OCR
RECOGNISING ACHIEVEMENT

GCSE

Applied Science Double Award

General Certificate of Secondary Education **J649**

Report on the Units

January 2008

J649/MS/R/08J

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 syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

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

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REPORTS ON THE UNITS

B481: Developing Scientific Skills (Portfolio)

General Comments

In this session, the majority of Centres is to be commended for the way in which the new course has been implemented and delivered. Please note, however, that in terms of administration, some Centres have been very slow to either submit MS1s or portfolios to their moderator. Many Centres are also to be commended on their appropriate and accurate application of the assessment criteria. This encouraging start has also been seen from new Centres, though it is suggested that who are unsure should seek further guidance from OCR.

It should be noted, in the delivery of the course, Centres should not only be looking to simply fulfil the demands of assessment grids and specification content, but also pay due consideration to 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), 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.

In this session, many Centres had gone to great lengths to ensure that standardisation procedures had been carried out, and documentary evidence of this was supplied. In some, however, the lack of these procedures was evident in inconsistent marking and is an important issue that has to be resolved.

On an administration note, Centres must ensure that they comply with regulations, and send mark sheets and portfolios on the specified date or within the specified time frame. It would also greatly assist the moderation process if candidates' portfolios were presented in cardboard wallets or cut-flush folders, or bound with treasury tags, rather than in enclosed plastic wallets.

Comments on activities chosen

Many Centres, in particular those who are becoming more experienced with Applied Science, have adopted a truly vocational approach, linking in with local industries and thereby enabling candidates to compare their methodologies with professional techniques.

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 not always applied in nature. 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. In many instances, a broader investigation in context, in each subject area, would be more appropriate than a series of disparate activities.

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 now applying the assessment criteria appropriately. Some are not, however, apportioning marks to each skill area using the method recommended by OCR, and are referred to pages 25-27 of the specification. This guidance on deriving marks is also given in Appendices II and III. In the implementation of these guidelines, Centres' attention is also drawn to some significant changes from the old specification, 1497. Note that for candidates working at Band 3, a full complement of practical activities should be carried out, those not achieving Band 3 standard, to at least Band 1, in this instance.

As indicated in the specification, in strands a, b and c, and in certain instances in other strands, e.g., the calculations in strand e, assessor annotation of candidate portfolios is essential in the endorsement of the level attained. It should be noted that a level 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 copies of the standard procedures assignments that have been undertaken by their candidates to their moderator in addition to the portfolios. 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.

Particularly notable this session is that some Centres are encouraging candidates to improve the standard of their work in a single activity in Strands d and e so as to obtain higher marks. In these instances, please note the comments in the first paragraph, but also ensure that the necessary criteria, e.g., appropriate recording of data in Strand d, are addressed *unequivocally*. A minority of Centres still continues to undertake more than the required number of practicals and includes superfluous material and notes in student 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 is 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, and this is best demonstrated by the application of the principles of Health and Safety to new situations, for instance on industrial 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.

Risk Assessments were frequently given too generous a mark in 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 student competence 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, e.g., 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, and should be expressed to two 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, e.g., 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. 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, and cell counts using haemacytometers. 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 3, 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, e.g., 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, e.g., 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, including accuracy, precision and sensitivity of 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
Yeast cell counts (using haemacytometers)
Comparing fibres

Microorganisms
Antiseptic and disinfectant sensitivity testing
Investigating the effects of antibiotics on *Escherichia coli* (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 hydrogencarbonate ions in ear drops

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 insulating materials
Building bridges
The thermal conductivity of materials
Materials for housing

Appendix II 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
	11 marks for **two** areas at band 3; the other areas at least band 1
10-12 marks	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
	8 marks for **two** areas at least band 2
7-9 marks	7 marks for **one** area at least band 2
Band 1:	6 marks for **three** areas at band 1
	3, 4, 5 marks for **two** areas at band 1
0-6 marks	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: **5-6 marks**	6 marks for **six** completed risk assessments at band 3 5 marks for **four or five** completed risk assessments at band 3; one at least band 1
Band 2: **3-4 marks**	4 marks for **six** completed risk assessments at band 2 3 marks for **three, four or five** completed risk assessments at band 2
Band 1: **0-6 marks**	2 marks for **six** completed risk assessments at band 1 1 mark for **two, three, four or five** completed risk assessments at band 1

Strand c: **Follow standard procedures involved in practical tasks using scientific equipment and materials (8 marks)**	
Band 3: **7-8marks**	8 marks for **six** completed activities at band 3 7 marks for **four or five** completed activities at band 3
Band 2: **4-6 marks**	6 marks for **five or six** completed activities at band 2 5 marks for **four** completed activities at band 2 4 marks for **three** completed activities at band 2
Band 1: **0-3 marks**	3 marks for **five or six** 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

Strand d: **Make and record observations and / or measurements, present and process data (12 marks)**	
Band 3: **9-12marks**	12 marks for **six** completed activities at band 3 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: **6-8 marks**	8 marks for **five or six** completed activities at band 2 7 marks for **three or four** completed activities at band 2 6 marks for **one or two** completed activities at band 2
Band 1: **0-5 marks**	5 marks for **six** completed activities at band 1 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: **8-12 marks**	12 marks for **six** completed activities at band 3 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: **5-7 marks**	7 marks for **five or six** completed activities at band 2 6 marks for **three or four** completed activities at band 2 5 marks for **one or two** completed activities at band 2
Band 1: **0-4 marks**	4 marks for **six** completed activities at band 1 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					
TOTAL					

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. Students were appropriately entered for the foundation tier paper. Most showed knowledge across all question areas. Candidates made good use of time with very few part questions left unattempted.

Teacher's tip:
Students 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.

It is important that candidates learn the list of element symbols and formlae given in Appendix D of the specification. Simple formulae, such as that for carbon dioxide, were not known by candidates.

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.

a Most added together the percentage of gases in the table, but fewer realised that to work out the missing percentage they needed to subtract from 100%. Many tried to use the temperature (1170 ^{o}C) in their calculation.
Most realised that the water was leaving the volcano as steam, but fewer explained this in terms of the high temperature of the volcano.

Teacher's Tip
Students need to check how many marks are available for a part question. For example 'the water has turned into steam' has only made a single point. Encourage students to give further explanations when two marks are available by encouraging them to add a 'because….' to their answer..

Most gained at least one of the two marks for completing the pie chart. Some filled the boxes in by guesswork instead of referring back to the percentages of gases in the volcano.

b Most students knew that oxygen was one of the commonest gases in the Earth's atmosphere, but a surprising number thought carbon dioxide was the other. In (ii), vague answers such as 'the gases might kill her' or 'the gases are dangerous' did not score. Examiners looked for either a correct identification of which gases would cause harm, e.g. 'sulphur dioxide is harmful' or for a specific outcome of breathing the gases e.g. 'breathing these gases causes suffocation' or 'there is no oxygen in the gases'

2 This question was also aimed at lower demand.

a Almost all candidates correctly labelled the cell wall and nucleus, but fewer recognised the chloroplasts or cytoplasm. Most were able to link each cell part with its correct function in (ii).

b The question specifically asked candidates to 'use the information in the box to help you'. However, many candidates tried to answer the question from general knowledge. This question is a good one to use with candidates to practise extracting unfamiliar information from question stems.

Teacher's Tip
Before the examination, practise questions that use unfamiliar information with candidates. Candidates should practise extracting and using information given in the question. This question is a good one to use for this.

c Again, most candidates only made a single point here, although two marks were available. Again, vague answers such as 'it will kill you' were not given credit.

3 This question was another example of a question where most of the information the candidates needed to answer was given. Again, the question tested the candidates' skill in extracting the relevant information.

a This was intended to be straightforward. Candidates needed to take the words in bold in the diagram and separate them into materials 'IN' and materials 'OUT' of the furnace. Surprisingly few gained more than a single mark here, suggesting again that this type of question needs practice.

Teacher's Tip
As with question 2, use this to help students practice handling information that is given in the question.

b Not many candidate knew that iron was also extracted using a blast furnace. A common incorrect answer was 'steel' which was along the right lines, but steel is not directly extracted in the furnace itself.

c The equation was very poorly attempted. Most did not know even the formula for carbon dioxide. Incorrect formulae such as CO2, CO^2 etc. were not accepted.

Teacher's Tip
Students need to learn all the symbols and formulae given in Appendix D of the specification.

d Again, this part question relied on the candidate's ability to extract information from the table. Most did this task well, but some listed all the properties in the table e.g. 'good strength, density, effect of heat and useful life' rather than extracting the important ones. Such answers did not gain marks as they did not show the ability to extract information that the question was designed to test.

4 This question was the last of the lower demand questions on the paper

a Most scored well by suggesting ways that viruses are transferred between people.

b Most knew ways that people can cut down the likelihood of virus transfer. Not touching, keeping a distance apart and not sharing the same drinking or eating utensils were common correct answers.

c Performance here was variable. A certain amount of guesswork seemed to be operating, but at least this shows the willingness to have a go and it is good examination technique to guess rather than leave blanks. Many confused diabetes and mumps in the last 'gap' suggesting that diabetes was a disease that could be vaccinated against.

d This part question was poorly answered. Very few linked ideas about the strength of the heart to circulation. A few gave responses such as 'blood doesn't pump around the body as well', which gained a single mark. Fewer linked this to oxygen or glucose transport. In (ii) very few knew the effect of drinking, smoking or exercise on the health of the heart. Many talking about heart rate e.g. 'they make your heart beat faster'. Another common wrong answer was talking about negative effects of smoking on the lungs, rather than focussing on the question asked.

Teacher's Tip
Linking heart rate to rate of respiration is a 'key concept' for the course. Candidates need to realise that the rate of blood circulation affects the rate of respiration due to the availability of oxygen and glucose.

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. As such, it was difficult for many foundation tier candidates. In addition, the structures of colloids is a specification area that does not seem to be very well understood.

a Dispersed and continuous phase questions are commonly very poorly answered. There is a limited number of types of colloid listed in the specification and candidates need to know their structures. A single mark was available for identifying that a gel contains a solid/liquid colloid, even if the phases were in the wrong order. However, many foundation tier candidates chose other words such as 'solvent' and 'sugar' showing that they have a very poor understanding of colloids.
Few correctly identified 'foam' as a liquid/gas colloid.

Teacher's Tip
Dispersed and continuous phases of colloids are very poorly understood. Students need to practise and learn the examples given in the specification so that they recognise the different types.

c Almost no candidates knew that a solution involves a solid dissolved in water.

d Most knew that sugar should be reduced to make the lollies more suitable for diabetics.

e This question was well answered, most candidates being able to come up with two suitable properties of polyethene.

6 The last question on the paper was also targeted at grades DD to CC.

a Almost all candidates were able to extract information from the table to give two insulating home improvements. Fewer were able to explain what insulation is. 'Keeps heat in' was a common poor answer. This was not accepted because it implies that heat is absolutely 'kept in' rather than the more correct idea that *less* heat is lost (i.e. some will always escape!). Very few talked about less heat energy *passing through* the material.

b On the foundation tier, again this was mainly guesswork. Some candidates were reluctant to use the same word twice in the gaps (the second and third answers are 'gases' and 'gases'. This would be good practice to use in class to show that this sometimes is necessary.

c Very few candidates could correctly explain the meaning of 'payback time'. Vague answers such as 'the time it takes to pay the money back' were not accepted – such answers implied that it was the time to repay a lone. Best answers discussed the time for savings made to offset initial cost.

Teacher's Tip
Key specification terms need to be known well enough to be explained. Candidates should practise explaining key words such a 'payback' time. The use of glossaries or key fact cards in class may help

d Most were able to state that cost and payback time were the main drawbacks to the purchase of double glazing.

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

Teacher's tip:
Students 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 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 the higher tier are able to give appropriate definitions or explanations of scientific terms in the specification. This was a general weakness with very few being able to give more than a vague suggestion of the meaning of words such as 'insulation' and 'homeostasis'.
It was clear that a significant minority of candidates did not have calculators, these candidates were at a disadvantage. Calculators are required items for the exam and questions are set with the assumption that a candidate has a calculator.

Comments on Individual Questions

1 This question was an 'overlap' question which also appeared on the foundation tier paper. It was designed to test achievement at CC and DD grades. As such, it should be fairly straight forward for candidates on the higher tier. However few candidates scored more than three quarters of the marks.

a Composite proved a strong distracter to the correct response of mixture, suggesting candidates are types of colloids and types of material.

b Dispersed and continuous phase questions are commonly very poorly answered. There is a limited number of types of colloid listed in the specification and candidates need to know their structures. A single mark was available for identifying that a gel contains a solid/liquid colloid, even if the phases were in the wrong order.
Few correctly identified 'foam' as a liquid/gas colloid.

Teacher's Tip
Dispersed and continuous phases of colloids are very poorly understood. Students need to practise and learn the examples given in the specification so that they recognise the different types.

c Few candidates knew that a solution involves a solid dissolved in water. Many suggested it was a mixture.

d Most knew that sugar should be reduced to make the lollies more suitable for diabetics.

e This question was well answered, most candidates being able to come up with two suitable properties of polyethene.

2 This question was an also 'overlap' question which appeared on the foundation tier paper. It was designed to test achievement at CC and DD grades. As such, it should be fairly straight forward for candidates on the higher tier. Most candidates scored more than three quarters of the marks.

a Almost all candidates were able to extract information from the table to give two insulating home improvements. Few were able to explain what insulation is. 'Keeps heat in' was a common poor answer. This was not accepted because it implies that heat is absolutely 'kept in' rather than the more correct idea that *less* heat is lost (i.e. some will always escape!). Very few talked about less heat energy *passing through* the material. Higher tier candidates are expected to be precise in their definitions.

b Most candidates managed to get two of the three answers. The most common error was foam for the spaces in fibreglass. Some candidates may have been reluctant to use the same word twice in the gaps (the second and third answers are 'gases' and 'gases'. This would be good practice to use in class to show that this sometimes is necessary.

c Very few candidates could correctly explain the meaning of 'payback time'. Vague answers such as 'the time it takes to pay the money back' were not accepted – such answers implied that it was the time to repay a loan. Best answers discussed the time for savings made to offset initial cost.

Teacher's Tip
Key specification terms need to be known well enough to be explained. Candidates should practise explaining key words such a 'payback' time. The use of glossaries or key fact cards in class may help

c Many candidates were able to calculate the payback time, the most common error was to incorrectly transcribe £115.50 as £155.50. However a large minority clearly did not have calculators and had to do the calculation, often incorrectly, by hand.

d Most were able to state that cost and payback time were the main drawbacks to the purchase of double glazing.

3 This and subsequent questions are the higher tier only questions.

a This was well answered by most candidates, who were able to extract the appropriate information from the diagram. Common errors were to miss that it is impure zinc produced and to assume the process was identical to iron in a blast furnace, for example suggesting limestone is added.

b Many candidates were able to balance the simple equation and knew the formula required. However at higher tier candidates are expected to write chemical formula correctly, with clear upper and lower case letters and subscripts were appropriate

Teacher tip
Use this question to illustrate how easy it is too lose marks through careless writing.

c With the exception of part (iv) this was generally well answered.
However very few candidates had any idea why an alloy is harder than its constituent metals. It was the exceptional candidate that mentioned the sliding of atoms/layers over each other and the significance of the different sizes of the atoms. the most common error was to simply suggest that stronger bonds existed. The poorest answers talked about combining properties. It would appear few candidates were familiar with this higher tier material.

4 a Most candidates attempted all three parts of this, with many scoring well with valid points. Common errors were to talk about vague 'chemicals', to think that organic farming does not use fertilizers and to imply that organically farmed chickens do not die. Good answers mentioned labour costs, effects on habitats and issues related to overcrowding. The weakest candidates failed to identify which type of farming their points referred to.

b Most candidates correctly completed the graph. Common errors were increased weeds or pests.

c Very few candidates could answer this correctly. Most had no idea what DDT or BSE were and made up vague answers about what could happen. DDT and BSE required examples in the higher tier part of the specification.

5 a Generally well answered with many candidates scoring full marks. the statement about rock types was the strongest distracter.

b Nearly all candidates correctly labelled the diagram. However less than half were able to identify the symmetry of the patterns as the key supporting element.

c Very few candidates were able to describe what is happening in a convection current. Most candidates tried to use the idea of particles and the idea of density, but without very limited understanding. Common errors were to have 'heat particles' and 'density particles'.

6 a Most candidates could identify the microorganisms treated with antibiotics and those unaffected. Few identified secondary infections in part (iii), most choosing production of antibodies.

b Almost no candidates described natural selection. Most attempted to describe immunity and antibodies, despite the emboldening of the term 'natural selection' in the question.

Teacher tip
The use of bold type in a question is intended to draw the candidates attention to key words in the question, where it is thought that a candidate might be a little to easily misled.

c Many candidates were able to describe a temperature regulation mechanism, but not how the temperature was monitored in part (i). The weakest answers talked about using thermometers.
Almost no candidates could explain homeostasis. Many simply referring to controlling temperature.
Almost no candidates were familiar with how the breathing rate is controlled, another higher tier only aspect of the specification.

B483: Science at Work (Portfolio)

General Comments

There was a very limited entry for this component in January 2008, but for those Centres involved, it pleasing to see that excellent ways had been devised of incorporating local, and other, industry into this unit, particularly in strand a.

When delivering the specification, Centres should also encourage candidates to not simply fulfil the requirements of the assessment criteria, but to organise coursework material in each section more carefully into its respective themes. Some portfolios have a rather disjointed feel; time should be spent integrating more carefully section introductions, investigations, discussion material, evaluations and industrial comparisons. In their assessment of the course, Centres should also note that due consideration should be paid to the Assessment Objectives of the unit (Centres should refer to page 97 of the specification), and Performance Descriptions (see pages 114 – 115).

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.

On an administration note, Centres must ensure that they comply with regulations, and send mark sheets and portfolios on the specified date or within the specified time frame. It would also greatly assist the moderation process if candidates' portfolios were presented in cardboard wallets or cut-flush folders, or bound with treasury tags, rather than in enclosed plastic wallets. Please note also that there is no requirement to send a chemical sample produced in Strand b!

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

Some good work was seen, but there still tends to be some reliance on corporate websites such as http://www.learndirect-advice.co.uk/ and http://www.connexions-direct.com ; while these provide excellent stimulus material on careers, and information on qualifications required for those careers, they should be not be used as a sole source of reference. 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 2, candidates should then study two organisations in detail. 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.

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

In strand b, the level of science required when discussing the type of chemical reaction involved was sometimes underestimated at Bands 2 and 3.

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 Level 3.

There were some good industry comparisons, discussing energy inputs and wastes, and it hoped that these are developed further in future.

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 components are not too superficial, and note that explanations of why these components are used should be given at Band 3.

Assessing the performance of electronic circuits 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.

Strand d
A report on mechanical devices

In this strand, Centres should note 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.

Centres should ensure that all units are included in tables for candidates working at higher levels.

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. Centres should ensure, however, 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 potassium nitrate
	preparation of ammonium sulfate/nitrate
Precipitation:	preparation of lead chromate
	preparation of zinc carbonate/hydroxide
	preparation of silver halides
	preparation of barium sulfate
	preparation of iron(III)-hexacyanoferrate(II) (Prussian blue)
Esterification:	preparation of esters

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

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

A report on mechanical devices

Investigating levers, pulleys and gears
Investigating gym equipment

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

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

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

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** 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		
TOTAL for unit		

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		

Grade Thresholds

General Certificate of Secondary Education
Applied Science (Specification Code J649)
January 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B481	Raw	50	46	42	38	34	28	22	16	10	0
	UMS	100	90	80	70	60	50	40	30	20	0
B482/1	Raw	60	n/a	n/a	n/a	39	32	25	18	11	0
	UMS	69	n/a	n/a	n/a	60	50	40	30	20	0
B482/2	Raw	60	42	35	28	22	16	13	n/a	n/a	n/a
	UMS	100	90	80	70	60	50	40	n/a	n/a	n/a
B483	Raw	50	47	43	39	35	29	23	17	11	0
	UMS	100	90	80	70	60	50	40	30	20	0

Entry Information

Unit	Total Entry
B481	3275
B482/1	6270
B482/2	1438
B483	378

Specification Aggregation Results

Aggregation was not available this series.

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

Statistics are correct at the time of publication.

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