RECOGNISING ACHIEVEMENT

GCSE

Applied Science (Double Award)

General Certificate of Secondary Education **J649**

OCR Report to Centres

June 2012

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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

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

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

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Overview

General Comments

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

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

It is expected that candidates on both tiers use information provided to them in tables to answer questions; candidates were not always able to do this. Many candidates were also unable to identify elements, compounds and mixtures. Candidates should also be able to give appropriate definitions or explanations of scientific terms in the specification. This has been a general weakness throughout the sessions; candidates' knowledge and understanding of 'key' words and facts, and the ability to assign labels to key scientific diagrams, define the most important learning objectives on the specification.

In the portfolio units, some centres did not ensure that OCR's URS form was completed for each candidate, with the centre and each candidate's name and number, or record assessment information on OCR's recommended tracking grid.

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.

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

B481: Developing Scientific Skills (Portfolio)

General Comments

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

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

Centres should also take particular note of the presentation of candidates' portfolios. While this was often exemplary, it would have greatly assisted the moderation process if candidates' portfolios were presented in cardboard wallets or cut-flush folders, or bound with treasury tags, rather than submitting portfolio material in plastic wallets.

Comments on activities chosen

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

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

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

Comments on assessment

The vast majority of centres are applying the assessment criteria appropriately. However, there are some centres that are not apportioning marks to each skill area using the method recommended by OCR, while others are not recording these in a manner conductive to candidate assessment or helpful to the Moderator.

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

It was of note this session that the centres supplying copies of assignments undertaken to their moderator has become fewer in number (though this was often compensated for by information provided in detailed covering letters). Note that the provision of copies of the assignments greatly assists the Moderator in judging the degree of guidance given to candidates.

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

A small minority of centres still continues to undertake more than the required number of practicals and also include superfluous material and notes in candidate portfolios, along with, in some instances, more than one draft of assignment work. While the latter shows the evolution of a candidate's work, it is unnecessary and 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 be encouraged to reference sources in-text (in particular, visual material) and compile a References' List. At Band 3, this should be written with appropriate detail according to an accepted convention. There should also be some justification as to why each source was used. The use of 'copy and pasted' material should be discouraged, but if included, information from respective sources should be linked together with appropriate text, and credited appropriately.

Candidates are also assessed on the quality of the report, which must contain textual *and* visual material (which is often lacking or limited) at the appropriate level. Those working at Band 3 are expected to demonstrate an in-depth understanding of Health and Safety; arguably this is best demonstrated by the application of the principles of Health and Safety to new situations, for instance reviewing Health and Safety provision on workplace visits.

Strand b
Carry out Risk Assessments

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

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

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

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

In some centres, the confirmation of the competence of the candidate in the selection of equipment and the carrying out of each standard procedure was clearly indicated. In this session, rather fewer Centres had adopted a 'Certificate of Practical Skills' approach, with more choosing simple annotation of candidates' portfolios. A very few centres, however, gave just a single, overall mark of candidate performance, without designating how this is made up.

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

Strand d
Make observations and obtain and record measurements

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

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

Writing frames continue to be used, but without the necessary caution. While blank tables and axes of graphs are appropriate for lower ability candidates, their use will preclude achievement of Band 3, and unless the data recorded are particularly complex, eg the counts from cells of a haemacytometer, at Band 2 also. When awarding high levels for microscope diagrams, centres should ensure that candidates are producing these accurately, and also, not simply replicating textbook versions.

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

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

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

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

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

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

Strand e
Analyse and evaluate data

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

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

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

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

General Comments

The foundation tier paper is designed to test the knowledge and skills of candidates performing at grades GG to CC. In this session, candidates were appropriately entered for the foundation tier paper; most showed knowledge across all question areas. Candidates made good use of time and very few part questions were not attempted.

Comments on Individual Questions

1 (a) Candidates either knew this, or were unable to remember any of the correct gases. Of those who knew that the three gases were oxygen, carbon dioxide and nitrogen, many put the gases in the wrong places, showing that they do not know the relative abundances of these gases in the air.

(b) Candidates found it difficult to communicate their ideas for this question. Many knew that humans 'produce carbon dioxide' but did not link this with how the atmosphere is changing, that is 'the amount of carbon dioxide in the air is increasing'. Many said that the oxygen content of air is decreasing.

(c) (i) About three quarters of candidates could name at least one fossil fuel. Some gained only one mark by naming multiple products of crude oil, for example 'petrol and diesel' rather than giving a different example such as coal or gas.

(ii) About half of the candidates knew that energy is released when fuels are combusted.

(d) Just over half of candidates correctly identified 'respiration' as the process that produces carbon dioxide.

(e) Almost all candidates correctly identified at least one energy source that does not produce carbon dioxide.

2 (a) Almost all candidates chose 'iron' as the metal with the highest melting point.

(b) Over half of the candidates correctly calculated the mass of aluminium. Many gained one mark by correctly selecting the density from the table and using it in a calculation, even though their final answer was incorrect.

(c) The fact that overhead cables have to be low density escaped most candidates. The commonest incorrect response, therefore, was 'copper'.

(d) (i) In both parts of d, some candidates showed poor technique by listing all of the properties in the table. When it is important that information is *selected*, such answers are marked using the 'list principle' and therefore do not score if incorrect information is given.

(ii) Most candidates scored at least one of the available marks but, again, many gave additional, incorrect properties which meant that they did not score.

(e) Almost all candidates correctly identified at least one of the properties that are important for electrical wiring.

3 (a) About two thirds of candidates gained at least one mark for correctly processing the data from the table. Most recognised that the weekly limit was exceeded, fewer calculated Helen's weekly intake as '21 units'.

(b) Many candidates did not refer to the table when answering this question. Vague answers such as 'men can take more alcohol' or 'men drink more without it having much effect' were commonly seen.

(c) (i) Most answers correctly identified at least one of the two substances needed in respiration.

(ii) Over half of the candidates knew that the heart pumps blood. Some poorer answers did not mention blood, but implied that the heart 'pumps the substances around the body'.

(d) Most candidates gave at least one clear benefit of stopping smoking, usually in terms of avoiding health problems such as lung cancer or heart problems. Some did not read the question carefully and discussed financial benefits.

4 (a) Most candidates scored the food chain marks, but many added words other than the organisms onto the lines, for example 'ladybirds eat the greenfly' rather than just 'ladybirds'. A common error was to reverse the order.

(b) (i) Most candidates identified that the crop yield increases if greenfly are killed.

(ii) Fewer candidates could explain why the increase occurs. Answers such as 'it helps the crop yield' were common.

(c) Some candidates misunderstood the food chain, believing that ladybirds directly eat wheat. Answers from this misconception stated that crop yield increases with fewer ladybirds as the crop is not eaten. Better answers discussed the effect on the greenfly population and the resultant decrease in crop yield.

(d) (i) The minerals needed for growth were well known. Most candidates correctly identified at least one.

(ii) Almost all candidates knew that roots absorb minerals.

(e) Candidates found it difficult to express how weeds reduce crop yield. Some very good answers about competition for light, water or minerals were seen, but most discussed the weeds 'choking' the plants.

(f) Very few candidates knew a disadvantage of herbicides. Many thought that the wheat itself would be killed.

5 This is the first of the two 'overlap' questions which are common to the foundation and higher tier. Most foundation tier candidates found these questions very challenging.

(a) Most knew that lack of employment would be a disadvantage of the steel works closing, but few were able to give an advantage. Some correctly discussed the reduction in noise, dust or traffic. Most gave answers that did not gain marks, such as 'shortage of steel'.

(b) Almost all candidates knew the roles that scientists would do in the steelworks.

(c) Very, very few candidates were able to identify an element, a compound and a mixture from the diagram.

(d) About a third of candidates identified the correct description of an ore.

(e) (i) Nearly half of candidates knew the main waste gas from the process. Others often gave 'carbon monoxide' as an incorrect answer.

(ii) Almost no foundation tier candidates knew the word equation for the reaction between carbon monoxide and iron.

(f) A very high number of candidates correctly identified all four correct formula, showing a good knowledge of the formula of the substances involved in Blast Furnace reactions.

(g) About a quarter of candidates knew that lead is also extracted using carbon.

6 (a) (i) Many candidates interpreted the data that this diagram shows, gaining marks across (a)(i) and (a)(ii). Over three quarters correctly identified the radiation types that hit the surface of the Earth.

(ii) Some candidates misunderstood the idea of telescopes and chose the types of radiation that do, rather than do not, hit the surface. Hence 'microwave and visible' were common incorrect answers.

(iii) Over half of the answers correctly gave 'ultraviolet' as the missing radiation.

(iv) Most candidates gained at least one of the marks for correctly identifying a difference between the waves.

(b) Just over half of the answers identified at least one astronomical object outside of the solar system, but 'planets', 'asteroids' and 'comets' were common incorrect answers.

(c) 'Distance' and 'time' were chosen with roughly equal frequency by candidates, implying confusion over the meaning of the unit 'light-year'.

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

General Comments

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

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

Comments on Individual Questions

Question 1 is a common question with the Foundation tier.

(a) Candidates commonly referred to a reduction in pollution. Pollution from industrial works located in residential areas is minimal and therefore wasn't credited. CO_2 reduction, being more of a global issue was also not credited. Noise pollution was the most commonly credited answer for the advantage mark. The disadvantage mark was answered well with the majority of answers relating to the loss of employment.

(b) Part (b) was well answered by nearly all candidates.

(c) Few candidates correctly selected examples of an element, mixture and compound. Mistakes were most commonly made with the identification of the mixture, commonly naming a compound.

(d) The most common error was to suggest that an ore was pure metal.

(e) Most candidates correctly identified carbon dioxide as the waste gas. Carbon monoxide was the most common error. Part (ii) was very poorly answered. Candidates often got the reactants correct but then missed off iron on the products side.

(f) Part (f) was answered well with most candidates scoring both marks.

(g) Many candidates chose incorrectly and with there being no apparent pattern to the incorrect choice.

Question 2 is a common question with the Foundation tier.

(a) In part (i) candidates were expected to interpret the graph in order to obtain the answer. The question was answered relatively well, however some candidates lost out on marks by referring to other parts of the electromagnetic spectrum. In part (ii) many candidates became confused, with frequent references to reflecting telescopes, etc, possibly due to a lack of familiarity with types of telescope. Most candidates correctly identified ultraviolet in part (iii). In part (iv), the most common error was radio waves and ultraviolet having different speeds in a vacuum.

(b) For part (i), the most common error was referring to 'planets' without further explanation of them meaning planets of other solar systems, therefore losing the mark. In part (ii), the common mistake was for candidates to identify a light-year as being a unit of time.

Question 3

(a) Candidates often correctly stated the formula for glucose, but it was rare to see any other correct formulae in part (i). In part (ii), few candidates were able to identify that the lack of oxygen would enable anaerobic respiration. Candidates often missed out on marks by producing vague answers, not referring to enzymes becoming denatured and the best conditions for enzymes.

(b) Most candidates scored 1 or 2 marks, but few gained all 3 or 4 marks. Most commonly correct was 'produces cells with chromosomes', most commonly incorrect was 'produces only two daughter cells'.

Question 4

(a) Candidates often picked up the mark for high electrical conductivity, but most failed to mention the fact that copper is cheaper than silver.

(b) Most candidates picked up the mark for the higher atomic mass not being related to melting point and failed to mention the relationship with density. Many quoted figures from the table, but when doing this only quoted a single piece of data to prove the relationship between density and atomic mass and this was insufficient for the mark.

(c) In part (i), few candidates scored 2 marks, the most common errors were the density and corrosion rows. For part (ii) candidates more commonly picked up the mark for material to type of bonding, but often only managed to match up one of the correct descriptions to the type of bonding.

Question 5

(a) Part (i) was answered well, but few candidates managed to describe three of the points, and so failed to get full marks. Most common answers related to the energy source not running out and there being little running costs. In part (ii), candidates often failed to pick up two marks by only describing one point. Often in part (iii), candidates forgot the stem of the question and quoted answers in relation to driver safety instead of saving energy.

(b) Part (i) was generally answered well, however many candidates incorrectly referred to the LEDs as being cheaper and brighter. In part (ii), a large portion of candidates incorrectly rearranged the formula, coming up with the answer '2'. For part (iii), again incorrect rearrangement of formula (which is a requirement of the higher tier) led to common incorrect answers of '360' and '0.4'. Many candidates failed to understand the question being asked in part (iv) and that they need to be thinking about energy efficiency.

Question 6

(a) Most candidates correctly recalled that tuberculosis is a bacterium, virus being the common error in part (i). Part (ii) was answered well, with the majority of candidates identifying that antibiotics are only used to treat bacteria.

(b) Although generally answered well, again candidates need to ensure that they are describing 3 valid points in order to pick up the 3 marks available for this question.

(c) Many candidates picked up marks on this question. Some common misconceptions were that the vaccination contained antibodies or that it contained a small amount of the bacteria.

B483: Science at Work (Portfolio)

General Comments

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

For practical activities, centres should have ensured 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. Candidates working towards a Band 3 score should have had a full complement of practical activities at a minimum of Band 2.

Presentation of candidates' portfolios was often exemplary, but it would have greatly assisted the moderation process if they had been presented in cardboard wallets or cut-flush folders, or bound with treasury tags, rather than in plastic wallets.

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

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

Note that after the initial overview of science in the workplace at Band 1, candidates should then study **two** organisations in detail. Attention is drawn to the hierarchy among the criteria; candidates are often identifying at Band 1, describing at Band 2, and giving explanations at Band 3. An *explanation* of the importance of the work carried out by an organisation is often easier when supported by statistical data. There were instances where explanations were lacking, but candidates had nevertheless been awarded band 3.

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

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

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

The main area of deficiency seen was in criterion six – a review of the energy inputs and the treatment of wastes in the industrial version of the process. While some centres have now found appropriate information sources, coverage of this criterion was often absent, or minimal in others. For candidates researching the commercial extraction and production of copper, centres found the website www.kennecott.com; http://www.kennecott.com/in-the-news/reports/?year=2007 invaluable.

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 were generally good in annotating portfolios to give an indication that a symbol equation has been balanced by the candidate.

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

Evaluations were often too simplistic to be awarded Band 3.

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

In this strand, centres should have ensured that discussions of the use of electronic devices and components were not too superficial, and noted that *explanations* of why these components are used should have been given at Band 3. Candidates should also have reviewed a wider series of components than just those used in the device that they had produced.

Assessing the performance of electronic circuits, at Bands 2 and 3, should ideally have included the collection of numerical data. 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.

Strand d
A report on mechanical devices

In this strand, all units should have been included in tables for candidates working at higher levels.

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

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

In this strand, centres had chosen an interesting range of organisms to monitor. Candidates in many centres sometimes, however, neglected in their discussions the reasons for monitoring the organism. Note that for band three to be awarded, *complex* processing of data is required. The calculation of growth rates is often a way of addressing this criterion at Band 3, though some centres, commendably, are introducing statistics into their analyses of data at this level. Centres should also ensure that candidates working at higher levels display data appropriately and relate

their findings to scientific principles. Discussions should, however, be fully integrated into their conclusions; often a good deal of physiological information when monitoring human performance is included simply as a 'bolt-on'.

Evaluations were often marked generously.

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