of how to apply the assessment criteria accurately should seek further guidance from OCR.

For B483, as well as fulfilling the requirements of the assessment evidence grids, it should be noted that due consideration should be paid to appropriate coverage of the Assessment Objectives of the unit (centres should refer to page 97 of the specification), and Performance Descriptions (pages 114 and 115). One important issue observed in write ups of experimental work by higher ability candidates was that in many instances, only a limited attempt had been made to relate experimental findings to scientific principles (AO2).

For practical activities, centres should also ensure that candidates working at higher levels use good scientific practice and ensure that data are recorded appropriately. Tables, for instance, must be correctly labelled and include units, and candidates should have an appreciation of the use of significant figures. Conclusions at higher levels must relate findings to background science and evaluations must use appropriate scientific terminology. The attention of Centres is also drawn, in particular, to the fact that candidates working towards a Band 3 score must now have a full complement of practical activities at a minimum of Band 2.

Centres should also take particular note of the presentation of candidates' portfolios. While this was often exemplary, it would greatly assist the moderation process if candidates' portfolios were presented in cardboard wallets or cut-flush folders, or bound with treasury tags; please *do not* enclose portfolio material in plastic wallets.

Strand a
A report on how science is used in the workplace

Some good work was seen, but there still tends to be an over-reliance on corporate websites as often the sole information source. While websites such as https://nextstep.direct.gov.uk/planningyourcareer/jobprofiles/Pages/default.aspx http://www.connexions-direct.com and www.icould.com (search for 'Science') often give an excellent introduction to careers, information on qualifications required for those careers, and the background of people found in workplaces that use Science, they should be used as stimulus material, and not the principal reference. Higher scoring candidates should also be *explaining* the significance of these qualifications and skills. It was noted in this session that centres with excellent links with the world of work often did not exploit these to the full.

Note that after the initial overview of science in the workplace at Band 1, candidates should then study **two** organisations in detail. Attention is drawn to the hierarchy among the criteria; candidates are often identifying at Band 1, describing at Band 2, and giving explanations at Band 3. An *explanation* of the importance of the work carried out by an organisation is often

easier when supported by statistical data. There were instances where explanations were lacking, but candidates had nevertheless been awarded band 3.

More emphasis should also be placed on investigating and explaining the *science* used by these workplaces, particularly in candidates working towards higher levels. Some candidates had researched very carefully scientific reasons for the siting of industries, and are realising the implications of this in working with other subject areas. Note that there is no requirement to address *all* reasons cited for the location of an organisation, ie scientific, economic, social and environmental, for *both* of the organisations studied.

Strand b
The production of pure, dry samples from two types of chemical reaction

This strand has been well-covered, with candidates in all centres carrying out appropriate chemical reactions. In instances where three or more chemical samples had been prepared, candidates should select the best two to submit.

The main area of deficiency seen was in criterion six – a review of the energy inputs and the treatment of wastes in the industrial version of the process. While some centres have now found appropriate information sources, the coverage of this criterion was absent, or minimal in others. For candidates researching the commercial extraction and production of copper, centres will find the website www.kennecott.com invaluable (use the whole site = the company report 'Copper Environmental Profile Declaration' is particularly useful – see http://www.kennecott.com/in-the-news/reports/?year=2007.)

For criterion 1, the type of reaction was often not mentioned at all, and the level of science required when discussing the chemical reaction involved was sometimes underestimated at Bands 2 and 3. Centres should also annotate portfolios to indicate that a symbol equation has been balanced by the candidate, or evidence should be presented that demonstrate that the candidate has a clear understanding of how to balance the equation.

A key feature of portfolios of candidates working towards higher levels is that reports should be carefully produced, and not contain simple errors, such as the confusion of lower and upper case, and subscript and superscript in chemical formulae. The latter, in particular, is often an IT issue, and appropriate guidance should be given to candidates here. Note that it is also essential that higher scoring candidates should not use very prescriptive writing frames.

Evaluations were often too simplistic to be awarded Band 3.

Strand c
A report on the assembly and assessment of the effectiveness of one electronic or optical device

In this strand, centres should ensure that discussions of the use of electronic devices and components are not too superficial, and note that *explanations* of why these components are used should be given at Band 3. Candidates should also review a wider series of components than just those used in the device that they produce.

Assessing the performance of electronic circuits, at Bands 2 and 3, should ideally include the collection of numerical data, and centres should ensure that evaluations are carried out to a level appropriate to the ability of their candidates. For electronic devices, the best activities tended to involve the construction of potential divider circuits, which also enabled candidates to discuss the scientific principles involved. Some excellent work was also seen involving the construction of telescopes.

Strand d
A report on mechanical devices

In this strand, centres should ensure that all units are included in tables for candidates working at higher levels.

It should also be noted that for candidates to achieve the full six marks, there is a requirement to investigate the performance of a second, commercial device. Although this is ideally carried out on a practical basis, it could be done using secondary data. Candidates working at Band 3 are expected to evaluate the performance of the devices as well as making efficiency calculations.

Strand e
A report on monitoring the growth/development/response of an organism

In this strand, centres had chosen an interesting range of organisms to monitor. Candidates in many centres sometimes, however, neglected in their discussions the reasons for monitoring the organism. Note that for band three to be awarded, *complex* processing of data is required. The calculation of growth rates is often a way of addressing this criterion at Band 3, though some centres, commendably, are introducing statistics into their analyses of data at this level. Centres should also ensure that candidates working at higher levels display data appropriately and relate their findings to scientific principles. Discussions should, however, be fully integrated into their conclusions; often a good deal of physiological information, when monitoring human performance, is included simply as a 'bolt-on'.

Evaluations were often marked generously.

Appendix I Practical activities undertaken

The production of pure, dry samples from three types of chemical reaction

Redox:	displacement of copper from copper sulfate
	preparation of copper from malachite/copper oxide
Neutralisation:	preparation of potassium nitrate
	preparation of ammonium sulfate/nitrate
Precipitation:	preparation of silver halides
	preparation of barium sulfate
	preparation of Prussian blue [iron(III)-hexacyanoferrate(II)]

A report on the assembly and assessment of the effectiveness of one electronic or optical device

Simple potential divider circuits
Monitoring light and temperature in a greenhouse
A night light
Making a transparency meter
Making an electronic thermometer
Making a telescope

A report on mechanical devices

Investigating levers, pulleys and gears
Investigating gym equipment

A report on monitoring the growth/development/response of an organism

Monitoring yeast growth (in bread and alcoholic drinks)
Monitoring human performance
Monitoring the growth of cress seedlings
Monitoring the behaviour of primates
Monitoring the germination of seeds

Appendix II Awarding of marks

Unit 3: Awarding of Marks

In each strand, marks should be awarded as follows:

Strand a:

A report on how science is used in the workplace (11 marks)

Band 3:	11 marks for **five** criteria at band 3
9-11 marks	10 marks for **four** criteria at band 3; the **other** criterion completed at band 2
	9 marks for **two or three** criteria at band 3; the **other** criteria completed at band 2
Band 2:	8 marks for **five** criteria at, at least band 2
6-8 marks	7 marks for **four** criteria at, at least band 2
	6 marks for **two** or **three** criteria at, at least band 2
Band 1:	5 marks for **six** criteria at, at least band 1
0-5 marks	4 marks for **five** criteria at, at least band 1
	3 marks for **four** criteria at, at least band 1
	2 marks for **two or three** criteria at, at least band 1
	1 mark for **one** criterion at band 1

Strand b:

The production of pure, dry samples from two types of chemical reaction (13 marks)

Band 3:	13 marks for **six** criteria at band 3
10-13 marks	12 marks for **five** criteria at band 3; the **other** criterion completed at band 2
	11 marks for **three or four** criteria at band 3; the **other** criteria completed at band 2
	10 marks for **one or two** criteria at band 3; the **other** criteria completed at band 2
Band 2:	9 marks for **six** criteria at least band 2
6-9 marks	8 marks for **five** criteria at least band 2; the **other** criterion completed at band 1
	7 marks for **three** or **four** criteria at least band 2; the **other** criteria completed at band 1
	6 marks for **one** or **two** criteria at least band 2; the **other** criteria completed at band 1
Band 1:	5 marks for **six** criteria at band 1
0-5 marks	4 marks for **five** criteria at band 1
	3 marks for **four** criteria at band 1
	2 marks for **three** criteria at band 1
	1 mark for **one or two** criteria at band 1

Strand c:

A report on the assembly and assessment of the effectiveness of one electronic/or electrical or optical device (7 marks)

Band 3:	7 marks for **three** criteria at band 3
6-7 marks	6 marks for **one or two** criteria at band 3; the **other** criteria/criterion completed at band 2
Band 2:	5 marks for **three** criteria at band 2
3-5 marks	4 marks for **two** criteria at band 2; the **other** criterion completed at band 1
	3 marks for **one** criterion at band 2; the **other** criteria completed to band 1
Band 1:	2 marks for **three** criteria at band 1
1-2 marks	1 mark for **one or two** criteria at band 1

Strand d:

A report on mechanical devices (6 marks)

Band 3:	6 marks for **three** criteria at band 3
5-6 marks	5 marks for **one or two** criteria at band 3; the **other** criterion/criteria completed at band 2
Band 2:	4 marks for **three** criteria at band 2
3-4 marks	3 marks for **one or two** criteria at band 2; the **other** criteria/criterion completed at band 1
Band 1:	2 marks for **three** criteria at band 1
1-2 marks	1 mark for **one or two** criteria at band 1

Strand e:

A report on monitoring the growth/development/response of an organism

Band 3:	13 marks for **six** criteria at band 3
9-13 marks	12 marks for **five** criteria at band 3; the **other** criterion completed at band 2
	11 marks for **four** criteria at band 3; the **other** criteria completed at band 2
	10 marks for **three** criteria at band 3; the **other** criteria completed at band 2
	9 marks for **one or two** criteria at band 3; the **other** criteria completed at band 2
Band 2:	8 marks for **six** criteria at band 2
5-8 marks	7 marks for **five** criteria at band 2; the **other** criterion completed at band 1
	6 marks for **three or four** criteria at band 2; the **other** criteria completed at band 1
	5 marks for **one or two** criteria at band 2; the **other** criteria completed at band 1
Band 1:	4 marks for **five or six** criteria at band 1
0-4 marks	3 marks for **four** criteria at band 1
	2 marks for **three** criteria at band 1
	1 mark for **one or two** criteria at band 1

Appendix III Recording of marks

Unit 3: Science at work			**Centre:**
Candidate:			

Strand a

Science in the workplace

Criterion		Mark Band
1	Identify careers	
2	Work carried out by organisation	
3	Location of organisation	
4	Job titles and qualifications	
5	Use of science	
6	Quality of report	
Total		

Strand b

Chemical reactions

Criterion		Reaction		Mark Band
		1	2	
1	Type or reaction			
2	Products/reactants/equation			
3	Obtain product			
4	Calculation of yields			
5	Evaluation			
6	Energy input/waste disposal			
Total				

Strand c

Electronic/optical device

Criterion		Mark Band
1	Uses of electronic/optical devices	
2	Assemble device	
3	Evaluate device	
Total		

Strand d

Mechanical device

Criterion		Mark Band
1	Types of mechanical devices and components	
2	Assemble/ investigate performance	
3	Calculations of performance	
Total		

Strand e

Monitoring an organism

Criterion		Mark Band
1	Identify organism	
2	Produce plan/ monitor organism	
3	Record measurements/ observations	
4	Present and process data	
5	Explain findings	
6	Evaluate monitoring process	
Total		

Total for unit:

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