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GCSE

Applied Science Double Award

General Certificate of Secondary Education **J649**

Report on the Units

June 2010

J649/R/10

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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.

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CONTENTS

Applied Science Double Award (J649)

REPORT ON THE UNITS

Chief Examiner's Report

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, although notably, some part questions were left unattempted.

There was evidence to suggest, however, that 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 specific to the higher tier and many questions require candidates to analyse and present answers at a much higher level than on the foundation paper.

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 that define the most important learning objectives on the specification.

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 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 (detailed knowledge and understanding is 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 for candidates to be awarded a Band 3 mark.

B481: Developing Scientific Skills (Portfolio)

General Comments

In this session, the majority of Centres is 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. In this session, the small number of centres new to the qualification is to be congratulated on their correct application of the marking criteria.

Centres must also 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.

In this session, many Centres had ensured that internal standardisation procedures had been carried out, and documentary evidence of this was supplied. In a minority, however, the lack of these procedures was evident in inconsistent marking between different teachers, and this is an important issue that has to be resolved.

For B481, it was apparent that Centres had ensured diligently that candidates had fulfilled the requirements of the assessment evidence grids, but it should also 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 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 have been seen to develop further themes initiated in previous sessions.

Centres should also take particular note of the presentation of candidates' portfolios. 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

In this session, many Centres 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 that are inappropriate; please see the appendices, and consult OCR for further guidance if necessary.

Particularly successful has been the industrial involvement in the section on Working Safely in Science, with many 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.

Many instances were seen where several B481 activities were encompassed within a broader context. Particularly successful were those developed around a forensic science or brewing scenario. A more carefully chosen context, in many instances, would not only be more within the spirit of the course, but also be more conducive to candidates' achievement at all levels of ability.

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. An increasing number of Centres has developed a spreadsheet for calculating marks, but Centres must ensure that these are calculating the marks accurately.

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.

Some Centres are also sending to their moderator copies of the standard procedures assignments undertaken by their candidates. This 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. If including images obtained from a website or textbook in their reports, many candidates are now acknowledging their source, although a number of candidates are 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 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 some are not looking sufficiently hard for opportunities. Teachers should also check carefully levels 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, 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.

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 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 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', '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 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 antibiot ics on *Escherichia coli* or *Micrococcus luteus* (could also extend to Unit 3)

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
The concentration of hydrogencarbonate in 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
Properties of food packaging materials
Properties of polymers labelled as biodegradable
Properties of insulating materials
The thermal conductivity of materials
Investigating the properties (compressive stren gth, 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
7-8marks	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
9-12marks	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.

Teacher's tip:
Candidates aiming at a grade CC should be entered for the foundation tier paper where they will be able to show what they know and can do. The higher tier paper is designed to differentiate between higher grades.

More candidates left answers blank than in previous sessions. Sometimes this happened in questions where an answer had to be selected from a tick list or a 'put a ring around' list. In some cases, questions that asked for 'two ticks' in boxes were only given a single selection by candidates. Candidates should be encouraged to complete all the questions.

Comments on Individual Questions

1 This question was an introductory question and, along with the other earlier questions on the paper, was designed to test achievement between grades GG and EE.

Candidates found this question difficult, many only scoring one or two marks.

a) In (i), most knew the cell wall and cell membrane, but many reversed the order (which was given a single mark). Cytoplasm was less well known. Not many correctly gave 'nucleus' and 'chloroplast' for storage of information and photosynthesis, respectively. Guesswork, by including any of the cell parts, was common.

b) Very few candidates knew the process of selective breeding but most guessed by filling in the blanks using the given words.

2 This question produced higher scores. Most candidates showed some knowledge of the chemistry of oil and its products.

a) Most candidates identified at least some of the true statements correctly. Interestingly, not all candidates knew that the compounds are organic. The confusion with organic vegetables seems to cause problems here.

b) All knew 'carbon' but not all gave 'hydrogen'. Common incorrect answers were 'hydrate' and 'chlorine'.
All knew that petrol is a mixture of compounds.

c) The products of crude oil were not well known. Many thought chlorine was a crude oil product.

> **Teacher's tip**
> The products that the candidates have to know are given in the specification. Use the list in revision activities.

d) Most knew that mining operations are 'noisy', gaining an easy 'disadvantage' mark. Fewer gave a mark-worthy advantage. 'Cheap fuel' was a common incorrect answer. Some correctly identified that mining brings jobs into an area.

3 Candidates found the graph unexpectedly tricky to interpret.

a) Vague answers cost marks, such as 'it's accurate'.

b) In both (i) and (ii), candidates found interpreting the graph difficult. Not all realised that Joe's temperature fell when he slept and increased when he woke. Only about half the candidates gave the correct time (2.00) for his waking up.

c) Not all candidates realised that Joe's temperature was below the average. Again, this implies difficulty in understanding the graph.

d) Very few knew that 'respiration' is the process that produces heat.
Most knew the processes that increase when Joe moves.

e) Very well answered! All knew about the processes of transfer of microorganisms between people.

4 This question was the last of the lower demand questions on the paper. Most candidates scored over half marks. Candidates seem to do well in questions where they are given information to interpret.

a) Most scored a single mark. The last distracter 'Electricity generation produces no harmful gases' was commonly incorrectly chosen. Candidates were perhaps confused because the electric *car* does not produce harmful gases during use.

b) Answers saying merely 'it is cheaper' did not score. The mark scheme demanded an explanation such as 'cheaper to run' or 'only 2p per mile'.

> **Teacher's tip**
> Examiners very rarely accept 'cheaper' as a correct answer. Candidates need to qualify cost answers by explaining why the cost is cheaper e.g. in this case running cost.

c) Most came up with only one, rather than two disadvantages.

> **Teacher's tip**
> Candidates need to use the mark indication to decide how many points to make in their answers.

d) Almost all candidates knew that heat is an output from the car. Many also correctly gave 'electrical' as the input.
Very few correctly selected 'movement' as the main output. 'Light' was a common choice, presumably because candidates often meet Sankey diagrams in the context of light bulbs.

5 This question was an 'overlap' question which also appeared on the higher tier paper. It was designed to test achievement at CC and DD grades. Consequently, it was difficult for many foundation tier candidates. Very few scored more than one or two marks.

a) Very few identified that salt dissolved in water is a solution. 'Solvent' was a common incorrect choice.

b) Candidates always find continuous and disperse phase questions difficult. Just identifying that both mixtures were a liquid-gas mixture scored (2) but many incorrectly put 'solid' into one or both rows in the table.

> **Teacher's tip**
> The mixtures that the candidates need to know are given in the specification. These are the only ones that are tested on the examination papers. Use these mixtures as examples in teaching and revision.

c) Vague wording meant that candidates did not score well here. Many confuse reusing with recycling. Answers such as 'use them again' did not score, as they imply that the cans can be refilled. Very few gave arguments about landfill space or saving finite mineral resources. This area of the specification is not well known.

d) Most candidates did not give clear arguments for why the cans do not work at $5^{o}C$. Answers such as 'it's too cold' were common. Few linked their answer to the information about boiling points given in the question.

6 The last question on the paper was also targeted at grades DD to CC. Again, foundation tier candidates found this question difficult. Many failed to score more than two or three marks.

a) Most candidates knew that the surface of the Earth has changed due to movement, but were unclear that this movement is due to tectonic plates. Very few could give a further example of a slow change, although some did correctly suggest 'making mountains'. Many chose fast changes (such as earthquakes or volcanoes) or changes that were not related to the process (such as global warming).

b) Very few correctly identified photosynthesis here.

c) Most gained an easy mark for saying that oxygen was needed 'for breathing' but many also thought that carbon dioxide was needed 'for breathing'. Few correctly discussed the fact that the Earth would be too cold for life without the Greenhouse Effect.

d) Many did not score here because, although they knew that the Solar System contains planets, they also listed 'stars and galaxies' as also being a part. All knew that the Universe started with the 'Big Bang'.

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.

Comments on Individual Questions

1 This is an overlap question aimed at grades C and D and is common with the foundation paper.

- a) Most scored the mark for solution, the most common error was 'solvation'.
- b) Candidates were often confused between 'continuous' and 'dispersed' phase, getting gas and liquid the wrong way round. Solid was also a common error in the shaving cream row.
- c) i Answers were often too vague to gain a mark such as 'cheaper' and 'good for the environment'. Candidates also needed to clarify that they were talking about the 'metal' being reused.
- c) ii Mostly answered well. Weaker candidates described the content of the can and the idea that they were dangerous or needed cleaning, which is insufficient.
- d) i Common mistakes were 'chloride' and 'carbon hydroxide'
- d) ii Answers were often vague, stating that 'the gas doesn't work' or that it wrongly 'turns to a solid', showing that a lot of candidates were not able to interpret the information on boiling points correctly.

2 This is an overlap question aimed at grades C and D and is common with the foundation paper.

- a) i This was answered well, mainly. Some candidates lost marks by not mentioning 'tectonic plates', and a selection didn't read the question properly and described the effects of global warming.
- a) ii Many candidates missed 'changes to the Earth's surface' in the question and gave answers relating to climate change. Also many missed 'changes that are very slow' and stated volcanoes and erosion as answers.
- b) Few candidates identified 'photosynthesis' as the process involved. A common error was to simply repeat the change described in the question.
- c) i By far the most popular answer was 'to breathe,' which on this occasion was accepted for a mark.
- c) ii Most marks were picked up for 'photosynthesis', although many only described the process, which was insufficient for a mark. Many candidates were confused about the affect of CO_2 on temperature, and most candidates missed the 'greenhouse effect' mark.
- d) i Candidates lost marks by describing the contents of space rather than 'the solar system,' often losing marks for stating 'stars' and 'galaxies' as an answer.
- d) ii Answered well, with many stating 'big bang'. The most common error was referring to explosions.

3 a) Very few described the change of state, to gas, required for the mark, although many insufficiently described separation as a reason for the heating.

b) Most candidates correctly chose for 2 or 3 of the statements. The mostly commonly incorrect were, 'The process involves distillation' and 'The compounds in the fractions are organic chemicals.'

c) i Many gave correct answers and often included all three of the possible fuels.

c) ii Candidates mostly failed to describe the fractions in terms of 'supply and demand.' The mostly commonly gained mark was for the kerosene and bitumen being produced with the petrol.

c) iii Candidates mostly lost this mark by not describing the molecules in terms of the amount being 'supplied' as required by the question. Answers were often very vague.

d) The most common correct answers were tarmac and cosmetics. A significant minority lost marks by stating fuels and giving a use, which is already stated in the question.

4 a) In general, the boxes in the food web were completed well. However, very few were able to complete the arrows. The mostly commonly missed arrow was from the heather to the voles.

b) Many candidates scored both marks, usually for the idea that foxes kill grouse and that there would be more grouse. Few candidates gave the 'commercial advantages' point.

c) i The mark here was commonly lost for incomplete explanations; many missed stating that there would be more foxes.

c) ii Many candidates failed to observe that voles and grouse were competition for the same food resource (or that they don't eat each other!). They instead described the affect of the fox on the two animals, which was already covered in the previous two parts of the question.

d) This question was mostly answered well, although many lost the mark relating to the process continuing over generations. Most gained the select and breed marks. The descriptions of other species being bred with grouse and transfer of genetic material highlighted many candidates' misunderstanding of the term 'selective breeding'.

5 a) i Most candidates gained all 3 marks. The most common error was to mix up conduction and convection. This confusion was often carried over to part aii.

a) ii Candidates were often missing out 'particles' in their explanation of conduction and convection. Knowledge often seemed limited to 'vibrating particles' for conduction, with few describing how the energy was passed on. Convection was answered less well, with the omission of 'particles' leaving a great portion of candidates without a mark.

a) iii Candidates' omission of the 'method' of heat transfer meant that many lost out on a mark. Most answers were vague comments about insulation or keeping heat in.

b) This was mostly answered well. Common errors were candidates missing out the 'x100' and dividing 'energy coming' in by 'energy used' instead of the other way round.

6 a) This was answered well. Few were penalised for capitalisation and subscript errors. Marks were most commonly lost for balancing errors and an incorrect formula for glucose.

b) i Candidates had difficulty explaining the advantage of aerobic respiration over anaerobic respiration. They often incorrectly referred to the speed of respiration or the use of oxygen in aerobic respiration.

b) ii Few candidates explained about the need for extra oxygen to break down lactic acid. Instead, many described why lactic acid is formed in the first place.

c) Very few candidates scored even one mark here. Most candidates described the lack of oxygen as the reason for the breathing rate increase. Those that did mention carbon dioxide did not specify that it was in the blood or the role of the brain.

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, 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. In this session, the small number of centres new to the qualification are to be congratulated on their correct application of the marking criteria.

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 recorded carefully 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.

In this session, many Centres had ensured that internal standardisation procedures had been carried out, and documentary evidence of this was supplied. In a minority, however, the lack of these procedures was evident in inconsistent marking between different teachers, and this is an important issue that has to be resolved.

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 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).

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.

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 1.

Centres should also take particular note of the presentation of candidates' portfolios. 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 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.

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.

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, i.e., 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.

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 - difficult to address, but some have now found appropriate information sources.

For criterion 1, the type of reaction was often not mentioned at all, however, and the level of science required when discussing the chemical reaction involved was sometimes underestimated at Bands 2 and 3. Centres should 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. 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’. The calculation of growth rates is often a way of addressing criterion four at Band 3, though come Centres, commendably, are introducing statistics into their analyses of data at this level.

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 sulphate
preparation of copper from malachite/copper oxide

Neutralisation: preparation of potassium nitrate
preparation of ammonium sulfate/nitrate
preparation of sodium citrate

Precipitation: preparation of zinc carbonate/hydroxide
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 o ne electronic or optical device

Simple potential divider circuits
Monitoring light and temperature in a greenhouse
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 human performance
Monitoring the growth of plants (cress, broad beans, *Pelargonium*)
Monitoring the growth of chicks
Monitoring the behaviour of various 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
6-8marks	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: **6-7 marks**	7 marks for **three** criteria at band 3 6 marks for **one or two** criteria at band 3; the **other** criteria/criterion completed at band 2
Band 2: **3-5 marks**	5 marks for **three** criteria at band 2 4marks 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: **1-2 marks**	2 marks for **three** criteria at band 1 1 mark for **one or two** criteria at band 1

Strand d: A report on mechanical devices (6 marks)	
Band 3: **5-6 marks**	6 marks for **three** criteria at band 3 5 marks for **one or two** criteria at band 3; the **other** criterion/criteria completed at band 2
Band 2: **3-4 marks**	4 marks for **three** criteria at band 2 3 marks for **one or two** criteria at band 2; the **other** criteria/criterion completed at band 1
Band 1: **1-2 marks**	2 marks for **three** criteria at band 1 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: **9-13 marks**	13 marks for **six** criteria at band 3 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: **5-8 marks**	8 marks for **six** criteria at band 2 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: **0-4 marks**	4 marks for **five or six** 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

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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