GCSE

Applied Science (Double Award)

General Certificate of Secondary Education **J649**

OCR Report to Centres

January 2012

J649/R/12J

Oxford Cambridge and RSA Examinations

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

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

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

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General Certificate of Secondary Education

Applied Science (Double Award) (J649)

OCR REPORT TO CENTRES

Overview

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 notably, very few part questions were not attempted.

On the foundation tier paper. some questions were well-answered, but in others, there were clear gaps in candidates' knowledge. Many were confused about how antibiotics work, and did not know that baking kills the yeast present in bread, and the question on waves and the electromagnetic spectrum was not generally well done. In common with previous sessions, candidates' knowledge of gases in the air was lacking. Few could describe, from the graph, and explain the fluctuations of carbon dioxide concentration in the air. Candidates should also be reminded to read and assimilate information provided in the question before proceeding to complete the answers.

For the higher tier paper, there was evidence to suggest, in common with previous sessions, that a significant number of candidates were inappropriately prepared for this tier. In particular, many appeared unfamiliar with specification content required at this level. Many able candidates were clearly making educated guesses in some questions, without the scientific knowledge that would have helped. Common errors were often made when giving the names of chemical elements to match symbols, and the use of scientific terms such as, 'organic' (as in chemistry) and the term 'fractional distillation' (as opposed to just 'distillation'). The questions on earthquakes, the reflex arc and temperature control in the human body were not well-answered. Please note also that many questions require candidates to analyse and present answers at a *much higher* level than on the foundation paper.

In the portfolio units, please 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 *all* Centres recorded assessment information on OCR's recommended tracking grid, which can be found in the appendices of this document. 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. 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 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, with detailed knowledge and understanding required at Band 3. *All* candidates should attempt evaluations, and appropriate scientific terminology must be used to procure Band 3. In B483, please note that all criteria must be completed in lower mark bands for candidates to be awarded a Band 3 mark.

B481 Developing Scientific Skills (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, and fewer arithmetical errors and clerical errors were noted when Centres calculated their final marks for the units.

However. a few Centres continue to need to 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.

Though marking was largely consistent in this session, little documentary evidence of internal standardisation was supplied.

For B481, it was apparent that Centres had ensured diligently that candidates had fulfilled the requirements of the assessment evidence grids, Centres are reminded 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). In many instance, the higher ability candidates made only limited attempts to relate their experiment 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 have been seen to develop further themes initiated in previous sessions.

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.

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. In a number of centres, however, this section seemed to be based largely on Internet research.

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 is 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 satisfactorily on the OCR marking grid.

As indicated in the specification, in strands a, b and c, and in certain instances in other strands, eg, the calculations in strand e, 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 few centres supplied copies of assignments undertaken to their moderator, though this was often compensated for by information provided in a covering letter. 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 encouraging candidates to improve the standard of their work in a single activity in Strands d and e, so as to obtain higher marks, must ensure that the necessary criteria, eg, appropriate recording of data in Strand d, are addressed *unequivocally*. 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 minority of Centres still continues to undertake more than the required number of practicals and also includes superfluous material and notes in candidate portfolios along with, in some instances, several drafts of assignment work. While the latter shows the evolution of the candidate's work, it is unnecessary and may 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 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. Many candidates are now acknowledging their source when including images obtained from a website or textbook in their reports, although a number of candidates are only presenting photocopied material and material printed directly from the Internet in their portfolios. Centres need to appreciate that the latter is only appropriate for Band 1.

Candidates are also assessed on the quality of the report, which must contain textual *and* visual material 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. An 'appropriate' Risk Assessment refers, for instance, to an appropriate 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, in titrations.

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. 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 at Band 2 unless the data recorded are particularly complex, eg, the counts from cells of a haemacytometer. When awarding high levels for microscope diagrams, Centres should ensure that candidates are producing these accurately and also, not simply replicating textbook versions.

To achieve Bands 2 and 3, students 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. Candidates should show their working.

Centres should annotate candidates' work, indicating the formulae given to make their calculations. Note also that at Band 3, it is essential that candidates demonstrate 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 to 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 of different materials.

For candidate evaluations, comments relating simply to how successful the standard procedure was, can only be credited at Band 1. At Band 3, candidates should comment on strengths and weaknesses of the procedure, and be using the terms, 'accuracy', 'precision', 'reliability' and 'sensitivity' when discussing equipment and reagents, along with practical difficulties associated with the procedure and sources of error introduced by themselves, but *not* those produced as a result of carelessness. Suggestions for improvements should be explained at this level.

Appendix I Practical activities undertaken

Microscopy
Preparing temporary slides of onion cells
Preparing temporary slides of cheek cells
Examining prepared slides of plant and animal tissues
Comparing fibres
Forensic examination of hair
Examination of stomata

Microorganisms
Antiseptic and disinfectant sensitivity testing
Investigating the effects of garlic extracts on bacteria (linked also with B483)

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
Hydrogencarbonate eardrops

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
Investigating the hardness of materials
Properties of food packaging materials
Properties of insulating materials
The thermal conductivity of materials
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 not attempted.

Comments on Individual Questions

1 **(a)** Most candidates gained at least one mark for this first, straightforward question. Although typhoid is passed through food and water, other answers which showed understanding of the way microbes are passed between people eg touch, were accepted.

(b) Most gained two marks. Dead bacteria were not always known to be the contents of the vaccination, and some candidates thought that the body makes microorganisms.

(c) **(i)** There is some confusion was shown about how antibiotics work. Many candidates thought that antibiotics stimulated the body's immune system in a similar way to a vaccination.

(ii) The parts of the transport system for blood were well known, but some candidates included nerves in their answer.

(iii) Most candidates knew that body temperature is 37°C, but 25°C was a common incorrect choice.

(d) Less than half of the candidates knew both health problems caused by microorganisms. Asthma and cystic fibrosis were common incorrect choices.

2 **(a)** Most candidates gained at least one of the two marks, usually for knowing that electrons are on the outside of the atom. The particles in the nucleus were less well known.

(b) **(i)** Fractional distillation was recognised by most candidates as the separation method for crude oil.

(ii) Most candidates were able to estimate the boiling point of naphtha, using the boiling points in the table as a guide. Some made errors in the range of carbon atoms, often going one number too far either above or below the correct range.

(c) **(i)** Almost every candidate recognised the symbol for flammable.

(ii) Candidates typically gave general laboratory safety advice, such as wearing goggles, and many suggested that workers should not smoke. Vague answers such as 'wear safety equipment' did not score.

(d) Almost all candidates gained at least one mark for identifying the products of crude oil.

3 **(a)** A relatively common error was to attempt to join all four boxes to the three types of electromagnetic radiation. Candidates should be aware that sometimes there is an additional choice which is incorrect for all. The commonest correct answer was to link infrared radiation to its use in remote controls.

(b) The three missing types of electromagnetic radiation were not well known. For one mark, correctly identifying microwaves was the most common correct answer.

(c) **(i)** Just less than half of the candidates correctly identified the label for the wavelength of the wave.

(ii) Few candidates knew the correct definition of frequency. Many attempted to define the 'everyday' meaning of the word, using expressions such as 'how often something happens'.

(iii) Candidates did not know which type of electromagnetic radiation has the longest wavelength or highest frequency. Some attempted to answer using letters from the diagram above.

4 **(a)** **(i)** A common error throughout this question was to pick statements from the table without explaining the science between the process eg saying 'mixing the yeast'. Some candidates thought that yeast expands, which seems to confuse bread expanding with yeast growing or multiplying.

(ii) Most candidates gave answers that did not focus on the yeast, such as 'the bread is baked' or 'it rises more due to the heat'. Few realised that the yeast dies when the loaf is baked.

(b) Most candidates knew that the sugar acts as food for the yeast.

(c) Both parts of this question were well answered. Most candidates knew that the process involved is fermentation, and that beer and cheese rely on a similar process.

(d) Most candidates gained both marks, showing a good working knowledge of the differences between organic and intensive farming.

5 **(a)** Typically, candidates either gained both or neither of the marks. Many confused parts of the skateboard with substances, giving answers such as 'the wheels' or 'the gloves'. Such answers did not score.

(b) Few foundation tier candidates knew all of the characteristics of composites, but many gained a single mark for a partially correct selection of the statements.

(c) **(i)** Most candidates gained two marks by interpreting the information in the diagram to discuss the advantages of ceramics.

(ii) Just over half of the candidates correctly identified the other properties of ceramics from the list.

(iii) Most candidates gained one mark for correctly identifying one ceramic correctly. 'Ionic' was a common incorrect choice.

(d) Very few candidates knew that the main problem with recycling products made from mixed materials is that they must be separated. Most candidates discussed the fact that old skateboards would be 'worn out' or 'rusty'.

6 **(a)** The identities of the gases involved in aerobic respiration, keeping the Earth warm and the relatively high proportion of nitrogen in the atmosphere were not well known by foundation tier candidates. Many thought carbon dioxide or oxygen make up most of the atmosphere.

(b) Most candidates knew that carbon monoxide should be monitored, but fewer picked out sulfur dioxide as a second pollutant gas.

(c) This question asked about the overall trend shown by the graph. Foundation tier candidates were often confused by the variations of carbon dioxide concentrations. Answers such as 'the concentration goes up and down' did not score because it was not clear that the overall trend was upwards. Few candidates were able to give a reason for the fluctuations, but some did recognise that the changes were seasonal.

(d) Few candidates knew that carbon dioxide concentrations are found by examining ice cores. Looking at temperature records and igneous rocks were both common incorrect choices.

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 ongoing problem and can seriously disadvantage candidates.

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

Comments on Individual Questions

Question No. 1 Common with Foundation

Most candidates correctly answered part (a), the most common incorrect answers seen were gloves and steel for part (ii).

In part (b) most candidates knew about the properties of composites and the example of a composite. However many candidates thought composites were always arranged in layers and did not appreciate that the atoms must be different.

In (c), part (i) was answered well with most candidates identifying 2 or 3 advantages. Weaker candidates suggested the ceramic bearings did not get hot. Part (ii) was also answered well; there was no particular pattern to the errors. In part (iii) many candidates did not read the question and only ringed one example, the most commonly missed correct answer was cement, with melamine proving a very common error.

For part (d) many candidates did not discuss the difficulty of separation of composites but gave answers related to the wearing out of materials or the re-using of materials.

Question No. 2 Common with Foundation

Part (a) was well answered with many candidates giving all three gases in the correct order. The most common error was carbon monoxide for carbon dioxide in part (ii).

Again many candidates did not read the question and only ringed one answer in part (b). Carbon monoxide was the common correct answer and methane the most common error.

For part (c) many candidates gave good answers which included both variables in the correct context for part (i). Part (ii) proved challenging with only the better candidates identifying seasonal variation and even fewer linking this to plant activity.

In part (d) few candidates selected the correct answer, examining ice cores, with temp records and igneous rocks being the most common errors.

Question No. 3

Many only scored part marks for part (i) reflecting some gaps in their knowledge of intensive and organic farming. There was no pattern to the errors.

For (b) part (i) the knowledge of elements and their symbols was generally poor - a common error was to write phosphates for phosphorus. Part (ii) was poorly answered with most responses being a vague reference to growth without any further details. A common error was photosynthesis. Very few knew active transport for part (iii), and diffusion and osmosis were the common errors.

Part (c) was basically the recall of required examples but few candidates could do this. For DDT, some candidates who identified it as toxic did not discuss the idea of DDT passing along the food chains or bioaccumulation. In part (ii) very few candidates discussed the idea of passing on disease and similarly for naming the diseases. The most common answer was mad cow disease.

Question No. 4

Part (a) (i) was usually well answered with most candidates gaining both the 6 protons and 6 neutrons mark; the most common error was writing electrons for neutrons. In part (ii) there was confusion between organic and natural. Again in (iii) candidates did not read the question and often only ringed one answer. Ceramics was the most common correct answer and polymers the most common error.

In part b (i) Only a few candidates answered in full ie fractional distillation; too many simply wrote 'distillation' which was insufficient to score. Part (ii) was well answered by many candidates who usually recognised that propane and butane have lowest boiling point or are gases. It was good to see candidates make correct references to size of molecules and number of carbon atoms.

In (iii) many candidates correctly gave bitumen, the most common error was fuel oil.
For part (iv) the most commonly scored marks were for “more demand for petrol” and for the idea of “no waste products”. Many answers simply repeated information in the question.

Question No. 5

Very few candidates knew the correct answer (with virtually no spelling error) in part (a) (i), common incorrect answers included GPS and Richter Scale. Candidates did not know how to find the frequency from the graph in part (ii), although some candidates gained a mark for the units Hz. The calculation of speed in part (iii) was usually done correctly.

Although part (b) could be worked out from the information given, most candidates appeared to be treating it as recall, with many putting the inner core as solid.

Part (c) included many fully correct answers. The most common error in part (i) was showing the plates coming together at the constructive plate margin. For part (ii) the most common correct answers included convection currents or gravity. The most common error was continental drift.

Question No. 6

Many candidates in part (a) incorrectly included B in their answer. The sequence was nearly always incorrect with no apparent pattern to the errors.

In part (b) (i) few candidates got this correct. Some ticked more than one box, Receptors was a common error.

For part (ii) knowledge of vasodilation was very poor. Many candidates gave general answers about temperature regulation with references to shivering and skin hairs.

B483 Science at Work (Portfolio)

General Comments

In this session, almost all of the small number of Centres submitting candidates' portfolios are to be commended for the way in which this unit has been implemented and delivered. Administration has, on the whole, been efficient, though Centres must guard against arithmetical errors when calculating final marks for the units, and clerical errors in the transfer of these onto the OCR Interchange or MS1s.

Centres must also make careful checks on the way the assessment criteria are being addressed, and the 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.

Though marking was largely consistent in this session, little documentary evidence of internal standardisation was supplied.

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). In many instance, the higher ability candidates made only limited attempts to relate their experiment 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. 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 2.

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

Some good work was seen, but much was disappointing. There still tends to be an over-reliance on corporate websites, as often the sole information source, even when good links with scientific workplaces have often been in evidence in the past. While websites such as http://www.learndirect-advice.co.uk/ and http://www.connexions-direct.com often give an excellent introduction to careers, and information on qualifications required for those careers, 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 did not exploit these to the full.

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 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 those 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 more than three 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, this coverage of this criterion was absent, or minimal in others.

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. 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 their device.

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 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 d
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 neglect their discussions of the reasons for monitoring the organism. 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 come 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 much physiological information is included simply as a 'bolt-on'.

Evaluations were usually 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 ammonium sulfate/nitrate
Precipitation:	preparation of barium sulfate

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

Monitoring light and temperature
A night light
Making a transparency meter

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 the growth of seedlings
Investigating the effects of garlic extracts on bacteria (linked also with B481)

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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