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Examiners' Report Summer 2009

IGCSE

IGCSE Science (Double Award) (4437)

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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.

Comments on individual questions

Question 1

The multiple choice questions were a gentle start to the paper – many candidates showed good knowledge and scored 4/5 marks or more. The questions that were answered less well were (d) where many felt that the weight would not change if the fan was switched on and (f) where many thought that carbon dioxide was used in respiration or was needed for combustion.

Question 2

This question tested the candidates' knowledge of factors affecting plant growth and also of selective breeding.
(a) This question was not particularly well done. Most candidates scored one mark only and many did not refer to increased temperature, etc.
(b) (i) The question was done fairly well, with most candidates gaining two marks or more. The most common answer was reference to desired characteristics. Few mentioned choosing offspring and repeating the process.
(b) (ii) Most gained the mark here for reference to either increased milk yield or meat production.

Question 3

This question focused on the structure of an insect-pollinated flower.
(a) (i) Candidates scored fairly well here. Almost all gained the mark for petals. A few got anther and stigma the wrong way round.
(a) (ii) The question proved difficult for many candidates. Many did not refer to features that could be seen in the diagram. The most common correct answer was to refer to large petals.
(b) This was answered well, with many gaining the two marks. The most common correct answers were transfer of pollen by insects.

Question 4

This question tested the candidates' understanding of photosynthesis and the procedure for testing a leaf for starch.
(a) (i) The word equation for photosynthesis was answered well, although some candidates got carbon dioxide and oxygen the wrong way round.
(a) (ii) Only the better candidates got the idea of chlorophyll trapping light.
(b) This was answered fairly well, with most candidates scoring at least two marks. The most common marking points gained were iodine and blue/black colour.

Question 5

This question tested candidates' knowledge of enzymes, their substrates and products.
It had mixed responses, with many being confused between the large molecule broken down and the small molecule produced. This was especially true for lipids and fatty acids.

Question 6

This question tested the candidates' knowledge and understanding of the production of beer.

(a) This was answered well, with the two most common answers being warm and moisture.

(b) Most candidates knew that stage 5 was where alcohol was made.

(c) (i) This question produced mixed responses, with about half the candidates gaining the mark for the idea of removing debris. Many mistakenly thought it was to kill microorganisms,

(c) (ii) The was answered well with almost all of the candidates referring to microorganisms being killed.

Question 7

This question focused on turtles and tested candidates' knowledge and understanding of food chains and global warming as well as their ability to analyse data.

(a) This was answered well, with candidates showing a good knowledge of the term endangered species.

(b) Candidates showed a good knowledge of food chains, although some still have the arrows going in the wrong direction.

(c) (i) The relationship between temperature and time to hatch was deduced well by most candidates.

(c) (ii) This temperature was read from the graph well.

(d) (i) This temperature was read from the graph well.

(d) (ii) This question discriminated well. Many candidates gained the two marks, although some only got one mark for giving the percentages.

(e) The mark scheme allowed for a variety of answers to this question. It produced a mixed response, with some just giving the relationship from the graph, rather than a scientific explanation.

Question 8

This question allowed candidates to demonstrate their knowledge and understanding of the human heart and the effects of smoking on the heart.

(a) (i) This was answered well, with most candidates knowing the vena cava and the aorta.

(a) (ii) Almost all candidates knew that LV stands for left ventricle and that RA stands for right atrium.

(a) (iii) This produced a mixed response, ranging from no marks to two marks. Most candidates gained one mark for the idea of taking blood from the heart to the lungs.

(b) Candidates produced the full range of marks here. A significant number talked at length about the effect smoking has on the lungs rather than on the heart. The most common marking points gained were increase in heart rate, heart attack and lack of oxygen.

Question 9

This question was centred around the effect of exercise on heart rate.

(a) Most candidates scored one or more marks here, but some only gained one mark as they did not refer to the rise leveling off.

(b) Many candidates gained the two marks for the calculation, but some just gained one mark for some appropriate working.

(c) (i) Not many candidates gave the correct response of anaerobic respiration.

(c) (ii) Most candidates gained one mark for the idea of more oxygen, but few gained the mark for aerobic respiration/less anaerobic respiration.

Question 10

This question tested the candidates' knowledge of cloning.

(a) This produced a mixed response. The most common mark was 3 or 4, with the answers best known, nucleus, uterus and identical.

(b) This question was answered fairly well, with most candidates gaining the two marks for XX and XX.

4437 Science (Double Award) Paper 2F

Section A

Question 1
This question was generally answered well.

Question 2
Part (a) was generally answered well.
In part (b) candidates were required to select words in order to complete sentences concerning a reversible reaction. While the most able candidates scored full marks, many answers suggested random guessing – it was not uncommon for the reaction to be described as both exothermic and endothermic in the same direction. The reversible reaction concerned is specifically mentioned in the specification and candidates are expected to have used anhydrous copper sulphate as a qualitative test for water and to have heated hydrated copper sulphate.

Question 3
This question was about the Haber process. In (a) many candidates were unable to name the elements that are reacted together to make ammonia, carbon dioxide and oxygen were common incorrect answers. Of the candidates who could name the elements involved, many were under the misapprehension that hydrogen occurs in significant quantities in the atmosphere or that the reaction between a metal and an acid is an economically viable method of producing it. In (b) candidates simply stated "high" rather than give an acceptable value.; those who did give numerical values often failed to give units. Once again it should be stressed that candidates should be discouraged from giving ranges for numerical values; if they give a range it must be fully within the accepted range in the mark scheme – hence both the lower and upper limits given by the candidate must be acceptable values and so the candidate has a better chance of gaining the mark if they just give one of the values. Part (c) was poorly answered, many substances unrelated to ammonia were seen, a common near miss was to fail to use "ammonium" for the name of cation ("ammonia nitrate" was seen often). Since the question asked for the names of chemicals, general answers such as "fertilisers" were not accepted.

Question 4
In (a) some candidates did not understand the table, thinking that in the column headed "State symbol" they had to state the symbol of the substance – this is despite the state symbol of hydrogen chloride already being completed. While some good answers were seen there were many that contained seemingly random colours; both chlorine and hydrogen chloride were not infrequently thought to be alkaline; it should be noted that the descriptor "clear" does not mean "colourless". Very few candidates used (aq) as the state symbol for hydrochloric acid.
In (b) some good word equations were seen, although there was some miss use of the –ine and –ide endings, however, some candidates seemed not to be familiar with halogen displacement reactions and compounds such as "chloride bromine" were not uncommon. The explanation in (c) was rarely correct, of the candidates who based their answers on relative reactivities many tried to compare the reactivity of bromine to sodium or to sodium chloride.

Question 5
In (a) candidates were required to write a chemical equation, at foundation tier candidates can not be asked to balance an equation, and so any equation they write will not require any stoichiometric coefficients; despite this some candidates lost marks by attempting to

balance the equation – these attempts may have been triggered by having incorrect formulae due to their not recalling the valencies of the ions. The table in (b) usually gave the candidates some marks, most commonly for the names of the products however, flame test colours were usually wrong and silver bromide was often thought to be white.

Question 6

Parts (a) & (b) were generally answered well.

In part (c) candidates gain one mark for realising that combustion was the reaction with oxygen and a second mark for knowing the products of complete combustion of a hydrocarbon. Few candidates scored both marks, oxygen was frequently seen as a product and some candidates tried to burn substances other than octane. In part (d) most candidates could identify carbon monoxide as the toxic gas, but much fewer could explain why it is poisonous; errors included the idea that it stopped the lungs working or prevented the blood flowing.

Section B

Question 7

While a few very good answers were seen to this question, some candidates seemed very confused about the common uses of metals. Of those candidates who could name zinc as a metal used to prevent rusting, very few could explain why in terms of reactivity – most seemed to think that zinc did not react with oxygen/water. Worryingly copper was sometimes thought to be good for electrical wiring because it is an insulator. Most candidates who names iron or steel as used for railway tracks could relate this use to its strength.

Question 8

Parts (a), (b) & (c) were generally answered well.

Part (d) was poorly answered at foundation tier with most candidates just stating a recalled fact ("they are unreactive") rather than using the information provided to draw a conclusion.

Question 9

In (a) it was not uncommon for candidates to lose marks through careless use of terminology – with hydrocarbons being described as "elements" or "atoms" and carbon/hydrogen being described as "molecules" or " compounds". Very few candidates gained the mark in (b) at foundation level; many were thinking about saturated solutions. Of those that did focus on the bonding a common error was to state something along the lines of "carbon has formed the maximum number of bonds"; in all stable organic compounds each carbon forms four bonds, at least one of which will be a sigma bond and the remainder pi bonds.

Part (c) was generally answered well.

Most candidates drew the correct structure in (d), although some structures had incorrect valencies. A common error in (e) was the use of the term "isotopes" in place of "isomers". Many errors were made in (f), it was common for the polymer to contain double bonds.

Question 10

At foundation tier in (a) many candidates managed to pick up one mark for stating either the crystals get smaller or the water becomes green, few gained both marks. Some vague answers were given such as stating the water changed colour but not saying what colour.
Part (b) was generally answered well.
In (c) although many candidates seemed to know that it would be faster they either did not say what was faster or thought that a chemical reaction was occurring. Only the most able foundation candidates could explain why the process was faster at higher temperatures with many failing to refer to particles of some type.

4437 Science (Double Award) Paper 3F

Question 1
Candidate performance on this question was generally good with them showing skill in reading from a graph accurately and interpreting the graph.

Question 2
Although most candidates appeared to be familiar with reflection the identification of the angle of incidence and the angle of reflection and the line as the normal was poor. Of those who could identify the image as virtual very few could explain how they knew this.

Question 3
(a) This question produced some very vague answers but some of these managed to work around to a correct response. There were a pleasing number of well reasoned correct responses.

(b) There were a number of suggestions which showed a lack of knowledge of devices which use heat usefully.

(c) Candidates here were very clear about the thin metal wire being the pathway of electricity but a surprisingly large number showed a lack of knowledge of the energy transfer involved. Chemical energy was suggested a number of times which was disappointing.
The explanation of why fuses are used produced a wide variety of responses and candidates were often very vague in their responses. This led to them failing to score marks when a little more thought to their answer may well have resulted in a mark worthy response.

Question 4
(a) Many candidates were influenced by part (ii) in part (i) and appeared to assume that the answer should be a colour. The position of green in the spectrum was clearly well understood.

(b) This differentiated between the candidates very well. There was some clear understanding and knowledge demonstrated despite the box of words being completely irrelevant to part(i).

Question 5
The candidates in general did not seem to have an appreciation of the energy flow and the factors involved. This appeared to be more a lack of knowledge or experience of the concepts involved rather than an inability to answer the question.

Question 6
Whilst the majority of candidates were correctly able to identify the LEDs were connected in parallel many could not explain why this was so. The suggestions for an example of a dc supply and the meaning of ac were varied and mostly inaccurate even if frequently amusing.

Question 7
A good proportion of candidates understood the atomic particles and their characteristics.

Question 8
A substantial number of candidates appeared to have no knowledge of Hooke's Law and therefore did not perform well in this question.

Question 9
The change in the size of printing the 2 diagrams obviously caused some problems for the candidates and affected the standard of their responses. The calculation of the frequency produced most of the points scored on this question and it was pleasing to see so many good answers. The final part was very poorly answered and seemed to show a lack of understanding or possibly experience of the concepts involved.

Question 10
Candidates showed knowledge of heat transfer processes and frequently scored well in the calculation.

Question 11
This question was poorly answered with candidates showing a lack of knowledge of radioactivity. The calculation of half life often demonstrated that the candidates were completely unfamiliar with this topic. The variety of suggestions for background radiation were concerning. Part (c) often had answers relating to medical use of radioactivity and many candidates only were able to offer this or warfare related answers.

4437 Science (Double Award) Paper 4H

Question 1

Almost every candidate offered a sensible explanation for the term 'endangered species', which is very encouraging to those of us who care about the plight of the Earth's fauna and flora. It was also pleasing to note that drawing food chains is a skill mastered by most. Though not compulsory, the examiners also appreciated the occasional sketches of the organisms. Candidates appreciated that the warmer the sand is the quicker eggs will hatch and most candidates could read the correct answer to (c) (ii) from the graph. Pleasingly, most were able to calculate the number of males and females. Those who transposed the numbers in the table were still given one mark and those who did % only were also awarded one mark. In part (e), a small number of candidates lost marks by thinking the temperatures would rise to ridiculous levels sufficient to cook organisms.

Question 2

Candidates scored highly in parts (a) (i) and (ii), demonstrating excellent knowledge of the heart. The role of the pulmonary artery in taking deoxygenated blood to the lungs to be oxygenated was also understood by most. Less able candidates merely mentioned that it transports blood with no indication of oxygen level or destination. Part (b) exposed a common weakness with candidates. Candidates need reminding of the importance of reading a question carefully before they start their answer. This question makes it clear that it is the effects of smoking on the human heart that is being examined. Unfortunately, many candidates wrote copious accounts about the human lung. Nevertheless, credit was given for recognising basic principles. The examiners continue to be concerned by the number of candidates who believe tar blocks arteries.

Question 3

Candidates should notice that two marks were available for part (a), which ought to key them into writing two different observations. Most stated that there is an increase in heart rate but only the more able candidates noticed that the heart rate reaches and stays at a maximum. In the calculation, two marks were awarded for 100%. For those who struggled with the calculation, one mark was still available if the examiners could see the numbers 120 and 60 somewhere in the working, once again stressing the importance to candidates of showing their working. The vast majority recalled that anaerobic respiration produces lactic acid and that deep breathing can reduce the build up of lactic acid because more oxygen is available for aerobic respiration.

Question 4

Putting the correct words into the passage proved to be a good discriminator. A common error was believing that a gene had been taken and put into an unfertilised egg, rather than a nucleus being put into an enucleated egg. Many believed that the ball of cells is called a zygote; that the embryo is placed into an ovum, and that meiosis is the cell division producing the embryo. Most had the courage to put XX twice in the table in part (b). Candidates ought to be reminded of the importance of making a clear distinction between the letter X and the letter Y when putting pen to paper. Markers are told not to give a mark if they are uncertain.

Question 5
There were many poor drawings of a root hair cell and often the quality of labelling left much to desire. However, there were some outstanding drawings. Most were able to write sensibly about osmosis in part (b).

Question 6
Most knew that F is where bile is made. Common errors were to choose E or D. The role of bile is emulsification of fat and neutralisation of stomach acid is well understood. However, there are many who still believe bile digests fat. In part (b) (i), the small intestine, ileum or the letter C was accepted. The structural reasons to explain how a villus is adapted for absorption challenged candidates. Markers credited answers that discussed the large surface area provided, the dense network of capillaries close to the surface to reduce diffusion distance and containing blood that moved to maintain a concentration gradient. Recognition that a lacteal was present was also credited. The names of the products of digestion were not credited.

Question 7
Many candidates were able to draw an acceptable genetic diagram and gain three marks. The more able candidates also gave the correct phenotypes. A common error was to describe a phenotype, such as having PKU, with incorrect terminology, such as homozygous recessive. A surprising number of candidates produced a correct genetic diagram and then quoted the probability of the child not having PKU as 25%. Markers assumed they had not read the question carefully. The treatment for PKU is to provide a diet lacking in phenylalanine but other sensible suggestions were credited. A surprising number of candidates believe that protease digests amino acids.

Question 8
In part (a) marks were awarded for the correct pyramid shape, the names of the organisms at each trophic level and the correct order of these names. Many incorrectly drew an inverted pyramid. In part (b), examiners were very impressed by the knowledge candidates have about energy transfer efficiency. However, some still confuse the processes of excretion and egestion.

Question 9
Sadly, part (a) posed problems for many candidates. There were many excellent answers describing the procedures used with genetic modification, but there were many answers that described selective breeding or concentrated on aspects of cloning or micropropagation. In part (b), a large number of candidates appreciated that micropropagation allows for large numbers of identical plants to be produced in a short space of time.

Question 10
Many were able to get maximum marks in part (a). Common errors confused the pancreas and the liver, and confused glycogen with glucagon. Answers to part (b) (i) showed that candidates understood the need to start the test with normal glucose levels. In part (ii) of this question, only the more able candidates gave three distinct reasons to support the idea that the person was not a diabetic. Most commented on the fall in glucose levels caused by release of insulin but few acknowledged that the starting level was within a normal range and that the levels did not rise above 9 mmol per litre.

Question 11

The vast majority of candidates correctly identified Iceland and Japan as the two countries where more fish is eaten than meat. The calculation was challenging. The correct answer of 13 was seen quite often but there were many scripts that had variations of this number. Candidates who gave an incorrect answer could still be awarded one mark if the markers could see 130, or 100 and 30 in the working. Most candidates were able to give an acceptable reason why protein is important for growth. In part (b) (i), answers that mentioned the need to remove organic waste and to allow maintained oxygenation were credited and in part (ii) markers credited answers that made it clear that this method of feeding would reduce wastage and the chance of oxygen depletion by bacterial decomposition. Answers to part (c) showed an excellent appreciation of the formula. In part (d), many appreciated that solving overcrowding, providing sufficient food and separating different sized fish would help to reduce intraspecific competition, and that separating different species by a sensible method would reduce intraspecific competition.

4437 Science (Double Award) Paper 5H

Section A

Question 1

While a few very good answers were seen to this question, some candidates seemed very confused about the common uses of metals. Of those candidates who could name zinc as a metal used to prevent rusting, very few could explain why in terms of reactivity – most seemed to think that zinc did not react with oxygen/water. Worryingly copper was sometimes thought to be good for electrical wiring because it is an insulator. Most candidates who names iron or steel as used for railway tracks could relate this use to its strength.

Question 2

Parts (a), (b) & (c) were generally answered well.
Part (d) was poorly answered with most candidates just stating a recalled fact ("they are unreactive") rather than using the information provided to draw a conclusion.

Question 3

In (a) it was not uncommon for candidates to lose marks through careless use of terminology – with hydrocarbons being described as "elements" or "atoms" and carbon/hydrogen being described as "molecules" or " compounds". Very few candidates gained the mark in (b); many were thinking about saturated solutions. Of those that did focus on the bonding a common error was to state something along the lines of "carbon has formed the maximum number of bonds"; in all stable organic compounds each carbon forms four bonds, at least one of which will be a sigma bond and the remainder pi bonds.
Part (c) was generally answered well.
Most candidates drew the correct structure in (d), although some structures had incorrect valencies. A common error in (e) was the use of the term "isotopes" in place of "isomers". Many errors were made in (f), it was common for the polymer to contain double bonds.

Question 4

In part (a) many candidates managed to pick up one mark for stating either the crystals get smaller or the water becomes green, few gained both marks. Some vague answers were given such as stating the water changed colour but not saying what colour.
Part (b) was generally answered well.
In (c) although many candidates seemed to know that it would be faster they either did not say what was faster or thought that a chemical reaction was occurring. Only the most able candidates could explain why the process was faster at higher temperatures with many failing to refer to particles of some type.

Section B

Question 5

This question was about the Haber process. Part (a)(i) was well answered, although natural gas as a source of nitrogen and air as a source of hydrogen were occasional errors. Methane was not accepted in place of natural gas as it is not a raw material. The equation in (a)(ii) caused problems for many candidates; although some gave NH_4 instead of NH_3 as the product, most errors involved the use of the symbols N and H instead of the formula N_2 and H_2. Part (b) posed few problems for most candidates. Answers to (c)(i) were generally poor, with many candidates describing the formation of ammonia, and several descriptions of separation referred to fractional distillation or ammonia being denser and sinking to the bottom. The attempts in (c)(ii) to describe recirculation sometimes foundered because it was not clear that the unreacted gases were immediately returned to the reactor (answers such as "used again" and "stored to make more ammonia" were not accepted). Part (d) produced few all-correct answers. Apart from those who gave the names of non-existent compounds (such as nitrogen sulphate) the commonest naming error was "ammonia sulphate". Many equations showed NH_4SO_4 or $(NH_3)_2SO_4$ as the product, often accompanied by H_2 or H_2O, which may explain "displacement" frequently appearing as the reaction type.

Question 6

This question was about hydrogen and water. Part (a) was generally well answered. The explanation in (b) sometimes referred to the breaking of a covalent bond or did not extend to mentioning the small amount of energy needed to overcome the intermolecular forces. The dot and cross diagrams in (c) were generally well drawn; the few errors included the presence of six non-bonding electrons rather than four in the outer shell of oxygen, an extra electron in the hydrogens' outer shells and two oxygens joined to one hydrogen atom. In part (d), (i) and (ii) were usually correct, but (iii) was poorly answered, with the worst answers referring to intermolecular forces. Those who answered in terms of bonds broken and formed frequently stated that energy was needed to form bonds. Part (e) was usually correct. Very few equations in (f) were correct; those that gained some credit showed the wrong number of water molecules or used (aq) for the state symbol of the product. Rather more showed extra products such as H_2 or O_2 or the formation of non-existent compounds such as H_2CuSO_5.

Question 7

This question was about the isotopes and chemistry of copper. The definition of isotopes in (a) often failed to score both marks; sometimes there was no mention of atoms, or a correct statement that the numbers of protons were the same was contradicted by one that stated that the numbers of electrons were different, or had the protons and neutrons in the wrong parts of the answer. The completion of the table and calculation of the relative atomic mass in (b) was usually correct, with few candidates failing to quote the answer to the required one decimal place. Most knew how to calculate the relative atomic mass, with just a few averaging the two mass numbers. In (c) a wide variety of elements were quoted, with copper and chlorine appearing frequently, along with the predictable hydrogen. Part (d) was well answered, although in (e), many properties that were generally true for all metals were given, instead of those specific to transition metals. More able candidates found parts (f) and (g) accessible although there were frequent errors in the colour change in (f). Although in (g)(i) a formula was asked for, several candidates wrote a complete equation. In (g)(ii) the result of the addition of excess ammonia was less well known, with many answers including gases bubbling off and the formation of white precipitates.

Question 8

This question was about a salt preparation and its associated calculations. Very few candidates scored full marks in (a); many failed to mention filtration, while others started from the reagents instead of from the mixture mentioned in the question. The commonest errors were to omit the washing step or fail to state how the water would be removed from the residue. Some who mentioned filtration then evaporated the filtrate rather than drying the residue. The calculations in (b) were very well done, with few arithmetic errors and few using wrong methods. The commonest error was in (b)(iii), where either atomic numbers instead of atomic masses were used for calcium sulphate, or the M_r of another compound (frequently sulphuric acid) was calculated.

4437 Science (Double Award) Paper 6H

General

An incomplete list of formulae was given on the inside front cover of the paper. Parts (a) and (b) of Question 8 were not marked. As a result the paper was marked out of 85 instead of 90.

Question 1

Part (a) was not well answered and the amount of crossing out showed a degree of uncertainty. The rubber band was not always associated with Graph C and many candidates showed two lines going from or to one of the boxes.
In (b)(i) many candidates thought that the two quantities were directly proportional to each other but named incorrect pairs of quantities such as 'force' and 'length' or 'force' and 'mass' and so did not score either mark. A less common error was 'force and extension are inversely proportional'.
In (b)(ii) practically all candidates knew that Graph D represented an object that obeyed Hooke's Law.

Question 2

Part (a) showed that many candidates who understood the concepts of amplitude and wavelength were unable to answer this part correctly.
In (i) rather than state that an increase in amplitude could be achieved by increasing the height of the rope many candidates shook the rope 'harder'.
In (ii) many were given credit for 'shaking the rope faster' but not for 'moving closer to the chair'.
The calculation in (b) caused few problems except where candidates divided frequency by wavelength.
Part (c) was poorly answered with many candidates not appearing to understand the difference between transverse and longitudinal waves.

Question 3

This question was very well answered with candidates scoring 3 or more marks in part (a). Some did not correctly identify 'convection' as the fourth answer and a few used words that were not in the box such as 'decreases'.
Part (b) was usually correct although a few candidates divide by *g* and a few added another zero from somewhere to give 350 000 N.

Question 4

In part (a)(i) some acceptable spellings of becquerel were seen but it appeared that some candidates had not seen the word written down before.
The calculation in (ii) was well done although a few candidates either divided or multiplied 10 000 by 2.
In (b)(i) a pleasing number of candidates correctly stated what is meant by an isotope although a few either contradicted themselves or mixed up protons and neutrons.
In (b)(ii) a surprising number of candidates were unable to state 'background'.
In (c) few candidates were only able to state one correct non-medical use of radioactivity often giving medical uses or those associated with nuclear weapons or energy.

Question 5

In part (a) most candidates could identify component X as a variable resistor. In (b) completing the sentence 'current is the flow of charge' for one mark was incorrectly done with 'amount' or 'speed' instead of 'flow'.
In (c) many candidates ignored the request for units for the quantities to be written in full. Instead the abbreviations C, A and s were given often interspersed with Ω.

In (d)(i) the electron was well known but in (ii) the flow was described rather than explained with answers such as 'they go clockwise' or 'they flow from negative to positive'.

Question 6

Most candidates were able to state the equation for acceleration in part (a)(i) and calculate it in (ii). The majority converted to seconds and scored 3 marks. A small number of candidates used '50' in their calculation.

The motion in the section MN was described accurately but in part (b) only a minority of candidates gave the correct unit in (d) with most answering 'metres'.

Question 7

Part (a) was very well answered. In (a)(i) some answers only referred to one of the forces while in (ii) 'upthrust' was frequently seen with 'gravity' less frequently seen. In (iii) nearly all candidates knew that the friction force increased although in (iv) not all knew the term terminal speed (or velocity).

Part (b) was well answered with many candidates scoring full marks. The remainder either used the wrong equation for kinetic energy, transposed the equation incorrectly or forgot to take the square root of v^2. The correct unit was usually seen.

Question 8

In part (c) the unit kPa was well known with a variety of acceptable spellings seen. The most common wrong answer was 'pressure'.

Question 9

In part (a) the formula and calculation were frequently correct. The main cause of error was missing out multiplication by 10 for *g* which was reflected in the formula. The answer to a(iii) was often not the same as in a(ii). In some cases the equation for kinetic energy had been used. A few may have thought of the formula for kinetic energy and then decided to halve the value from (ii).

Few candidates scored well in part (b) where often 'large force' and 'quickly stopping' from the stem were repeated without giving an explanation. A common misconception was that the force acting on the pile was equal to the kinetic energy of the falling mass.

Many got the idea of the deceleration being large and more used $F = ma$ in their answer somewhere but very few mentioned a short stopping time.

Most candidates tried to explain in terms of deceleration rather than energy transfer but the latter rarely mentioned was $W = Fd$ in their answer.

The usual answer to (b)(ii) was 'downwards'.

Question 10

Parts (a) and (b) were well answered with '275' occasionally being used instead of '273'.

In part (c) candidates often gave incomplete answers stating that the average kinetic energy merely increased rather than doubled when the kelvin temperature was doubled.

Question 11

The majority of candidates scored the mark in (a) but a wide variety of wrong answers was seen such as 'current' and 'force field'.

Part (b) was answered well although some examples of right hand and grip rules were seen. The left hand rule was attributed to many scientists including Ian Fleming.

Many candidates got most marks from their diagrams although some diagrams were very poor and it was not possible to tell which finger was meant to represent what. Some candidates stated that the first finger was (magnetic) 'force' with the thumb being termed 'movement'

Better diagrams were labelled twice, with "first finger" and "field", rather than just "field".

The most common errors were omissions of the direction of either current or field or confusing them (e.g. current goes from north to south).
In part (c) some candidates confused the effect with electromagnetic induction by stating 'move the magnet faster'.

Question 12
In part (a) a large number of candidates either left this blank or showed an incorrect angle of refraction.
In part (b) candidates often did not refer to the 'angle' of incidence in their statement or gave a correct answer apart from using 'reflection' rather than 'refraction'.
In part (c) the equation relating refractive index and critical angle often lacked 'sine' or was the correct one that related *n*, *i* and *r*.
In part (d) candidates were familiar with total internal reflection.
In part (e) between two and four reflections scored the marks.
Common errors were: the angle between the incident and reflected rays was a right angle, more than four reflections were shown and the ray was not continued from the provided ray to the wall of the fibre.

Question 13
Part (a) was well answered with a lot of crossing out and drawing lines around the back of boxes in evidence.
In part (b) the symbol for the alpha particle was well known.
Problems in (c)(i) stemmed from the subscript for e being given as +1. Candidates still went on to refer to beta radiation and the emitted electron in (ii). A few candidates identified the radiation as alpha or gamma but still earned a mark for the emitted electron.

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 long question based on an ecological investigation. It was a fairly easy start to the paper.

(a) (i) Most candidates scored full marks here. A few got crucible and gauze the wrong way round.

(a) (ii) Almost all candidates gained this mark. Those who did not just made general references to safety instead of referring to protecting the eyes.

(b) Most candidates gained the first mark for using some form of heat. Fewer gained the second mark for the reference to time. Candidate who referred to a drying agent or to detection of water using a chemical method were rewarded.

(c) Many candidates gained the 2 marks here. Those who did not tended to gain one mark for appropriate working.

(d) (i) Most candidates referred to the correct sample – 2.4.

(d) (ii) Most candidates gained the mark here. The most common answer was more plants or seaweed.

(d) (iii) Again, most candidates gained the mark here, with the idea of more plants being the most popular answer.

Question 2

This question tested the candidates' knowledge and understanding of the effect of exercise on pulse rate. It gave the candidates an opportunity to demonstrate their knowledge of accuracy in taking measurement as well.

(a) Most candidates gained one mark here for knowing where the pulse would be taken. Not so many made reference what they would use to measure the time. Some confused it with a similar question in a previous paper where candidates had to refer to counting per minute, but this was given in this question.

(b) (i) This question was done well, with many candidates gaining full marks. The most common error was to miss out the units in the table.

(b) (ii) This question was done well, with many candidates gaining the three marks. The most common answers referred to oxygen and muscles. Fewer referred to glucose and energy.

(c) This question discriminated well. Many candidates gained one mark for the idea that the heart slows, but not many linked this to less accurate answers. A few confused accuracy with reliability.

Part (a) was answered well, although some candidates put microscope and/or funnel as items needed for testing food samples for glucose. Most new Benedict's test, although some thought iodine was used. The majority of candidates knew that iodine was used to test for starch. A significant number lost the part in (b) (iii) as they simply put 'no colour change', rather than giving the colour of iodine itself, e.g., yellow/brown etc.

Question 3

This question was centred around enzymes. It allowed candidates to demonstrate their graphical skills and knowledge of how to work out concentrations.

(a) Most candidates gained at least 4 or 5 marks when drawing the graph. The most common mistake was to have the axes the wrong way round.

(b) (i) Most candidates were able to give an appropriate conclusion drawn from the data in the graph.

(b) (ii) Some candidates had difficulty in realizing what the question was asking and merely repeated their answer to the previous question. Others usually gained the first mark for the idea of digestion or breakdown, but only the more able candidates gained the second mark by referring to the idea of becoming more fluid.

(c) Most gained at least one mark here, with the most common answers being temperature, size of funnel and pH. Some wrongly referred to the mass of jelly/paste, but this was not credited as it was said to be the same in the stem of the question.

(d) Most candidates answered this well, although some wrongly said 0.5g in 50 cm^3.

Question 4

This question centred around trapping insects and tested the candidates' ability to record information, as well as their knowledge and understanding of reliability and drawing conclusions.

(a) (i) Most candidates gained full marks here. Some lost a mark or two in their tallies by miscounting, but were then allowed a carry forward error mark if they transferred the number correctly.

(a) (ii) Most candidates gained the mark here for the idea of using 10 traps or repeating.

(a) (iii) This question was reasonably well answered. The most common answers were more food at night and fewer predators.

(b) Most candidates had a good go at this question. Credit was given either for agreeing or disagreeing as long as an appropriate reason was given. The most common answers related to the fact the dead animals cannot escape or that it was inhumane to kill them.

Question 5

This question tested the candidates' understanding of planning and carrying out an experiment. It was based on how the distance apart seeds were planted would affect their growth.

Most candidates scored around 4 marks. The most common points missed were how growth would be measured or reference to the same age/species of seed.

4437 Science (Double Award) Paper 08

Question 1

Most candidates, as expected, scored well on this question. The vast majority of candidates could name all five items of equipment in (a). In (b) a small number of candidates names equipment that was not shown in the picture, nor given in the box. Part (c) was the most discriminating part of the question with sodium chloride/sugar being a not uncommon choice.

Question 2

This question was based on the separation technique of chromatography.
While many candidates scored well in (a), some candidates answers suggested that they had never seen or conducted the process of chromatography. There were suggestions that the paper should be fully submersed in water; that the paper should be horizontal (as in radial chromatography) and that a lid should not be used or that the lid was not tight enough. Chromatography is a simple, safe and relatively quick technique and it is hoped that all candidates will have the opportunity to use it in the laboratory. In (b), while most candidates could determine the number of colours in the blank ink, in (ii) some confused the term "ink" and "colour" and just listed the colours of the spots produced by the black ink. In (b)(iii) a common error was to think that the fact the blue ink did not split into different colours showed that it was insoluble; if this was the case then the red ink would also be classed as insoluble, which it clearly was not. To answer (c) candidates did not need to have been taught about R_f values since details of how to do the calculation was given in the question. However, some candidates seemed not to have a ruler with them in the examination and so estimated the distances, other chose to ignore the instruction in the question to include units. The answer in (ii) could be to any number of significant figures, but if a number is rounded it must be done correctly.

Question 3

Part (a) required **two** things that must be kept constant to make the investigation a fair test. Candidates still need to be reminded that if they state more than two things, then all will need to be correct if they are to avoid losing marks. It was very common for candidates to suggest that the mass of magnesium hydroxide or the temperature of the acid should be kept constant – despite these being the independent and dependent variables respectively. In this specification "amount" is taken to mean "moles" - and so if the "amount" of acid is kept constant it could mean, for example, a larger volume with a lower concentration – which would not make it a fair test.
Part (b) required a change to the apparatus, many candidates focussed on the measurement of mass or volume, and so stated apparatus that would give accurate values (such as burettes), however, since in the question no indication of how the mass or volume were measured was given, no improvement is possible. The only apparatus in the method is a "glass beaker" and so improvements were expected to be based on this in order to reduce heat losses. A water bath is not appropriate since this will reduce the temperature increase measured.
Most candidates scored the marks in (c), although some had difficulty with the scale on the thermometer. The most common error in (d) was to ignore the instruction that the mean should be given to one decimal place, or to incorrectly round 7.5333 to 7.6.
In common with requirements on previous papers, the explanation in (e) must explain the direction of anomalous result – so explanations had to explain why the temperature change was too high. Hence answers such as "wrong mass of magnesium hydroxide" do not score, but "too much magnesium hydroxide" does score. Again, candidates should avoid putting

multiple reasons; if more than one reason is given none can be wrong if a mark is to be awarded.
The graph in (g) caused some problems; for some reason it was not uncommon to plot one of the last three points incorrectly, despite having plotted the first four points correctly. The instruction was to draw two straight lines yet many candidates attempted to do this without a ruler or drew more than two lines. In (g)(ii) it was not uncommon for candidates to ignore the command word "describe" and instead try and "explain", they could still gain full marks if their explanation also contained a description, but they generated extra work for themselves.

Question 4

Part (a) was generally answered well. Many candidates gained full marks for completing the table in (b). However, some candidates failed to record all of the data.
Only the most able candidates gained marks in the remaining parts of this question. In (c) the idea of the tap being open was rarely seen, one common wrong answer was to state that not enough iron was used (any amount of iron would still cause some change in water level) while it was not uncommon for candidates to enter into an explanation based on pressure and the trough of water – suggesting that the water level would never change in this experiment.
In (d) a few candidates spotted that we did not know the starting volume for the air but few could suggest a solution to the problem; some suggested entirely different experiments.

Question 5

Common errors in (a)(i) were to fail to label the axes or to put the wrong scale on the y axis. In (ii) some volumes were given in units of "g" and it was not uncommon for the scale 0n the x-axis to be read incorrectly. Candidates need to be careful to ensure that their tie-lines are horizontal/vertical and not sloping as this results in incorrect readings. It was common in (iii) for candidates to just require the whole experiment to be repeated – this will not help determine the volume for the maximum mass of precipitate – it will still be some where between 4 cm^3 and 6 cm^3, candidates should be used to the idea of taking more reading around the turning point on a graph.
Part (b) revealed that a large number of candidates were suffering from a major misconception about mass change in chemical reactions. The most common totally wrong answer was based on the idea that when the solutions are mixed the total mass will increase as the precipitate is formed. Where candidates realised that the best approach is to remove the precipitate and weigh it, the most common omission was to fail to wash the precipitate to remove soluble substances from the reaction mixture.
In (c) most candidates gained the marks in (i) but in (ii) some candidates chose to ignore the information in the table and used alternative reactions to differentiate between an aluminium and a zinc salt; unsurprisingly the vast majority of these were doomed to failure.

4437 Science (Double Award) Paper 09

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

Question 1

1(a)(i) Most gave the correct answer though a significant proportion gave 72 seconds.

1(a)(ii)1 The majority realised that the speed is getting faster though a small minority did not grasp the idea of a trend and simply noted that it is small.

1(a)(ii)2 Some missed the idea that the student is not reacting to an external stimulus.

1(b) Most gained all three marks. Some of those who got it wrong lost the opportunity to gain some credit because no working was shown.

1(c)(i) Almost all were able to count and record the number of spaces.

1(c)(ii) A majority got the correct answer although a significant minority used the number of dots rather than the number of spaces, even when they had got the first part correct.

1(c)(iii) Most were able to calculate the period of time correctly.

1(c)(iv) A majority gained this mark but the scale on the horizontal axis defeated many less able candidates. Some failed to record their distance from part (b) and then could not be given credit for correctly reading the time if their answer to (b) was wrong.

Question 2

2(a)(i) Almost all gave the correct reading to the nearest gram.

2(a)(ii) The more able candidates noted that it is almost impossible to apply the same force in both cases and that the top pan balance displays mass rather than force. However some candidates had difficulty in expressing their ideas and a fairly common incorrect idea was that the top of a top pan balance does not move when a force acts on it. Some claimed that different forces are needed or confused themselves by noting the differences in area.

2(b)(i) The majority measured the key correctly and calculated the area. Despite the question stating that the key is square, some candidates gave different measurements for the sides.

2(b)(ii) Most candidates calculated the pressure correctly and usually gave the result to 2 or 3 significant figures. However a minority ignored the force given in the stem of 2(b) and used the mass from 2(a).

2(b)(iii) Examiners were pleased to note that there appears to have been a significant improvement in most candidates' understanding of this concept even though it was clear that some candidates did not understand the difference between significant figures and decimal places. It was fairly common for these candidates to give 0.29 in part (b)(ii) and then to state that this is to 3 significant figures. Confident candidates correctly explained that they had used 2 significant figures because this is the same as the original data.

Question 3

3(a) Almost all gave the correct measurement to the nearest tenth of a centimetre or measured the separation as 36 mm.

3(b) Most correctly found the average value for the background radiation in (i) and could identify the anomalous result in (ii). However they failed to attach any significance to their possible connection. The most popular suggestion was that the anomalous result was caused by having the source nearby and only a minority correctly suggested that the count had been made for two minutes.

3(c)(i) Most correctly interpreted the graph and either expressed the range of these alpha particles as 6 cm or as 0-6 cm.

3(c)(ii) Too many candidates started by making irrelevant points about setting up apparatus which is already set up. A number attempted to describe the workings of a GM tube or Rutherford scattering. This often meant that a candidate had filled half the available lines before writing anything which would gain a mark. Too many failed to consider background radiation or failed to mention an appropriate safety precaution.

3(d)(i) The majority identified the use of tweezers as a sensible safety precaution though a minority often chose a lead screen.

3(d)(ii) Some candidates had difficulty in expressing their ideas clearly but, since many had already indicated the appropriate choice in part (i), most were able to secure two marks from the three marking points available to them.

Question 4

4(a) Many drew a correct circuit diagram with a power source, a rheostat and an ammeter in series. However some omitted one of these three essentials so no marks were available to them. Others included another resistor, such as a lamp, rather spoiling the point of the planned investigation and losing their second mark.

4(b)(i) Candidates who omitted an ammeter or cell from their circuit often added it here but gained no credit.

4(b)(ii) Many candidates failed to express their ideas clearly. Most scored two marks out of the three available; for setting distance L and measuring the current, moving the slider and noting the new length and current and for at least one more pair of measurements.

4(c) Nearly all correctly read the diagram of the meter.

4(d)(i) Full marks for the table were fairly common but less able candidates often failed to include the correct units, or to place the results in order or, occasionally, failed to transcribe all the readings correctly.

4(d)(ii)–(iv) Most scored well on this graph. Marks were sometimes lost if the axes were not correctly labelled. The scales created problems for some who failed to interpret them correctly and who then lost two marks for their points. However it was rare for candidates to fail to identify the anomalous point and most managed a well drawn curve of best fit for their remaining points.

4(d)(v) Only a minority realise that the most likely suggestion is that distance L has been read from the wrong end, or the wrong side, of the rheostat. Most contented themselves, but not their examiners, with a comment about misreading or faulty apparatus.

4(e) A majority used their subject knowledge or interpretation of the data to conclude that the current would be high but many incorrectly stated that the problem would be that the slider would be too wide to move to 2 cm or that this distance is too small to measure.

4437 Science (Double Award) Paper 10 (Coursework)

The total number of centres entering candidates for this component of the examination increased again this year.

The moderating instrument used was the Sc1 criteria previously used by home centres, using exemplars provided by the JCQ (Joint Council for Qualifications) as a guide.

Generally the work seen was of grade C or higher standard, with very few grade G candidates. The marks awarded by the centres for investigations for the separate sciences tended to be high and a number of full marks were seen in the samples and the average mark for the centres' assessments was in the mid twenties. In fact the lowest mark for a number of centres was in the low twenties.

Skill Area P: Planning

Comprehensive and detailed scientific information was often written but it was not always used sufficiently to support predictions and inform plans. Students did not always consider the control and monitoring of all relevant factors when they were planning how to obtain reliable evidence as often no plan was made to control or monitor the ambient temperature during the course of the investigation even though students had stated it was a variable to consider. As a consequence, it was not always possible to support the award of P.8a. Most students carried out some form of preliminary work involving the establishment of the range to be investigated, but on occasions some other factor was investigated, such as a suitable time duration for the osmosis activity. Students did not always appreciate that in order to satisfy P.8b they should show how this preliminary work informed the main investigation that they were going to perform.

Skill Area O: Obtaining Evidence

Many of the centres and their students failed to recognise that taking averages of results where there are significant variations, does not give reliable evidence. Very rarely did students identify these anomalies and then repeat the measurements so that they could ignore rogue results when calculating averages. Occasionally students averaged the readings for individual components such as voltage and current for a particular length before carrying out a calculation to determine the variable linked to the investigation (i.e. resistance) and, if the values of the item being averaged showed significant variations, then the reliability of the evidence was compromised. Some students did not appreciate the need to control and monitor significant variables. The obvious one being the ambient temperature at which the investigation was carried out. For these reasons, rarely was it possible to support the centre's award of eight marks for this Skill Area. However, most students were able to justify the award of at least six marks by the systematic and accurate means they had collected and presented their evidence.

Skill Area A: Analysing and Considering Evidence

Most students were able to carry out the required calculation for the factor under investigation, i.e. percentage change in mass of potato stick, rate of chemical reaction and resistance of a wire, and then use this information to draw the graph of the evidence, with a line of best fit in the form of the expected straight or curved line, thus achieving A.6a. Detailed scientific knowledge was often used to discuss the evidence to produce a valid conclusion, but this evidence was not always the processed evidence shown by the graph. Sometimes the data in the table of results made the award of A.8a problematical. It was good to see discussions that often considered the shape or angle of the graph in order to determine the exact relationship between the variables investigated. Students still find it difficult to discuss the prediction in terms of the processed evidence displayed in the graph and often ignored the tentative nature of any relationship displayed by the scattering of plotted points around the line of best fit, making the award of A.8b difficult to justify.

Skill Area E: Evaluating

Most students were able to identify anomalous results and make some comment on the quality of the evidence obtained and so satisfy E.4a. Discussion of the procedure and identification of possible improvements was surprisingly weak in some cases, although E.4b had usually been awarded. Most students understood that any further work suggested had to be described in some detail and justified in terms of the original task, either by extending the range investigated or by investigating a linked factor for E.6b to be awarded. However, discussion of the reliability of the evidence obtained and, in particular, explaining the cause of identified anomalies, was not always easily accomplished, yet E.6a seemed to be freely awarded in a number of cases.

At most centres there was clear evidence that internal standardisation had been scrupulously carried out, and there appeared to be consistency in assessment across the various groups in a large entry. The marks were always confined to a single investigation for the separate sciences (two could have been used) and mainly just two for the Double Award Science entries when a maximum of four investigations is possible.

Double Award 4437

The tasks chosen were in general much the same as those for the separate sciences, (rates, osmosis and resistance in wires) but in addition tasks involving enzyme reactions, yeast respiration and burning peanuts 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.
It may be worth reporting that one candidate who submitted the resistance task as part of his Double Award course was found to have sent in work copied from a website. Teachers need to be constantly on their guard against the submission of plagiarised work.

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				53	43	33	24	15
Higher Tier	79	68	57	46	37	32		

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

	A*	A	B	C	D	E	F	G
Foundation Tier				53	43	34	25	16
Higher Tier	80	68	56	45	36	31		

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

	A*	A	B	C	D	E	F	G
Foundation Tier				52	42	33	24	15
Higher Tier	78	67	56	45	36	31		

Option 4: with Coursework (Paper 10)

	A*	A	B	C	D	E	F	G
Foundation Tier				55	44	34	24	14
Higher Tier	80	69	58	47	37	32		

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

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