OCR
RECOGNISING ACHIEVEMENT

GCSE

Applied Science Double Award

General Certificate of Secondary Education **J649**

Report on the Units

June 2008

J649/R/08

Oxford Cambridge and RSA Examinations

OCR (Oxford, Cambridge and RSA Examinations) is a unitary awarding body, established by the University of Cambridge Local Examinations Syndicate and the RSA Examinations Board in January 1998. OCR provides a full range of GCSE, A level, GNVQ, Key Skills and other qualifications for schools and colleges in the United Kingdom, including those previously provided by MEG and OCEAC. It is also responsible for developing new syllabuses to meet national requirements and the needs of students and teachers.

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

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

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

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

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

CONTENTS

Applied Science Double Award J649

REPORTS ON THE UNITS

Chief Examiner's Report

General Comments

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

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, and knowledge of chemical symbols and formulae cited in 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 details. 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.

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. Centres are referred to the appendices of this document, where a list of assignments illustrating best practice is provided. A very small number of Centres appear to be using the old specification, which had a significant impact on marks in Unit 3, in particular, and this should be corrected immediately.

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.

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. It is recommended that careful checks are made on the marks submitted, both in the way in which mark bands are translated into marks, and the accurate transfer of marks to the MS1s. Those Centres 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 some, 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.

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.

On a presentation note, 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, or across subject areas, 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.

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 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.

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 also 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 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, 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 to Band 1.

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, and be using the terms, 'accuracy', 'precision', 'reliability' and 'sensitivity' when discussing equipment and reagents, along with practical difficulties associated with the procedure and sources of error introduced by themselves, but *not* those produced as a result of carelessness. Suggestions for improvements should be explained at this level.

Appendix I Practical activities undertaken

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

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
The thermal conductivity of materials
Materials for housing

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: **10-12 marks**	12 marks for **three** areas at band 3 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: **7-9 marks**	9 marks for **three** areas at band 2 8 marks for **two** areas at least band 2 7 marks for **one** area at least band 2
Band 1: **0-6 marks**	6 marks for **three** areas at band 1 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: **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

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

Unit 1: Developing Scientific Skills					
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: Science for the Needs of Society, 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 formulae given in Appendix D of the specification. Also, candidates should make sure to distinguish between capital and lower case letters in formulae, e.g. Co_2 is not acceptable as the formula for carbon dioxide (CO_2).

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 answered this question well, many gaining almost full marks.

a Most gained all three marks for identifying types of fuel.

b Almost all were able to recognise that the solar panels only work in good sunlight and sails only work in the wind.

c Most discussed the fact that solar energy is renewable, but some gave vague responses such as ‘less pollution’ or ‘more environmentally friendly’. These answers are too general to score; candidates need to either discuss the renewable nature of solar energy or to give an example of an environmental problem that is eased, e.g. ‘climate change’ or ‘less CO_2 emissions’. Similarly, ‘cheaper’ alone did not score (installation of solar panels can be very expensive!) but ‘cheaper running costs’ or ‘free energy source’ were given full credit.

Teacher’s tip:
Make sure students know that examiners almost never give credit for unqualified vague answers such as ‘causes pollution’ or ‘harms the environment’ or ‘it is cheaper’. It is important that a specific reason is given.

d Many candidates thought that solar panels collected heat rather than light energy, and many confused the energy transfers of movement and electrical.

e Almost no candidates knew that mobile phones communicate with satellites by microwaves.

2 This question was also aimed at lower demand. Again, this question was very high scoring.

a Almost all candidates correctly drew the food chain from the information provided.

b Most realised that rabbits would also have grass to eat.

c Most discussed the fact that fewer rabbits would be eaten, but many did not clearly say what effect this would have on the rabbit population, i.e. it would increase. A surprising number of candidates wrongly stated that rabbits eat owls.

d Most were able to complete the cloze passage exercise. Some confused respiration with photosynthesis.

e Many did not know the starting substances for fermentation. Carbon dioxide was commonly given as a starting substance, and water was often given as a product. Most recognised that juniper juice in water is a solution.

3 a A full range of marks was seen for this question. Many candidates read the graph fluently to gain all three marks; others read the highest peaks for the resting pulse rate.

> **Teacher's Tip:**
> Graph reading questions are 'knowledge free', so many candidates gain extra marks here. Practise graph reading question with students; this is a good example to use.

b Most candidates correctly labelled the heart and lung, but the terms diaphragm, trachea and rib were often confused – many confused the rib and diaphragm.

c Most knew that oxygen was needed for respiration, but many chose carbon dioxide, rather than glucose, for the other main reactant.

d Many knew that 37°C is average human body temperature, but all other temperatures were also regularly chosen.

4 This question was the last of the lower demand questions on the paper. This was more challenging than the earlier questions, and many scored less than half marks.

a Most recognised steel as a metal and some knew that nylon is a polymer. The other materials were not well known.

> **Teacher's tip:**
> The four classes of materials are a key learning area in section 4 of the specification. Some materials (e.g. GRP) are listed as ones that students need to know about. Practise classifying materials with your students – this is a common type of question in this area.

b Most had some knowledge about composite materials, but few gave their answers in scientific language, e.g. 'doesn't get affected by water' was not given credit, but a property such as 'waterproof' or 'strong' scored.

In ii, few gained full marks. This was a higher level question about the properties of polymers and was a little too subtle for most candidates.

In iii, again vague answers also stopped candidates from scoring.

> **Teacher's Tip:**
> Section 4 of the new specification now includes a list of ways that scientists are involved in developing new products. This is a new area that needs to be taught. It can be taught alongside Unit 3.

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. Very few scored more than a couple of marks.

a Most knew the formulae for carbon dioxide and water, but many formulae were too poorly written to score. Answers such as Co_2, CO2 and H^2O were not credited.

b The commonest reason for a poor score here was to give a vague answer such as 'if it's cheaper' or 'if it's environmentally friendly'. As this is an overlap question aimed at CC/DD demand, a higher level of discussion was needed.

c This is another new area of the specification. Problems and solutions related to mining are now clearly broken down in section 4. Candidates generally did not know the issues, many giving vague responses such as 'harms animals' or 'kills plants' or 'causes pollution'. Better answers discussed the effects on the local area such as eyesore, dust, traffic build up and loss of habitats.

In ii again, vague language was often used. Many repeated the question, saying such comments as 'needs to last 50 years'.

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

a Almost no candidates knew that frequency and wavelength are different for different types of EM radiation. Some did give different types of telescope, such as light and microwave, but many wrong answers, including microscope and even horoscope, were often seen.

b Again, this is new material that appears in section 6 of unit 2. Very few could give creditworthy descriptions of stars, galaxies or solar systems. Many confused all three, thinking that the solar system contain 'all the stars' and galaxies contained 'many planets'. Many also thought that stars were balls of rock.

c Many candidates gained a mark here for recognising that a light year is a unit of distance, but some thought it was related to time.

Teacher's tip:
If you have been teaching applied science for a few years, make sure that you cross check your scheme of work against the new specification. Section 6 is the main addition, but minor changes occur throughout the new document.

B482/02: Science for the Needs of Society, 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 continues to be a general weakness, with very few being able to give more than a vague suggestion of the meaning of words such as 'homeostasis'

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 Candidates often lost marks for incorrect chemical formulae, e.g. Co_2, CO2, CO^2. On the higher tier, candidates are expected to write chemical formulae correctly. The most common error in part ii was to equate 'organic' with natural.

b Few candidates scored both marks. In general, answers were too vague, with general reference to safety and cost, but no specific detail such as flammability or instillation costs. Other weak responses referred vaguely to environmental issues and efficiency.

c The most common correct answers in part i were noise and visual pollution. In part ii, most got the idea of strength; however, many candidates gave properties of the pipe rather than properties of the material.

2 This question was also 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 straightforward for candidates on the higher tier.

This question covered material that was new in the revised specification. Many candidates appeared to be unfamiliar with the content of this question and performed badly.

a This was rarely answered correctly. Few candidates knew that wavelength and frequency are wave properties. In part ii, many candidates appeared to be guessing about types of telescope, for example giving answers such as 'large' and 'microscope'.

b Some excellent answers were seen, giving detailed explanations of the objects. The most common error was confusion over scale, so that solar systems contained galaxies/universes. Weaker candidates tended to be led astray by providing an introduction, e.g. 'the sky is full of interesting things like stars, galaxies and the solar system', which left little space to explain what the objects were. However, many candidates had serious misconceptions, e.g. 'stars are rocks reflecting sunlight' and 'galaxies orbit the Earth like the moon'.

c About half the candidates new that a light year was a unit of distance; the most commonly selected distracter was time.

3 a This was generally well answered. The most common error was to suggest the dip in blood glucose resulted from resting or sleeping.

b Part i was usually answered correctly. The most common misconception was to suggest more glucose should be eaten. Few candidates could describe the action of insulin in part ii; many suggested it controlled glucose levels, by increasing or decreasing the glucose. The pancreas and digestive system were common errors for the site of action. Almost no candidates mentioned glycogen.

c Very few candidates could state what 'homeostasis' means, although many knew it was something to do with control of something.

> **Teacher's Tip**: Candidates should know the meaning of the scientific terms used in the specification are expected to know these for the exam.

d Many candidates were able to work out the correct sequence, but most made the mistake of including the brain in the reflex arc.

4 a This was generally well answered, although the language used was not always clear, e.g. ‘gas’ when referring to diesel. The most common error was electricity/battery.

b Most candidates understood the issues, but some only mentioned one of too little sunlight or wind.

c Candidates appeared more confident in the calculations. The most common error here was to divide 1000 by 120. Very few appreciated that the question required an answer related to the effect on the environment. Most incorrectly referred to the intermittent nature of the solar energy and lack of sunshine.

d Again, candidates were more confident in the calculation. The most common error was an incorrect rearrangement of P=IV; for example multiplying P by V and dividing V by P.

5 a Few candidates answered this correctly. A common misconception was to confuse selective breeding with genetic engineering, selecting a gene in one plant and inserting it in another. Weaker candidates simply talked about breeding, with no element of selection.

In part ii, very few candidates gave a correct answer. The most common correct point was ‘all catching the same disease’. Many candidates simply repeated the stem of the question.

b Most candidates gained some marks here. The most common error was placing B, insertion of genes, too early in the sequence.

c The most common correct response was ‘beans can grow in dry conditions’. Many candidates misread the question and talked about the process being ‘unnatural’, playing God’, etc.

6 Very few candidates were familiar with types of bonds.

a Some could identify covalent bonding. However, only a very small number could draw a dot and cross diagram. Many did not appear to realise that water has two hydrogen atoms and one oxygen atom in the molecule.

In part iii, many could write down the correct formulae for the equation, however very few could balance it.

b This was only occasionally answered correctly. The correct responses appeared to be dependent upon Centre; some candidates had clearly been taught the details of ionic bonding with some success.

B483: Science at Work (Portfolio)

General Comments

Centres are to be commended in the activities that have been devised in this unit to incorporate 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.

Please note, however, that in terms of administration, some Centres have been very slow to either submit MS1s or portfolios to their moderator. It is recommended that careful checks are made on the marks submitted, both in the way in which mark bands are translated into marks, and the accurate transfer of marks to the MS1s. Many Centres are to be commended on their appropriate and accurate application of the assessment criteria, though it is suggested that who are unsure should seek further guidance from OCR.

On a presentation note, it would 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 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. 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. Note 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

There was evidence in this session that some Centres are still working from the old, 1497 specification. Candidates should produce *two* samples from two *different* chemical reactions. Please note that there is no longer a requirement to calculate the cost of producing a given amount of the product, and that factors affecting the rate of chemical reactions is now part of Unit 2.

For criterion 1, the type of reaction was often not mentioned at all, and the level of science required when discussing the chemical reaction involved was sometimes underestimated at Bands 2 and 3. Centres should 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 Level 3.

For criterion six, there were some good industry comparisons, discussing energy inputs and wastes, though some Centres did not attempt to address this criterion.

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 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 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. Candidates working at Band 3 are expected to evaluate the performance of their device 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. 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’. 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 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
Investigating the car jack

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 growth of mould
Monitoring the behaviour of primates
Monitoring the germination of seeds

Appendix II Awarding of marks

Unit 3: Awarding of Marks

In each strand, marks should be awarded as follows:

Strand a: **A report on how science is used in the workplace (11 marks)**	
Band 3: **9-11 marks**	11 marks for **five** criteria at band 3 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: **6-8marks**	8 marks for **five** criteria at band 2 7 marks for **four** criteria at band 2 6 marks for **two** or **three** criteria at band 2
Band 1: **0-5 marks**	5 marks for **six** criteria at band 1 4 marks for **five** criteria at band 1 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: **10-13 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 **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: **6-9 marks**	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 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: **0-5 marks**	5 marks for **six** criteria at band 1 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** 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 (Double Award) J649

June 2008 Assessment 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				33	27	21	16	11	0
	UMS	69				60	50	40	30	20	0
B482/2	Raw	60	38	30	22	15	11	9			0
	UMS	100	90	80	70	60	50	40			0
B483	Raw	50	46	42	38	34	28	22	16	10	0
	UMS	100	90	80	70	60	50	40	30	20	0

Entry Information

Unit	Total Entry
B481	7991
B482/1	5403
B482/2	1978
B483	9259

Specification Aggregation Results

	A*A*	A*A	AA	AB	BB	BC	CC	CD	DD	DE	EE	EF	FF	FG	GG
UMS	270	255	240	225	210	195	180	165	150	135	120	105	90	75	60
Cum %	0.1	0.6	1.6	3.9	9.2	19.9	37.8	52.5	65.0	76.1	84.9	91.8	95.9	98.2	99.3

9286 candidates were entered for aggregation this series.

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

Statistics are correct at the time of publication.

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

OCR Customer Contact Centre

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

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553