edexcel
advancing learning, changing lives

Examiners' Report Summer 2008

IGCSE

IGCSE Science (Double Award) (4437)

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information please call our Customer Services on + 44 1204 770 696, or visit our website at www.edexcel-international.org.uk.

Summer 2008

Publications Code UG020273

Contents

4437 Science (Double Award) Paper 1F

General
The paper was felt to be of a similar standard to those set previously. The candidates' performance was felt to be similar to that of the previous series. The paper discriminated well, with a very wide range of marks seen. The full range of marks was seen for each part of each question.

Question 1
The multiple choice questions were a gentle start to the paper – many candidates showed good knowledge. The question that was answered less well was (g) where many did not calculate from the end of the race.

Question 2
This question tested the candidates' knowledge and understanding of the eye.
Part (a) was answered well by some and less well by others. Most knew the retina, but many were confused between pupil, cornea, lens and iris. In part (b), most knew the letter that represented the part containing the light sensitive cells, although fewer knew the letter that represented the part that controls the amount of light entering the eye.

Question 3
This question tested the candidates' knowledge of food chains.
In part (a), most candidates scored one or two marks. However, some had water plants at the top of the pyramid and others did not label the pyramid. The majority of candidates gained full marks in both parts of (b), showing a good knowledge of the interactions of the different members of the food chain.

Question 4
This question tested the candidates' understanding of the structure and function of the lungs.
Most candidates gained the mark in part (a) for the labelling of the trachea. Part (b) discriminated well, with the full range of marks being seen. Few candidates knew about cartilage. Part (c) also discriminated well. The majority of candidates gained one or two marks, usually by saying that the diaphragm moved down and the volume of the lungs was increased.

Question 5
This question tested the candidates understanding of the factors affecting photosynthesis. In parts (a) and (b) some candidates appeared confused about the relationship between the space occupied by the gas and photosynthesis. In part (c) most could identify at least one additional factor that could affect the amount of gas produced, the most common answer being carbon dioxide.

Question 6
This question was about cloning and was generally well answered.

Question 7
This question tested the candidates' knowledge and understanding of deforestation and its effects.
Many candidates gained one mark in part (a) for explaining how building the road would improve access, few gained the second mark for suggesting how the road could enable development of farming, mining or other land use. In part (b) many candidates were able to gain credit for explaining two effects of deforestation. Suitable examples included loss of habitat leading to loss of species due to migration or extinction and less photosynthesis leading to increased carbon dioxide levels.

Question 8
This question of plants tested reproduction, growth and photosynthesis.
In part (a) most candidates were able to identify the anther as the part of the flower that produces pollen and label it on the diagram. A few responses pointed to the filament. Pollination was accurately described by many candidates as the transfer of pollen, but not many gained the second part by saying from the anther to the stigma. In part (b) almost all responses were able to identify light or gravity as the stimulus for upward growth in a plant stem. Candidates who wrote a correct symbol equation for photosynthesis in part (c) did not lose credit but were more likely to make an error than those writing the word equation. Some responses to (c) (ii) described how the leaf is adapted to photosynthesis rather than how it is adapted to gas exchange so did not gain full credit.

Question 9
This longer response question tested the candidates' knowledge and understanding of the digestion of carbohydrate.
The best responses described the rice being chewed in the mouth, with the starch being acted upon by salivary amylase and maltose being formed. This maltose is then further digested in the duodenum by maltase, released from the pancreas, and broken down to glucose. Some responses discussed enzyme action in the stomach or described digestion to glucose in the mouth. Most candidates gained around 3 marks.

Question 10
This question brought together the cardiovascular system and the action of insulin on glucose. It required the candidates to fill in the gaps in a passage describing how insulin travels from the site of injection to the liver. Most gained around 3 or 4 marks. The most common errors were the misidentification of the hepatic artery as the hepatic portal vein and confusion between the aorta and the vena cava. Sometimes glycogen was spelled in such a way that it was unclear to examiners.

Question 11
This question tested knowledge and understanding of selective breeding and micropropagation.
In part (a) most candidates were able to show in the table the correct order of the steps involved in selective breeding. In part (b) most were able to describe the advantages of micropropagation as producing large numbers of genetically identical plants in a short period of time.

Question 12

This final question tested the growth of crops and the candidates' ability to perform a percentage increase calculation.

In part (a) few candidates were able to calculate the percentage increase, although some gained one mark for a part calculation. In part (b) only the very best responses described how an additional supply of nitrates could enable more amino acids to be produced and hence more protein for growth. Most gained just one mark for indicating that fertilizers would contain a (named) mineral.

4437 Science (Double Award) Paper 2F

Question 1

In part (c)(i), almost no candidates could say what an element was. Most gave a symbol or name as an example, or stated that it was made up of protons, neutrons and electrons.

Question 2

In part (b)(i), most candidates knew that the answer required was something to do with reactivity, but relatively few stated that zinc was more reactive than iron. Many attempts that came close referred to iron(II) or to iron(II) sulphate.

Question 3

In part (a)(i), the test for hydrogen was often correctly described, although with many candidates using a glowing splint through confusion with the test for oxygen.

Question 4

This question was generally well answered.

Question 5

This question required candidates to show the correct order of instructions used to prepare a salt. Very few left any of the boxes unfilled or repeated the instructions already used. Although a minority scored full marks, most received partial credit for orders that were partly correct.

In part (b)(iv), although the expected answer for a substance with pH = 7 was water, a great variety of suggestions was made, many of which were the names of acids.

Question 6

This question was based on the industrial extraction of aluminium. Most candidates gained the mark in parts (a)(i) and (ii) although a number gave aluminium as the electrode material. Some candidates omitted (a)(iii), it is suggested that rather than just look for dotted lines or gaps in which to write answers, candidates read the questions and use the marks indicated on the paper as a guide to what is required. In (a)(iv) a common error was to use bauxite as the electrolyte or even water. Most gained the mark in (a)(v) although some who went for electrode replacement did not gain the mark due to vague answers that referred to "electrode" rather than "anode" or "positive electrode". Part (b) was well answered although some very strand compounds were seen in (ii), candidates who correctly identifies the compounds as carbon dioxide sometimes did not go on to score the second mark because they identified the oxygen involved as coming from the air.

Question 7

This question was based on organic chemistry.
In (a)(i) common errors included stating physical properties were the same or that chemical properties followed a trend; other errors included statements about being saturated or hydrocarbons, some stated they had the same general formula despite the question asked. Part (a)(ii) was almost always correct . There were some unexpected errors in (b)(i) with hydrogen shown as having two electrons or carbon as

12. In (b)(ii) those candidates who new the formula of methane, which was given at the start of the question, generally picked up the marks; the number of candidates who did not know the formula of methane was disappointing. Very few candidates scored both marks in (c)(i) – terms such as "chemical formula" are not the equivalent of the term "molecular formula", it was not uncommon to see descriptions of isotopes to be written, sometimes followed by two correct diagrams of the isomers! Many candidates drew two diagrams of butane and just bent, rather than branched, the chain. Candidates who were unable to interpret the molecular formula of butane that was given could not score.

Question 8

This question was about the chemistry of Group 2 elements. In (a)(i) many candidates gave the same observations as for sodium – but calcium does not melt, it does not just float (although it may well move up and down) and it definitely does not catch fire when placed in water. The formula of calcium hydroxide was often incorrect. In (a)(iii) some candidates hedges their bet by giving two colours – this is not a good idea since it means that both colours must be correct; given that the indicator was litmus, having two colours is contradictory. Hence any reference to purple was wrong (since purple means neutral for litmus). In (b) the colours were well known (although a few though the oxide of magnesium was black). Collecting the hydrogen caused some problems, candidates sometimes gave contradictory answers – such us "upwards into a test tube – upward displacement". Some candidates chose to give three methods – a dangerous thing to do since all three methods need to be correct to gain the two marks, if one method is wrong and two correct then only one mark can be awarded. Despite asking for a word equation in (b)(iii) many tried to write a symbol equation – this does not answer the question set and so does not gain any marks. In the word equations "carbon dioxide" was not an uncommon product.

4437 Science (Double Award) Paper 3F

Examiners were pleased to note the high quality of some of the work.

Question 1

1ai, ii and iii Nearly all candidates were able to interpret the distance-time graph correctly.

1bi and bii Nearly all were able to complete the explanations correctly.

1c Some did not express themselves clearly and/or they confused distance and time taken in their answers. Good answers compared the appropriate intervals on the y-axis.

Question 2

2ai and ii Most chose correct words from the box. Full credit was given for either order.

2b Some had difficulty in expressing the idea that stray wires were the fault.

2ci and ii Most recognised that the plastic covering made it unnecessary for the small radio to be fitted with an earth wire and that the fuse is unlikely to blow because the current is only low.

2d The most popular correct suggestion was to use a circuit breaker or to have double insulation.

Question 3

3a Most knew that waves transfer energy but fewer knew that they also transmit information.

3b Most had the general idea correct but some chose A rather than D and/or chose B, or more commonly E, rather than C.

3ci and ii Many were uncertain about how to describe frequency and did not seem to realise that part (ii) was asking about the wave equation.

3di Most knew that waves which are not transverse waves are longitudinal waves.

3dii and iii Most recognised 20 Hz -20 000 Hz as the correct range of frequencies and nearly all knew the range for an elderly person is less than that for a teenager.

Question 4

4ai Most recognised that this must be a microphone.

4aii Nearly all were able to name an appropriate device such as an electric kettle.

4b Rather surprisingly this was less well answered with a significant minority incorrectly suggesting devices, such as a swing, where the transfer is from KE to GPE as well as from GPE to KE.

4c Most were able to give either heat or sound as their answer.

4d and e Only a minority were able to make the correct selection and/or knew that 'kinetic' correctly completes both boxes in part (e).

Question 5

5ai and ii In part (i) only a minority realised that this must be 100 000 and, because most did not realise that the unit refers to an average decay rate of one per second, very few could complete part (ii).

5bi A significant minority was able to calculate the counts per minute as 330.

5bii and iii Only a minority realised that the reading was due only to background radiation and even fewer described it as variable.

5c There was a wide variety of correct responses.

Question 6

6a Nearly all had yellow and green in their correct order.

6bi and ii When infra-red and ultra violet were given, they were almost always the correct way round and ultra violet was given as the part with the higher frequency.

Question 7

7ai and ii Both were usually correct.

7aiii Full credit was given for a response in the style of the printed example or for two separate lines each correctly labelled drinking (alcohol) and slippery (road).

7bi A variety of responses were credited. However, examiners were disappointed that that more did not offer 'air resistance'.

7bii Examiners were disappointed that only a minority seemed to understand that, if X is the centre of mass of the car, then its weight must act vertically downwards from this point.

Question 8

8ai and ii Most gave correct responses to both parts.

8bi and ii Many correct responses to both parts.

8biii Many muddled responses indicating poor understanding. Very few candidates were confident that, in a transverse wave, each point on the wave is moving at 90° to the direction in which the energy of the wave is moving.

Question 9

9ai Some did not seem to understand that 'voltage = current × resistance' is a perfectly correct response to this question and muddled themselves by attempting a transposed version in terms of current.

9aii However, many corrected themselves in this part though some omitted the unit.

9b 'decrease' followed by 'increase' gained two marks but (1) mark was awarded for 'increase' and then the consequentially correct 'decrease'.

Question 10

10ai Many correctly identified the component as a diode but light-emitting diode or LED was not acceptable.

10aii Only a minority offered 50 (mA) in both cases. 25 (mA) and 25 (mA) was a popular incorrect pair.

10aiii Only a minority noticed that one cell in the battery is connected the wrong way round or wrote that some of the voltage is across one, or more, of the other components.

10b Many offered a description of the shape of the curve rather than an explanation. Only a very small minority even mentioned temperature and consequently an appropriate response, for example, 'as the voltage across the filament increases the filament's temperature increases, therefore its resistance increases and the curve becomes less steep' was hardly ever seen.

Question 11

11ai Many correctly stated that, at absolute zero, molecules do make any kind of movement.

11aii and iii Many remembered that absolute zero is -273 °C and were able to calculate that 100 °C is 373 K.

11b Few were able to offer a modern explanation and some just copied parts of the passage. Examiners were looking for responses of this sort, 'Larger particles are knocked about by the random motion of tiny, invisibles molecules' but they rarely saw them.

4437 Science (Double Award) Paper 4H

The examiners were once again impressed by the knowledge and understanding shown by the candidates in this summer's examinations. They were particularly impressed by the ability of the candidates to apply their biological knowledge to novel situations, to make comparisons and suggest explanations of data. It was felt that the papers allow students to demonstrate their understanding of as well as knowledge of biological principles.

Question 1
Many candidates gained one mark for explaining how building the road would improve access or allow for transport. Most candidates were able to gain credit for explaining two effects of deforestation. Suitable examples included loss of habitat leading to loss of species due to migration or extinction and less photosynthesis leading to increased carbon dioxide levels.

Question 2
Most were able to identify the anther as the part of the flower that produces pollen and label it on the diagram. A few responses pointed to the filament. Pollination was accurately described as the transfer of pollen from the anther to the stigma. Almost all responses were able to identify light or gravity as the stimulus for upward growth in a plant stem. However, some candidates referred to the response rather than the stimulus. Candidates who wrote a correct symbol equation for photosynthesis in part (c) did not lose credit but were more likely to make an error than those writing the word equation. Some responses to (c)(ii) described how the leaf is adapted to photosynthesis rather than how it is adapted to gas exchange so did not gain full credit. It is clear that many candidates are familiar with the structural adaptations possessed by leaves to help them absorb carbon dioxide. However, a large number of candidates failed to read the question carefully and wrote at length about other adaptations to prevent water loss or to trap light.

Question 3
This was a question in which the candidates were able to write in free prose to show their knowledge of starch digestion. The best responses described the rice being chewed in the mouth, with the starch being acted upon by salivary amylase and maltose being formed. This maltose is then further digested in the duodenum by maltase, released from the pancreas, and broken down to glucose. Some responses discussed enzyme action in the stomach or described digestion to glucose in the mouth.

Question 4
This required candidates to fill in the gaps in a passage describing how insulin travels from the site of injection to the liver. Most gained credit with the most common error being misidentification of the hepatic artery as the hepatic portal vein. Sometimes glycogen was spelled in such a way that it was unclear to examiners.

Question 5
This provided a table showing the steps involved in selective breeding that the candidates were to put in order. Most were able to do this correctly. In part (b) most were able to describe the advantages of micropropagation as producing large numbers of genetically identical plants in a short period of time.

Question 6
This gave candidates a table of different crop yields grown on soil and using liquid fertiliser. In (a) the majority were able to calculate the percentage increase, however, as always, some candidates were unable to do this simple calculation. In part (b) the better responses described how an additional supply of nitrates could enable more amino acids to be produced and hence more protein for growth.

Question 7
This described the genetic control of dwarfism in mice. In part (a)(i) and (ii) most candidates could identify the parent mice as Dd and show the genotypes of their offspring and give the phenotypic ratio. In part (iii) the best responses described how two homozygous DD mice could not produce a dwarf mouse as they lacked the d allele and that the homozygous dd mice are sterile. Some candidates and perhaps staff are uncertain of the relationship between the terms gene and allele and seem to use them as interchangeable. In part (b) only the most able candidates could describe that a dwarf mouse would have a large surface area to volume ratio and therefore lose more heat so require more oxygen per g for respiration. Some candidates appear to believe that small organisms have a larger surface area. Some answers did raise a smile as the examiners had to picture dwarf mice scurrying after their bigger brothers and sisters as the attempted explanation for their oxygen consumption.

Question 8
Part (a) required candidates to recall the word equation for anaerobic respiration in yeast. Again although most gained full credit, some put lactic acid as a product while those who wrote a symbol equation were more likely to lose credit for a wrong formula. Part (b) enabled candidates to gain credit for describing how yeast could be genetically modified. Most gained full credit as they were able to describe the correct steps used. The better responses gained full marks in (ii) for explaining that the modified yeast would contain the amylase enzyme and would therefore be able to digest more of the starch.

Question 9
Nitrification is not understood by many candidates. The process was confused with nitrogen fixation, or even denitrification. The more able candidates appreciated the role of bacteria in producing nitrates for growth from ammonium compounds.

Question 10
In part (a) most were able to explain why fish need lipids. In part (b) most candidates were able to explain energy loss in terms of respiration, movement, heat loss, egestion and excretion. Part (c) enabled most candidates to demonstrate their knowledge of the eutrophication and its causes and consequences. Some less able candidates wrote about fish and fishermen being poisoned.

Question 11

This required candidates to calculate BMI values for three humans and interpret these. Almost all could do this correctly. Most were also able to recognise that an athlete with large muscle mass would have a higher BMI. In (c) (i) they were asked to draw conclusions from a graph of risk of heart disease against BMI. Most could do this correctly. However in part (c) (ii) few candidates gained full credit. Only the most able candidates were able to indicate that build up of cholesterol in the coronary arteries would reduce the amount of glucose and oxygen reaching heart muscle. This would lead to a move towards anaerobic respiration leading to build up of lactic acid which is toxic for the cells.

Question 12

Part (a) asked candidates to compare ultrafiltraion and selective reabsorption. Almost all candidates scored well on this item and the best gained full credit for comparing, for example, the location, the pressure used, the direction as into or out of the blood, the influence of hormones, and the role of ATP in active transport. The table in part (b) (i) again proved straightforward for most candidates, but challenging for the less able candidates. Part (b) (ii) required candidates to write about the consequences of pituitary damage on osmoregulation. The most able candidates gained full credit but some other candidate seem uncertain about how the change in permeability of the collecting duct wall relates to water movement and the consequences for urine and blood concentrations. In part (c) (i) most candidates were able to explain that using a vein is preferable because, for example, of reduced pressure, easier to find nearer skin surface and thinner walled. In (c) (ii) most could describe diffusion from a high concentration to a lower concentration and in (iii) name two waste products.

4437 Science (Double Award) Paper 5H

Question 1

This question was based on the industrial extraction of aluminium. Most candidates gained the mark in parts (a)(i) and (ii) although a number gave aluminium as the electrode material. Some candidates omitted (a)(iii), it is suggested that rather than just look for dotted lines or gaps in which to write answers, candidates read the questions and use the marks indicated on the paper as a guide to what is required. In (a)(iv) a common error was to use bauxite as the electrolyte or even water. Most gained the mark in (a)(v) although some who went for electrode replacement did not gain the mark due to vague answers that referred to "electrode" rather than "anode" or "positive electrode". Part (b) was well answered although some very strand compounds were seen in (ii), candidates who correctly identified the compounds as carbon dioxide sometimes did not go on to score the second mark because they identified the oxygen involved as coming from the air.

Question 2

This question was based on organic chemistry.
In (a)(i) common errors included stating physical properties were the same or that chemical properties followed a trend; other errors included statements about being saturated or hydrocarbons, some stated they had the same general formula despite the question asked. Part (a)(ii) was almost always correct. There were some unexpected errors in (b)(i) with hydrogen shown as having two electrons or carbon as 12. In (b)(ii) those candidates who knew the formula of methane, which was given at the start of the question, generally picked up the marks; the number of candidates who did not know the formula of methane was disappointing. Very few candidates scored both marks in (c)(i) – terms such as "chemical formula" are not the equivalent of the term "molecular formula", it was not uncommon to see descriptions of isotopes to be written, sometimes followed by two correct diagrams of the isomers! Many candidates drew two diagrams of butane and just bent, rather than branched, the chain. Candidates who were unable to interpret the molecular formula of butane that was given could not score.

Question 3

This question was about the chemistry of Group 2 elements. In (a)(i) many candidates gave the same observations as for sodium – but calcium does not melt, it does not just float (although it may well move up and down) and it definitely does not catch fire when placed in water. The formula of calcium hydroxide was often incorrect. In (a)(iii) some candidates hedged their bet by giving two colours – this is not a good idea since it means that both colours must be correct; given that the indicator was litmus, having two colours is contradictory. Hence any reference to purple was wrong (since purple means neutral for litmus). In (b) the colours were well known (although a few though the oxide of magnesium was black). Collecting the hydrogen caused some problems, candidates sometimes gave contradictory answers – such us "upwards into a test tube – upward displacement". Some candidates chose to give three methods – a dangerous thing to do since all three methods need to be correct to gain the two marks, if one method is wrong and two correct then only one mark can be awarded. Despite asking for a word equation in (b)(iii) many tried to write a symbol equation – this does not answer the question set and so does not gain any marks. In the word equations "carbon dioxide" was not an uncommon product.

Question 4

This question was, in general, very poorly answered. In (a), those who were unable to name the process were usually unable to pick up any marks in (ii). In part (ii) there were often incorrect references to "copper sulphate molecules". Many answers stated that "diffusion was the movement of particles from areas of high to low concentration" – this gives a rather simplistic idea and suggests one way travel, while we decided to credit this answer on this occasion it should be noted that diffusion is the **net** movement of particles from areas of high to low concentration and is brought about by the **random** motion of particles. There was some confusion with diffusion and Brownian motion; it should be noted that Brownian motion has been deleted from the specification.

Part (b) yielded some very strange answers, varying from a pungent gas being evolved to brown precipitates of copper. Some suggested that the copper(II) hydroxide precipitate was green or blue/green – which it is not. Very few correctly gave the formula of the complex ion.

Question 5

This question was based on sodium.

Most gained some credit in (a)(i), but although many used the term "effervescence" a number seemed not to appreciate its meaning – answers such as "it effervesces and bubbles" were not uncommon. It should be noted that the sodium should not catch fire spontaneously if a safe sized piece is used in this reaction and the sodium does not dissolve – if it simply dissolved then evaporation of the final solution should yield sodium metal. A common error in the equation was to either have sodium with a valency of two or to form the oxide. Most realised that rubidium would bubble more violently. In (b) many answers showed a lack of logical idea development, although in the majority of cases full marks could still be awarded. (b)(ii) showed some very poor use of terminology, most got the idea of strong forces or bonds requiring a lot of energy to break but the mark for stating the bonds/attractions were between ion was rarely awarded; it was not uncommon to see answers such as "ionic bonds lead to strong intermolecular forces between atoms"! This shows a fundamental problem with the understanding of atoms, ions and molecules.

Question 6

Part (a) was poorly answered by many candidates –although most picked up at least one mark. Some candidates decided not to use the reagents provided in the question, some even chose to start with magnesium chloride. Having been told the solubilities of magnesium carbonate and magnesium chloride, a worrying number chose to use a pipette or burette for the magnesium carbonate and then to collect the magnesium chloride as a precipitate. Salt preparations provide students with a chance to conduct some relatively safe practical work, some candidates seem not to have done (or even seen) these preparations. In (b) candidates need to be reminded that a colour change required both a start and a finish colour.

Question 7

The test for the carbonate ion was generally well known, although some gave the test for sulphate or halide ions. The equation was frequently wrong, the common error being an incorrect formula for sodium carbonate (despite it appearing in (b)!). Most candidates picked up some marks in (b), but few scored full marks in (i) – it was common to have formula mass of sodium hydrogencarbonate of 168 (2 moles) or 107 (2 sodiums). In (ii) some candidates ignored the equation given and tried working out the moles of carbon dioxide based on its molar mass.

Question 8

This question was based on the halogens.

Most were successful in predicting the boiling point of bromine (74.5^{o}C being a very common answer) but some ignored the minus sign in front of the figures for the boiling point of chlorine – and so predicted boiling points that were too high. In (b)(i), those who knew the formula of hydrogen chloride often did not recall that both hydrogen and chlorine are diatomic. In (b)(ii) most scored two marks for the first part but then scored poorly in the second part – it was not uncommon to think methylbenzene was an alkali and that there was (or was not) a neutralisation reaction. A common problem was the colour of universal indicator paper – a number stated that there would be no colour change and then lost the mark by stating it would stay green; universal indicator paper is normally orange until it comes into contact with water. Some thought litmus and universal indicator were the same thing.

Question 9

Most could name the type of rust prevention and a place where it is used, although it should be noted that it is not used for "tins" (which are so called as they were made from tin-plated steel) nor for food cans - soluble zinc compounds should not be ingested in quantity and so galvanised food cans may lead to death. In (iii) there were many answers that were based on "protective layers of zinc oxide" – this question was requiring an explanation of how a **damaged** zinc layer still prevented rusting, if the zinc layer is not intact then the zinc oxide that forms on the zinc would also not be intact. There was some confusion in (b) with candidates thinking that the increase in charge of the zinc was due to the gain of electrons. In part (c) common errors were to fail to make the nickel nitrate into the solution, to "react the nickel nitrate with the metals" (seemingly missing the whole point of the experiment since if the added metal is less reactive than zinc there will be no reaction) rather than adding them together. Some candidates decided that rather than use nickel nitrate and the provided metals they would use all manner of other substances. Disappointingly some thought nickel nitrate and nickel were one and the same thing.

Question 10

Part (a) was well answered. A frequent error in (b) was to ignore the requirement to show at least 4 carbon atoms in the structure. The calculation in (c) was often incomplete. Many good answers were seen (as well as some very poor ones) but there were commonly errors in simplifying ratios. It was not uncommon for just the empirical formula to be calculated with no attempt to find the molecular formula. Some of those that did attempt to find the molecular formula did not appreciate that if the relative formula mass of the compound divided by the relative formula mass of the empirical formula is not an exact whole number then a mistake must have been made.

General points

- If a word equation is asked for then a chemical equation (using formulae) will not score. The opposite is also true.
- If **one** or **two** etc. reasons points are asked for then it is not a good idea to give more than the requested number since any errors will lead to the loss of a mark.
- If a colour is required, do not give two colours as the answer as both colours must be correct.
- If a temperature (or pressure) is required then do not give a range since both extremes of the range must be correct.
- Candidates should use words in calculation to explain what they are doing.

4437 Science (Double Award) Paper 6H

General

With a greatly increased entry some truly outstanding work was seen.

Question 1

This question was very well answered. In (a)(i)(ii) candidates read the times correctly from the graph. In (a)(iii) most candidates drew two graphs to show the two effects separately of the driver drinking and the road being slippery. If they chose to do this rather than just show one graph consisting of two lines then the marks could only be scored if the separate graphs were suitably labelled.
In (b)(i) a wide range of factors were credited as affecting the force of friction on the car. Unfortunately a significant number of candidates responded with 'condition of tyres' and 'condition of road surface'.
In (b)(ii) a significant minority of candidates showed the arrow indicating the weight of the car coming downwards from the centre of the car instead of from its centre of gravity.

Question 2

In (a) candidates showed good recall of the use of parts of the electromagnetic spectrum but were less sure in (b)(i) and (ii) about the property shared by these waves and an example of another transverse wave. Although many candidates scored this mark by referring to water waves many more stated sound waves.
In (b)(iii) candidates were not often able to correctly fill the gaps describing the nature of transverse waves. The second gap was often 'direction'.

Question 3

This question was very well answered. In (a) the vast majority of candidates were able to state the equation and calculate voltage giving its unit from given values of current and resistance. In (b) most candidates were familiar with the behaviour of a light dependent resistor when moved to a lighter position although a significant number scored just one mark for getting the effect the 'wrong way round'.

Question 4

This question was not well answered. In (a)(i) a significant number of candidates were unable to recognise a diode from its circuit symbol with many considering it to be a resistor. A common wrong answer to (a)(ii) was to give both ammeter readings as 25 mA. In (a)(iii) the main reasons given were that the diode was connected the wrong way round, the cells had run down or the switch was open. Where candidates noticed that the cells were incorrectly connected they often commented in a clumsy manner usually referring to batteries rather than cells.
In (b) some excellent answers were seen but these were in the minority. Asked to explain the shape of the voltage –current graph for a filament lamp many noted that it was non-ohmic or the increase was not proportional. Often candidates wrongly referred to a decrease in current or spoilt a promising answer by stating that the resistance decreases.

Question 5

The second part of this question was not well answered.
In (a)(i) most candidates stated categorically that there was no molecular motion at absolute zero. Some did not score this mark because they had presented theories that go beyond the level examined or because of contradictory statements like: 'they are motionless but still vibrate a little'.
In (a)(i) most candidates dealt competently with the Kelvin and Celsius temperature scales.
In (b) a few candidates based their explanation of Brownian motion on diffusion without considering collisions. The difficulty that candidates faced was that given a long passage in the stem they were unlikely to score marks by repeating phrases from the passage. Terms like 'random' and erratic' were therefore best left out of the response.
The marking points were

- particles collide
- with smaller or different named particles
- causing a change of direction

with the second and third marks being dependent on the first.
Commonly seen was : 'particles collide and move randomly'.

Question 6

Part (a) was well answered but (b) was poorly done.
In (a)(i) many candidates either did not know or chose not to use the terms gradient or slope. In (ii) and (iii) the calculations including the unit scored well across a wide range of candidates. In (iii) a common error was 70 x 10 = 700 N or conversion of 70 kg to 700 N before multiplying by the value of deceleration.
The answers in (b) almost always commented on the damage that the boy would do to himself if he did not bend his knees. Some described this in great anatomical detail. All but a few missed the point that increasing the time or distance for his change of velocity would result in less deceleration and so less force. Many based their answers on the pressure, area and force involved and some showed confused logic by referring to a shorter time to come to rest.

Question 7

This question was well answered.
In (a) it was anticipated that many candidates would use the angle given as the angle of incidence. This did not happen although some did use the formula involving critical angle. Occasionally the answer was left as the sine of the angle scoring the first two marks only. In (b) the drawing of the refracted ray in a medium of lower refractive index with the same angle of incidence was usually correct although the explanation was often contradictory with reference to a larger angle of refraction and more refraction as being the same thing.
In part (c) the added line required was the normal and this was usually drawn incorrectly as a vertical line and not always at the point of incidence. The second mark for the angle of incidence could still be scored. A significant minority of candidates considered the line labelling the glass block to be the incident ray.

Question 8

Part (a) often showed a lack of logic which was not seen in part (b). Expressions in (a) frequently showed either multiplication or division signs.
The calculation in (b) was well done although some tried to use distance /time to calculate the speed in (iii).
In (c)(i) candidates had to identify a material from its force-extension graph. The most common answer was 'spring' which with only a minority scoring for naming metal or any metal. Part (c)(ii) was disappointingly answered because many candidates who did know the answer to which region of the graph was associated with Hooke's Law wrongly or carelessly labelled it. Very often the apex of the graph was circled. The mark in (iii) could not then be scored.

Question 9

In part (a) the Left Hand Rule was widely known. Part (b) represented a type of question that has been set before testing knowledge of the direction of three quantities the third of which is related to the first two. This was well answered but some of the directions and labels were not clear and **M** was often bi-directional. In particular the direction of the current was not always shown in the short rod. Part (c) was well answered, the only lapse was not stating the type of change so 'current' instead of 'larger current' was occasionally seen.
In (d)(i) some loose descriptions of alternating current were seen. Given room for a diagram the safest strategy for the candidate is to give a labelled graph showing at least two cycles and a roughly sinusoidal variation about an axis. Many drew generators. Part (ii) was poorly answered. The movement of the rod would be closely linked to the variation of the current but a significant number of candidates thought that the force would always be greater because the current was alternating.

Question 10

In part (a) the subscript and superscript for the neutron were known by half of the candidates who went on to give the corresponding quantities for the beryllium nucleus. In (b) many candidates knew which of the particles from (a) was emitted during alpha emission but relatively few knew what was emitted during beta emission. A significant number thought it was the proton after explaining that a neutron decays to a protons and an electron. In (c)(i) the definition of the term isotope was well known although many dropped a point by stating 'same element' instead of 'same number of protons' for the first mark.
Part (c)(ii) tested the most able candidates. An answer showing three equations with the steps necessary for uranium-238 to decay by three successive emissions into an isotope of uranium was occasionally seen but the equivalent, in words, was often seen. A common error was the addition instead of subtraction of emitted particles from a parent nucleus. Sadly a disproportionate number of blank spaces was seen.

Question 11

In part (a) candidates had to fill in four gaps to complete a statement about nuclear fission. The second and third usually scored with answers of 'two' (or three) and 'chain' but the first rarely and the fourth occasionally. The term 'daughter' was not known and those candidates who did not answer 'speed' or 'velocity' for the fourth lost the mark for 'energy' instead of 'kinetic energy'.
In (b) the questions about the role of the moderator and control rods in a nuclear reactor were again poorly answered.
The main errors were identical answers in both parts, mixing up the roles of the two and that either could stop radiation from escaping or even that the moderator was a person.

4437 Science (Double Award) Paper 07

General

The paper was felt to be of a similar standard to those set previously. The candidates' performance was felt to be similar to that of the previous series. The paper discriminated well, with a very wide range of marks seen. The full range of marks was seen for each part of each question.

Question 1

This was a gentle start to the paper – a simple recall question about food tests.
Most candidates scored full marks, although a few did not realise that a Bunsen burner was needed for testing for glucose. Some candidates lost marks because they gave more than two answers for each test.

Question 2

This question tested the candidates' knowledge and understanding of enzymes. It was set in the context of digestion.
Part (a) was answered well, although some candidates got mixed up with the speed of reaction and the time taken for the reaction. It did not matter whether candidates talked about speed or time taken, as long as they got what happened with temperature the right way round. The majority of candidates picked up the maximum two marks here, usually by saying it speeded up and then slowed down, as the temperature rose. Others correctly referred to the optimum point. In part (b) the full range of marks was seen. The majority of candidates gained 2 marks, usually by making reference to an optimum point and denaturation of the enzyme. The most able candidates talked in terms of increasing energy and movement of molecules with increasing temperature.

Question 3

This question was based on the germination of pea plants. It tested the candidates' skills of observation, graph plotting and understanding of genetic crosses.
In part (a) (i) almost every candidate gained the full two marks for the counting of the seeds. In (a) (ii) most candidates scored the full five marks for the graph. The most common mistake was in forgetting to label the axes properly. Part (b) discriminated well, yielding the full range of marks. The majority of candidates gained 2 marks, for identifying the parents as heterogeneous and for identifying smooth as dominant/wrinkled as recessive. Two marks could be gained by a correct Punnet square diagram.

Question 4

In this question, candidates were required to show their knowledge and understanding of planning, carrying out, analyzing and evaluating an experiment. It was based on osmosis in potatoes placed in different concentrations of sodium chloride solution.
In part (a) (ii) most candidates gained one mark for saying they would use a ruler. Only the more able indicated how all the cylinders could be cut to the same length (of 10 cm). Almost all candidates gained at least one mark in part (a) (i), for identifying a suitable factor, e.g. temperature. Only the more able candidates gained the second mark for saying how the factor might be controlled. e.g. by using a water bath. In part (b) (i) about half the candidates gained full marks for measuring the length of the cylinders. They gained one mark out of the two if one or two had been measured correctly and two marks if all three had been measured correctly. Most candidates gained the mark in (b) (ii) for calculating the change in length for all three cylinders (they could gain the mark even although they had not measured them

correctly in the previous part). Most candidates gained at least two marks for explaining the change in length in the potato cylinders. The most common mistake was to talk about the concentrations of the solutions the wrong way round. The majority of candidates gained the two marks for explaining what would happen to the length of the potato cylinders when placed into distilled water. A few candidates lost a mark because they did not make reference to length. Many candidates appeared confused about reliability and accuracy, with many answering initially in the wrong place for parts (d) (i) and (ii). A significant number of candidates realized their mistake and corrected this, using arrows to indicate their answers were in the wrong place.

Question 5

This question tested the candidates' understanding of planning and carrying out an experiment. It was based on transpiration in leaves.

Most candidates gained full marks in part (a) by indicating some kind of balance. They also scored well in part (b), showing a good understanding of the idea of reliability. Some, however, wrongly said for accuracy. Others lost the mark as they said for reliability and for accuracy. Most candidates gained at least two marks in part (c). The most common answers were wind and light. Some candidates wrongly gave temperature and the size of the leaves. The former was the independent variable in the experiment and the other had already been controlled. Part (d) was fairly well answered, with many candidates gaining one mark, usually for saying that the change in mass would decrease. Others were unsure of this, but gained a mark for saying that transpiration or evaporation would be decreased with a lower temperature. Part (e) was answered well with many candidates gaining two marks or more. Even if candidates did not realise that covering leaves was important, they gained a mark for knowing that the top and bottom surfaced should be investigated separately.

Question 6

This question tested the candidates planning skills. It was based on finding out the effects of temperature on the rate of sweating. It was answered very well, with a significant number of candidates gaining full marks. Most candidates gained at least 3 or 4 marks. It is clear that 'CORMS', from feedback meetings and the previous reports is being used well. A few candidates forget to give examples of fair testing.

4437 Science (Double Award) Paper 08

General Comments

Questions in this paper are targeted at full range of grades from G to A*.

Question 1

This question was generally answered well.

Question 2

In part (a) almost all candidates wrote three values, usually to 2 decimal places (with the last one as a 0 or 5). Very few read the burettes incorrectly, and the commonest errors were to invert the initial and final readings or to write 1.3 instead of 1.30. In (b), every possible combination of ticks was seen; apart from the correct choice, the most common combinations were all four or the last three. Many candidates scored consequential marks in the calculation, although quite a number did not give the final answer to the expected 2 decimal places. A few averaged the final burette readings instead of the titres.

Question 3

Part (a) was generally well done, with the vast majority of candidates choosing two features of malachite, rather than of the acid. Most chose two correct features, although some gave two answers that covered the same point, such as "same mass" and "same amount" (without any qualification, "amount" was taken to mean the number of moles). The "odd one out" in (b)(i) was usually correctly chosen, with an appropriate reason. Student 1 was the most common incorrect choice, usually because a negative sign was used to show the mass loss. Many tables in (b)(ii) scored 3 or 4 marks, although the headings often lacked one of the units or the correct headings. "Mass" with no indication of what it referred to, was quite commonly seen. A disappointing number included the results of all four students.

In (c), almost all candidates chose the obvious scale of 1 cm to represent 0.1 g. A few did not start the scale at zero, and some used 1 or 10 instead of 0.1, but most were able to plot the points correctly, although a surprising number omitted the one for 90 %. The straight line was usually carefully drawn, although it was not always extended to the origin, and the anomalous point was nearly always recognised. Many candidates had some idea of the errors that caused the anomalous result, but failed to score because their answers did not clearly explain why the mass of carbon dioxide was higher, rather than just different, from the expected value. So, "temperature too high" scored, but "wrong temperature" did not; "too much acid added" scored, but "acid concentration wrong" did not. Those who referred to the stopwatch sometimes wrote that it was started too late, rather than stopped too late. Nearly all candidates were able to estimate the mass of carbon dioxide at 70 % concentration.

In (d), most candidates were able to state that the mass increased as the concentration increased (although some had the relationship the other way round), but far fewer stated the direct proportion or a phrase such as "the mass double as the concentration doubles". Although most explanations referred to the collision theory, very few candidates scored both marks. Some omitted to mention particles, or referred to atoms or molecules, while most stated that there would be more collisions, but with no reference to frequency or time.

Question 4

In part (a)(iii) the vast majority of candidates were able to correctly calculate the solubility using the given formula, with a few scoring the marks consequentially on incorrect answers to (a)(ii). Although the solubility scale on the graph was more difficult than the scale used in 3(c), most candidates plotted all the points correctly. Nearly half chose to draw a straight line rather than a curve of best fit through the points. This error cost candidates only one mark, as (b)(ii) was marked consequentially.

Question 5

This question was generally answered well.

4437 Science (Double Award) Paper 09

The examiners were pleased to note the very high quality of the work from many candidates.

Question 1

1a Nearly all gave 55(g).

1bi Nearly all recognised that the measuring instrument was a measuring cylinder though some suggested a measuring tube.

1bii Most gave 68 (cm^3) though some suggested 64 (cm^3).

1biii Nearly all gained this mark, either by giving 18 (cm^3) or by subtracting 50 from their answer to part ii.

1ci Many used correct answers to parts a and b, arrived at 55 ÷ 18 = 3.05555… and then gave 3.1 g/cm^3 as the answer. Full credit was also given if the candidate correctly used his or her answers in part a and/or part b to arrive at a final value to two significant figures.

1cii Many candidates gained the first marking point by noting that, at best, the data is only accurate to two significant figures. However only a minority were then able to express the idea that to give the result to more than two significant figures was to pretend to an accuracy it did not possess.
Of course, examiners credited the second mark in cases where the candidate had expressed the idea in his or her own words.

1di Most obtained both marks by giving the conclusion that, because the stones all have the same value for their density, then they are made of the same material. Some gave the conclusion that mass is directly proportional to volume or vice versa. Both responses resulted in full credit.

1dii Many wrote that she could not be confident because her results were not particularly accurate. However, only a minority went on to use data from the table to support their statement, for example, by stating that the volume of stone P could be anywhere between 10.5 cm^3 and 11.5 cm^3.

Question 2

This was the best answered Question with a significant minority of candidates gaining full marks.

2ai Most suggested a ray box or gave a description of apparatus which would give a ray of light. However, candidates should know that a light box is not the same piece of equipment as a ray box.

2aii Only a minority correctly stated that the position of the ray should be marked with points or crosses or pin pricks.

2aiii The angle was accurately measured by nearly all candidates.

2b Both angles were located and accurately measured by most candidates.

2ci Many candidates gained full marks. Where mistakes were sometimes made, they were, in order of frequency

- to fail to record the values in either ascending or descending order,
- to fail to mention angle, or give the symbol, anywhere in the table,
- to record one, or more, incorrect value(s).

2cii Almost without exception, graphs were completed to a very high standard; with very few examples of lines that were inappropriately thick or with over-large points or with the origin included as a result. The point 17,57 was usually clearly identified as the anomalous point. Although this identification was usually made on the graph, examiners awarded the mark if this point was identified in the table or near the instruction.

Question 3

3a Most correctly suggested that the purpose of the polystyrene pellets was to reduce heat loss from the small beaker.

3b Only a minority were able to state that, before taking its temperature, the water should be stirred. In the context of this Question, examiners were surprised that a significant minority suggested that the water should first be allowed to cool to room temperature.

3ci,ii and iii Hardly any candidates made a mistake in reading the scales in the diagrams; almost all realised that they must be an ammeter and a voltmeter, though a small minority had them the wrong way round.

3civ Almost all read the scales correctly and, where they did not, were still able to gain the second mark by correctly calculating the difference between them.

3d A small minority got into a muddle with elaborate theoretical digressions.

Amongst the many correct, practical responses were

- heat loss (1) by evaporation from the surface of the water (1)
- very difficult to ensure identical starting temperature (1) because if this is done by adding hotter or cooler water the same final volume has to be measured out in each case (1) (without any change in temperature)
- the water is at its maximum temperature at its boiling point (1) so there will be no increase in temperature after that (1) (if the power is increased)

Question 4

4a, b and c Nearly all carefully followed the instructions and secured all three marks.
A small minority went their own way, for example by inexplicitly swooping down to the surface from point B.

4di and ii A tolerance of ±1 degree was allowed, so answers in the ranges 59 ↔ 61 and 34 ↔ 36 were credited but not answers which resulted from a failure to follow the instructions.

4e Examiners were pleased to see, and to credit, a variety of thoughtful responses from many candidates. However some candidates failed to respond to the task they had been set and incorrectly went ahead on the basis that the oil could be treated as if it were a block of glass or transparent plastic.

In each case all three marks were awarded when

- a relevant problem had been identified,
- an appropriate solution had been indicated,
- there was an explanation, or expansion, of either of the first two points.

Examples of suitable, three-mark responses included

- it will be difficult to see what happens to the light after it enters the oil (1); add water to the container so the oil will float on it (1), now it is possible to see where the light reaches the bottom of the oil (1),
- it is difficult to see a ray of ordinary light in oil (1) so use a laser (1) which is much brighter (1),
- it will be difficult to mark the normal at D (1), use a vertical rod held in a clamp stand (1) to mark the position of the normal (1),
- it will be difficult to see the ray of light (1), blackout the room (1) so that there is a good contrast (1),
- it is difficult to see through some types of oil (1), use a pale oil, such as vegetable oil (1) and a powerful source of light (1).

4437 Science (Double Award) Paper 10 (Coursework)

The moderating instrument used was the Sc1 criteria as used by home centres, using exemplars provided by the JCQ (Joint Council for Qualifications) as a guide.
Centres entering students for the coursework component of the iGCSE examinations in 2008, therefore had their coursework moderated to the same standards as for all home centres.

It was pleasing to see eight centres entering candidates for Double Award in Science this year. The tasks chosen were in general much the same as those for the separate sciences, but in addition an enzyme reaction involving trypsin, a parachute task, and a bouncing ball task, were seen. An unusual task from one centre was an environmental one on "water quality". In general the work seen was of a very high quality.

SCIENCE (DOUBLE AWARD) 4437, GRADE BOUNDARIES

Option 1 : with Paper 7 (Biology) & Paper 8 (Chemistry)

	A*	A	B	C	D	E	F	G
Foundation Tier				51	41	32	23	14
Higher Tier	72	60	48	37	27	22		

Option 2 : with Paper 7 (Biology) & Paper 9 (Physics)

	A*	A	B	C	D	E	F	G
Foundation Tier				50	41	32	23	14
Higher Tier	71	59	47	36	27	22		

Option 3 : with Paper 8 (Chemistry) & Paper 9 (Physics)

	A*	A	B	C	D	E	F	G
Foundation Tier				51	42	33	24	15
Higher Tier	72	60	48	37	28	23		

Option 4: with Coursework (Paper 10)

	A*	A	B	C	D	E	F	G
Foundation Tier				54	44	34	25	16
Higher Tier	73	62	51	40	30	25		

Note: Grade boundaries may vary from year to year and from subject to subject, depending on the demand of the question paper.

Further copies of this publication are available from
Edexcel UK Regional Offices at www.edexcel.org.uk/sfc/feschools/regional/
or International Regional Offices at www.edexcel-international.org/sfc/academic/regional/

For more information on Edexcel qualifications, please visit www.edexcel-international.org/quals
Alternatively, you can contact Customer Services at www.edexcel.org.uk/ask or on + 44 1204 770 696

Edexcel Limited. Registered in England and Wales no.4496750
Registered Office: One90 High Holborn, London, WC1V 7BH