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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Single and Double Award (Modular) 3468/3469

Specification A

Report on the Examination

2006 examination - June series

- Full Course

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Paper 1 (3468/1F) Double Award – Foundation Tier

General

There were sixteen questions on the paper. The first eight questions appeared only on the Foundation Tier and were targeted at grades E, F and G. The final eight questions (termed Standard Demand) were common to Foundation and Higher Tiers. These were targeted at grades C and D.
The marks for Quality of Written Communication this year appeared in questions 6 and 9. In both cases the mark was awarded for the correct use of scientific terms, and in both cases the mark was awarded less frequently than had been hoped.
Some examiners expressed concern about the apparent increase in illegible handwriting this year. Although it is still a very small percentage, candidates should be aware that if the examiner cannot read the script they will not be awarded any marks for that part.

Most candidates followed the rubric instructions correctly. There were however a few candidates who did not. For example, when asked to state **one** example, or give **one** reason, they should not give a list of possible alternatives.

Question 1 (Low Demand)

(a)(i) Most candidates were able to achieve a mark here. However, a common mistake was to read the question as 'Name one material *from* which fossils are formed' rather than '…*in* which fossils are formed. This led to candidates offering the answer 'bones'or 'skeleton'.

(a)(ii) Most candidates gained the mark by explaining that the soft parts were broken down, though better candidates made reference to decay or bacterial action.

(b)(i) Most candidates were able to identify Eohippus as the first animal to evolve, although a significant proportion chose Equus.

(b)(ii) Many answers included correct statements but no comparison. In some cases the candidate's use of language made it difficult for the examiner to discern intent. Many made mention of feet, legs, tail or body, rather than bones or toes. A significant proportion of candidates compared the animals themselves or the feet, rather than the foot bones. A few candidates compared the wrong horses.

Question 2 (Low Demand)

(a) Most candidates could correctly identify the nucleus, but chromosome and gene were often confused with each other.

(b) Ovary and womb were the most common correct responses, closely followed by contraceptive. The most common errors here were to use antibiotic rather than fertility drugs and to reverse fertility and contraceptive drugs.

Question 3 (Low Demand)

(a) Candidates found some difficulty in applying their knowledge of the periodic table to this question. Many made the question more difficult by trying to name the elements, while others gave a wide range of elements in their answers selected from all parts of the periodic table.

(b) This part was well answered by all but the weakest candidates.

(c) In the first part of this question, the majority of candidates believed that the modern periodic table was arranged in order of atomic mass rather than by atomic number. In the remaining parts, group and period were often confused.

Question 4 (Low Demand)

Able candidates usually scored full marks, but weaker candidates tended to confuse oxygen with neon, or water vapour with methane.

Question 5 (Low Demand)

(a) The use of rulers to draw straight lines was sadly lacking in this part – many lines were obviously drawn freehand. Most candidates who had drawn the line emerging from the block in the correct quadrant then went on to draw the refracted ray in the correct place. Common incorrect responses included drawing down the normal line, or showing total internal reflection, despite the question saying that the ray emerged.

(b) The most common answer to the first part was 'reflection' rather than speed and in the second part 'diffraction' was a common incorrect answer. A significant number of candidates elected to insert words of their own rather than words from the list.

(c) Some candidates were able to provide the name 'endoscope', but most gave a correct description of the use of this instrument. Other acceptable responses included decorative table lamps and Christmas trees. Candidates should be advised to be specific when answering questions of this type, eg simply stating 'they are used in hospitals' would not qualify for a mark.

Question 6 (Low Demand)

(a) Many candidates gained full marks. A common error was to reverse gamma and ultraviolet rays.

(b) Many candidates referred correctly to ultraviolet light and skin cancer. Some could not distinguish between the effects of ultraviolet and infra red rays.

Only a small percentage of candidates were able to gain the mark for Quality of Written Communication since their explanations did not include three relevant scientific terms such as ultraviolet, infra red, radiation, cancer, cell, mutation.

Question 7 (Low Demand)

Candidates used the data sheet to good effect and on the whole gave correct answers.

Question 8 (Low Demand)

(a) A very high proportion of candidates were able to complete the pie chart correctly. However, in some cases, candidates forgot to label the chart or else labelled it in such a way that it was unclear to markers.

(b) Most candidates gave correct responses for sweat and carbon dioxide. Many, however, confused the functions of the liver, the kidney and the bladder.

Question 9 (Standard Demand)

(a) Most candidates showed understanding of gender determination.

(b) The inheritance of cystic fibrosis does not appear to be well understood. The majority of candidates referred to the grandparents having the disease and it skipping a generation. Few candidates mentioned 'allele' but many realised that a gene somewhere in the families was responsible for cystic fibrosis. Although some realised that the parents were carriers, there was a lack of accuracy in explanations, and few were clear that one allele must come from the mother and one from the father. Confusion between 'gene' and 'allele' led to few candidates being awarded the mark for written communication.

Question 10 (Standard Demand)

The majority of candidates sensibly chose, for their responses, facts that they had been given in the bullet-point list. However, many candidates appeared confused about the difference between an *advantage* and a *disadvantage*. This led to many candidates using double-headed arrows to 'swap' their answers between parts (a) and (b).

Question 11 (Standard Demand)

(a) Most candidates attempted to write a word equation, with many gaining both marks. However, there was often confusion between 'chlorine' and 'chloride'.

(b) Only the best candidates are able to balance a symbol equation.

(c) Relatively few gave the correct response 'aqueous'. Many gave 'liquid' or 'solution'

Question 12 (Standard Demand)

(a) Able candidates usually gave the correct answer, but weaker candidates often did not understand the meaning of 'state' and gave a figure as the answer.

(b) A majority of candidates read the graph correctly, but many failed to include a minus sign in the answer.

(c) Most candidates recognised the relationship between boiling point and atomic number and some also gained a further mark by linking the boiling point to the positions of the elements in the periodic table. Weaker candidates did not understand that the smaller the minus number the higher the boiling point.

(d) Of those who knew neon had 10 electrons, most gave an electronic configuration of 2.8. Incorrect answers usually had the incorrect numbers of electrons. Other common mistakes were to add an extra ring of electrons, or to put the electrons into the nucleus.

Question 13 (Standard Demand)

(a) As examiners have noted previously, many candidates do not know how to calculate proportion. Many correctly added all the sectors to give 340, but did not know where to proceed from there.

(b) Most candidates gained the mark, but some included part of the electromagnetic spectrum, whilst others copied terms from the pie chart.

(c) Many candidates managed to gain at least one mark here for stating the correct type of radiation, most then going on to give the correct reason. However several just stated that the radiation was dangerous because it killed the cells, rather than mentioning its penetrating power.

Question 14 (Standard Demand)

(a) Very few candidates appeared to be familiar with this experiment. Many stated that it was the gaps between the atoms that allowed alpha particles through, in spite of the diagram showing the atoms touching. Others stated that the gold leaf was 'not strong enough'

(b) Rather more candidates were able to obtain a mark in this part – usually for stating that the nucleus was positively charged. Many candidates mistakenly thought that opposite charges repel. Others stated that the gold leaf itself was positive or that electrons would deflect the alpha particles.

(c) Many candidates stated that the atom contains protons, neutrons and electrons, but few were able to elaborate on how these were put together in the atom. Several candidates obtained full marks from a correctly labeled diagram.

Question 15 (Standard Demand)

(a) There were many varied answers to this question and it was often very difficult to follow the candidates' working or logic. However, examiners did see many correct answers.

(b) The energy content of food 'C' was calculated correctly far more commonly than 'B'. Many candidates had failed to notice, in the information given, that 'fats releases about twice as much energy as carbohydrates or proteins'. This oversight meant that they failed to double the number given in the table for fat.

(c) Many candidates could explain that food was digested but few went on to state that the products were absorbed into the blood. Many candidates seemed unsure of the position of the small intestine in relation to the stomach and large intestine and a very large percentage thought main function of the small intestine was to prepare the food for removal from the body.

Question 16 (Standard Demand)

(a) Most candidates managed to gain one mark by correctly linking the increase in bubbling to the increase in temperature. Of these candidates, many then went on to gain the other mark for stating what happened after 20°C.

(b) Very few candidates answered in terms of limiting factors. Most thought that 20°C was the highest temperature at which photosynthesis could take place. Most answers stated that the plant had reached boiling point, or that it had run out of bubbles, or had been killed by high temperatures.

Paper 2 (3468/2F) Double Award – Foundation Tier

General

There were fourteen questions on this paper. The first nine questions, a total of fifty marks, were targeted at grades E, F and G. The last five questions were targeted at grades C and D and were common to both Foundation and Higher Tiers.

All candidates appeared to have had sufficient time to complete their paper. The majority of candidates attempted most parts of their paper. Candidates gained marks when their answers were clear and precise. Vague and unspecific responses were often seen for questions requiring explanations or descriptions. Such responses sometimes repeated information already given in the question or contradicted part of what was a correct answer. It should be noted that when candidates gave several answers when only one or two were required, they risked not being credited for their correct ideas if errors or contradictions were included in their response.

Although most candidates had knowledge of basic scientific ideas, they seemed to have difficulty with the understanding of some scientific words and terminology. These included corrosion, corrosive, distillation, infra red radiation, proportion, acceleration, greenhouse effect, acid rain, particle collisions, process, food web, electrical circuit and balanced forces. Some very common biological processes, such as digestion and respiration, also chemical reactions and quantitative relationships were not well known. It should be noted that candidates are asked to show their working so that if they give an incorrect answer they can still gain credit for the correct use of the figures. Experimental procedures were not understood as well as might have been expected. The use of the words 'it', 'them' and 'they' meant that many candidates lost marks when their responses was ambiguous.

Fundamental concepts, including straightforward factual recall, the understanding of key ideas and the application of these were tested throughout the paper. This meant that candidates needed to be reminded that it was essential to read the questions carefully, analyse the information and think about what is required before writing their response.

Question 1 (Low Demand)

(a) This first part was well answered, although it proved a useful discriminator because candidates confused the order of the words.

(b) Part (b) was generally well done, the most common errors were to select 'respire' instead of 'digest' and 'hot' instead of 'warm'.

Question 2 (Low Demand)

Most candidates scored less than half marks. Many candidates missed the first mark because they did not state that the problem is caused by the burning of coal or any other fossil fuel. Many candidates were able to identify and mane the acidic gases, however, they did not appreciate that these gases dissolved, mix or react with water to produce acid rain.

Question 3 (Low Demand)

Although many candidates gained only one mark for part (a), it was therefore suprising to find that the majority of candidates did know that alcohol/ethanol is produced during this fermentation. The majority of candidates did know that the best temperature to use for fermentation is 35 ^{o}C. Many candidates did remember the change in the appearance of limewater, but very few candidates were able to correctly identify the gas that caused this change.

Question 4 (Low Demand)

(a) Most candidates were able to identify N_2 as nitrogen, and they were able to describe the meaning of reversible reaction.

(b) The table was usually completed correctly.

(c) The hazard symbol caused some confusion between the terms 'corrosion' and 'corrosive'.

(d) A majority of candidates could give at least one way of increasing the rate of reaction between a metal and nitric acid.

Question 5 (Low Demand)

The units of newtons and metres were often correctly placed. The most common error was for candidates to write in 'distance × force' rather than 'force × distance'.

Question 6 (Low Demand)

The vast majority of candidates scored both marks here. There was a pleasingly high level of clarity in the lines drawn, which has not always been the case with this type of question.

Question 7 (Low Demand)

(a) The first part of (a) was usually correct, however, in the second part most candidates thought that the forces are only balanced when the car has stopped.

(b) Generally part (b) was well answered.

Question 8 (Low Demand)

(a) Most candidates could not identify the process as a distillation, instead they stated other processes, such as, the 'Haber process' or 'cracking'.

(b) It was good to observe that the majority of candidates could use the table of data to both identify the pattern and state clearly the relationship between the number of carbon atoms and the boiling point.

(c) The element hydrogen was usually correct in (c)(i). In the final part of this question most candidates correctly selected carbon dioxide but were unable to correctly select water vapour as the other product formed from the burning of hydrocarbon.

Question 9 (Low Demand)

(a) The majority of candidates incorrectly thought that UV radiation will heat water.

(b) Part (b) was reasonably well answered with many candidates giving the expected answer of black/dark/matt or dull. The most common error was to state that the best type of surface was 'metal'.

(c) The majority of bar charts were correct and clearly, labelled and drawn.

Question 10 (Standard Demand)

(a) Most candidates realised that phytoplankton are a producer.

(b) A large number of candidates were unable to appreciate that a ban on cod fishing would cause an increase in the number of cod. Instead these candidates based their arguments on cod being banned and some thought that the minke whales were banned from eating cod. Too many candidates interpreted incorrectly the energy flow arrows, so they thought the sand eels would eat the cod. However, a good proportion did achieve full marks for the sand eels decreasing in number but explanations for an increase in the number of sand eels were not so good. Some confused responses gained credit for identifying that the sand eels would have fewer predators. Many candidates got the idea that the minke whales would eat more cod but were unable to link this to the minke whales therefore eating fewer sand eels.

Question 11 (Standard Demand)

(a) Few candidates understood that the number of each source needed to be considered. Frequently candidates made references to factories, power stations, size of a plane or animal other than cows.

(b) Respiration was well known but many incorrectly thought that the process was breathing.

(c) Many candidates did not realise that they were being asked to use the date in the table. There were too few full comparisons made, such as use a bus instead of a car because a bus carries more passengers, because otherwise this would appear to be contrary to the information in the table. Candidates often scored one mark for a statement such as 'use less transport', 'walk' or 'use fewer planes'.

(d) Many answered part (d) correctly, however, a significant number of candidates incorrectly referred to depletion of ozone.

Question 12 (Standard Demand)

(a) The first part was reasonably well answered, most knowing that a gas/carbon dioxide was produced.

(b) Descriptions of how the rate of reaction changed during the experiment were generally good. Some candidates thought that the reaction rate levelled off rather than the reaction stopping. Often descriptions confused mass changes with rate changes. The explanations, given by candidates, often did not relate to the changes in the rate of reaction shown by the graph because they wrote in terms of 'if the concentration increases, then the number of collisions will also increase'. Some candidates introduced factors such as the effect of temperature to explain the rate changes.

(c) Although some candidates correctly calculated the relative formula mass of 124, very few went on to calculate the correct percentage.

Question 13 (Standard Demand)

(a) Most candidates correctly identified that the speed was steady/constant, although there were those candidates who thought that the skier had stopped. Those candidates, who knew the correct formula, usually used the correct values and gained both marks. Too many candidates, who produced incorrect answers, did not give the formula or showed no working and so they gained no credit. Most candidates recognised that the graph after 40 seconds showed that the skier was decelerating. Again those few candidates who knew the formula usually used the correct values and gained three marks for the calculation. Most candidates did not know the correct unit for acceleration.

(b) A majority of candidates gained credit for drawing lines indicating greater acceleration, greater speed or stopping in less time.

Question 14 (Standard Demand)

(a) The first part was often answered incorrectly, the typical incorrect answer being just 'resistor'. The majority of candidates did not understand how to wire a voltmeter across the electromagnet. The most common mistake was to wire the voltmeter in series at some point in the circuit. There were many correct answers for the calculation. The most common incorrect answer was 48. Again, for incorrect answers, no credit was gained if candidates had not stated a correct formula or had not shown any working out. Very few candidates gained full marks.

(b) Many marks were not gained because candidates often did not use the term 'current'. A reasonable number of candidates gained the marking point indicating that the circuit would be broken and that the electromagnet would attract the iron switch.

Paper 1 (3468/1H) Double Award – Higher Tier

General

There were sixteen questions on the paper. The first eight questions were common to Foundation and Higher Tiers. These were targeted at grades C and D. The final eight questions were targeted at grades B to A*.
This year the majority of candidates were able to score very respectable marks, with very few questions left un-attempted. The majority of candidates probably left the examination with a sense of positive achievement.

The marks for Quality of Written Communication this year appeared in questions 1 and 13. In both cases the mark was awarded for the correct use of scientific terms, and in both cases the mark was awarded less frequently than had been hoped. Often the differences between similar scientific / English words are not fully grasped eg 'absorb' and 'reabsorb'; 'refraction', 'reflection' and 'diffraction'; 'gene' and 'allele'.

Question 1 (Standard Demand)

(a) The vast majority of candidates at this level showed understanding of gender determination.

(b) Many candidates answered in terms of general inheritance rather than why this particular child inherited cystic fibrosis. Hence many answers contained phrases such as 'one or both parents must be a carrier' or 'then the child is a carrier'. Although Punnet squares and 'knitting needle' diagrams were often used, candidates often failed to identify the child with cystic fibrosis. Confusion between 'gene' and 'allele' resulted in many candidates failing to gain the mark for Quality of Written Communication.

Question 2 (Standard Demand)

At this level, the great majority of candidates gained full marks. Many candidates attempted explanations rather than selecting appropriate statements from the list.

Question 3 (Standard Demand)

(a) Most candidates at this level can write a correct word equation, though a significant number confused chlorine and chloride – even though these were given as labels on the diagram.

(b) Although this was a relatively simple balancing task, many candidates contrived to give inexplicable numbers in the equation.

(c) Even though the state symbols 'l' and 'g' appeared in the equation, many candidates gave 'liquid' or 'gas' as the answer to 'aq'. Although phonetic spellings are generally accepted, this does not apply if the word given has another meaning. Examples included 'aquarius' and 'aqua.'

Question 4 (Standard Demand)

(a) The great majority of candidates realized that radon would be a gas at room temperature.

b) A significant number of candidates missed the minus sign from their answer, or gave the answer '−149'. Many candidates did not appear to understand the scale on the vertical axis.

(c) Candidates should understand that to gain two marks they have to state two facts. Usually, either information from the graph was used (boiling point rises with atomic number) or information from the periodic table was used (boiling point rises down the group), but rarely both.

(d) In the rare cases where full marks were not scored, either nothing was written or additional shells were added (despite instruction to *only* use 'dots or crosses').

Question 5 (Standard Demand)

(a) Most candidates at this level gained at least one mark. Candidates should be encouraged to show all their working. Many candidates with incorrect final answers might have gained credit for correctly calculating the denominator had they shown working.

Parts (b) and (c) were answered correctly by most candidates at this level, only the weakest failing to mention penetrating power in (c).

Question 6 (Standard Demand)

(a) Only the most able candidates gained the mark by referring to space inside the atom. The majority of candidates ignored the diagram and answered in terms of spaces between the atoms.

(b) Although this was frequently answered correctly, often the question was just rephrased eg 'particles bounced off the gold atoms', without adding to the information given in the question.

(c) Most candidates showed good understanding of the structure of the atom, but many failed to make it clear that protons and neutrons are found in the nucleus.

Question 7 (Standard Demand)

Parts (a) and (b) were generally answered correctly, a minority of candidates failing to note that fats give off twice as much energy as carbohydrates and proteins.

(c) Most candidates referred to digestion and absorption, although blood was often not mentioned. Weaker candidates continue to confuse the functions of the large and the small intestine.

Question 8 (Standard Demand)

(a) Most candidates gained one mark for the general increase of rate with temperature, but a significant number did not describe non-linearity.

(b) The more able candidates realized that temperature was no longer the limiting factor, but even these candidates often failed to suggest which factor was now limiting.

Question 9 (High Demand)

Most candidates gained two marks for stating that larger guppies were more likely to survive and to breed in the upper pool. Only the most able candidates correctly described the origin of larger guppies in the upper pool in terms of mutation or variation. A majority of candidates still give explanations in terms of organisms intending to change in order to survive.

Question 10 (High Demand)

(a) Only the more able candidates were able to interpret the graph.

(b) At this level, candidates should appreciate the difference between egg production and egg release. Often candidates referred to eggs being released more often.

(c)(i) Although there were many good answers, many candidates merely copied information about the 'morning-after pill' without commenting on it.

(c)(ii) It was encouraging to note that many candidates this year made good attempts at answering this 'moral / ethical' question rather than resorting to the fall back answers 'God does not like it' or 'It is against religion'.

Question 11 (Standard Demand)

(a) Most candidates answered parts (i) and (ii) correctly.

In part (iii) most candidates started out on the right lines, but went on to include phrases such as 'more outer shells'. The consequential understanding of relative attraction of outer electrons was often omitted so candidates failed to gain the second mark.

(b)(i) Most candidates referred to the full outer shell, but only the better candidates completed the answer in terms of tendency to lose / gain electrons.

(b)(ii) Very few candidates used all the information in parts (i) and (ii) about the reactivity of Group 0 elements, and therefore failed to realize that radon would be more reactive than xenon because the outer electrons are further from the attractive force of the nucleus.

Question 12 (Standard Demand)

(a) Few candidates used the information in the diagram to state that each carbon forms three covalent bonds with other carbon atoms, leaving 'free' electrons to carry an electric current.

(b) Although many candidates referred to layers, few gave explanations in terms of weak forces between the layers of carbon atoms.

Question 13 (Standard Demand)

(a) Although 'total internal reflection' was given almost universally, only a minority of candidates went on to explain that this was because the angle of incidence is greater than the critical angle. Failure to use these terms resulted in failure to gain the mark for Quality of Written Communication.

(b) Most candidates completed the diagram correctly and were able to name the effect.

(c) Candidates who can transform equations have little difficulty with this type of calculation, although many could not cope with the large number of 'noughts' in the figures.

Question 14 (Standard Demand)

(a) All but the weaker candidates correctly read the graph and stated that P waves travelled faster than S waves.

(b)(i) Very few candidates gave explanation for the curved path through the mantle in terms of changes in wave speed or changes in density. Many stated that S waves 'bounced off the core', ignoring the curved path shown on the diagram.

(b)(ii) Few candidates gave an explanation in terms of movement from a liquid into a solid.

Question 15 (Standard Demand)

Only the most able candidates brought an understanding of the functioning of the kidney to the data in the table.

(a) In part (a), three marks could be obtained by stating that glucose is filtered, ions are filtered, and protein is not filtered. The remaining two marks could be gained by stating that all the glucose is reabsorbed and some of the ions are reabsorbed. Many candidates confused filtration with absorption.

(b) In part (b), only the very able candidates explained in terms of water being reabsorbed but not urea.

(c) In part (c) there were many good answers. Candidates seemed to be much more confident about the effects of ADH than they were with kidney functioning.

Question 16 (Standard Demand)

(a) Most candidates answered (i) correctly, but many repeated their answer in (ii).

(b) Most candidates gained both marks, but many stated that these metals are unreactive. If they were, they would not form any compounds.

Paper 2 (3468/2H) Double Award – Higher Tier

General

There were thirteen questions on this paper. The first five questions, a total of fourty marks, were targeted at grades C and D and were common to both Foundation and Higher Tiers. The last eight questions were targeted at grades B to A*.

A number of candidates were inappropriately entered for this paper. Centres must understand that approximately 55% of the marks are targeted at grades B to A*, and that borderline grade C candidates will therefore find the majority of questions well beyond their capabilities.

All candidates appeared to have had sufficient time to complete their paper. The majority of candidates attempted most parts of their paper. Candidates gained marks when their answers were clear and precise. Vague and unspecific responses were often seen for questions requiring explanations or descriptions. Such responses sometimes repeated information already given in the question or contradicted part of what was a correct answer. It should be noted that when candidates gave several answers when only one or two were required, they risked not being credited for their correct ideas if errors or contradictions were included in their response.

Although most candidates had knowledge of basic scientific ideas, they seemed to have difficulty with the understanding of some scientific words and terminology. These included acceleration, proportion, greenhouse effect, particle collisions, biomass, microorganism, equilibrium, bond energy, cracking, polymerisation and Haber process. Some very common biological processes, such as eutrophication and energy flows in food webs, also chemical reactions and quantitative relationships were not always well known. It should be noted that candidates are asked to show their working so that if they give an incorrect answer they can still gain credit for the correct use of the figures. Experimental procedures were not understood as well as might have been expected. The use of the words 'it', 'them' and 'they' meant that many candidates lost marks when their response was ambiguous.

Fundamental concepts, including straightforward factual recall, the understanding of key ideas and the application of these, were tested throughout the paper. This means that candidates need to be reminded that it is essential to read the questions carefully, analyse the information and think about what is required before writing their response.

Question 1 (Standard Demand)

(a) The majority of candidates realised that phyoplanton are a producer.

(b) A number of candidates were unable to appreciate that a ban on cod fishing would cause an increase in the number of cod. Too many candidates interpreted incorrectly the energy flow arrows so they thought the sand eels would eat the cod. A significant number of candidates explained the decrease in terms of more cod, resulting in more minke whales eating more sand eels. A good proportion did achieve full marks for the sand eels decreasing in number but explanations for an increase in the number of sand eels were not so good. Some confused responses gained credit for identifying that the sand eels would have fewer predators. Many candidates got the idea that the minke whales would eat more cod but were unable to link this to the minke whales therefore eating fewer sand eels. A significiant number of candidates explained in terms of more cod, resulting in more minke whales eating more sand eels.

Question 2 (Standard Demand)

(a) Few candidates understood that the number of each source needed to be considered. Frequently candidates made references to factories, power stations, size of a plane or animals other than cows.

(b) Respiration was well known but many incorrectly thought that the process was breathing.

(c) Many candidates did not realise that they were being asked to use the data in the table. There were too few full comparisons made, such as use a bus instead of a car because a bus carries more passengers, because otherwise this would appear to be contrary to the information in the table. Candidates often scored one mark for a statement such as 'use less transport 'walk' or 'use fewer planes'.

(d) Most answered part (d) correctly, however, a significant number of candidates incorrectly referred to depletion of ozone.

Question 3 (Standard Demand)

(a) The first part was well answered, most knowing that a gas/carbon dioxide was produced.

(b) Descriptions of how the rate of reaction changed during the experiment were generally good. Some candidates thought that the reaction rate levelled off rather than the reaction stopping. Often descriptions confused mass changes with rate changes. The explanations, given by candidates, often did not relate to the changes in the rate of reaction shown by the graph because they wrote in terms of 'if the concentration increases, then the number of collisions will also increase'. Some candidates introduced factors such as the effect of temperature to explain the rate changes.

(c) Although some candidates correctly calculated the relative formula mass of 124, only the more able were able to calculate the correct percentage.

Question 4 (Standard Demand)

(a) Most candidates correctly identified that the speed was steady/constant, although there were a few candidates who thought that the skier had stopped. Those candidates, who knew the correct formula, usually used the correct values and gained both marks. Too many candidates, who produced incorrect answers, did not give the formula or showed no working and so they gained no credit. Most candidates recognised that the graph after 40 seconds showed that the skier was decelerating. Again those candidates who knew the formula usually used the correct values and gained three marks for the calculation. Many candidates did not know the correct unit for accelleration.

(b) The majority of candidates gained credit for drawing lines indicating greater acceleration, greater speed or stopping in less time.

Question 5 (Standard Demand)

(a) The first part was often answered correctly, the typical incorrect answer being just 'resistor'. Many candidates did not understand how to wire a voltmeter across the electromagnet. The most common mistake was to wire the voltmeter in series at some point in the circuit. There were many correct answeres for the calculation. The most common incorrect answer was 48.

Again, for incorrect answers, no credit was gained if candidates had not stated a correct formula or had not shown any working out. Many candidates gained full marks.

(b) Marks often were not gained because candidates did not use the term 'current'. There were many good, clear answers. The most common error was not to refer to a high current and that this caused the magnetic field to be stronger.

Question 6 (High Demand)

(a) The first part was suprisingly, poorly answered. Very few candidates gained full marks and zero marks were common even for the more able candidates. Most candidates did not refer to energy losses. These candidates usually attempted to explain the decrease in biomass as being caused by a decrease in the number of organisms at each stage. Many candidates who realised that energy was being lost at each stage could not give three ways in which this happened.

(b) Often the reading of 0.012 g from the graph was incorrect. Although a reasonable number of candidates calculated correctly the increase in mass, many of these candidates did not use this to state that the new mass of one fish would be 2.36g. Most candidates could appreciate what was happening if the pond contained twice as many fish but they found it difficult to communicate the idea that there was less food for each fish or that there was more competition for food.

Question 7 (High Demand)

(a) A large number of candidates knew that the ammonium compounds came from the plant protein by a decay process. Many of these candidates did not mention microorganisms at all and explained the production of ammonium comounds by chemical process of various kinds. A significant number of candidates stated incorrect types of microorganisms, such as, nitrifying or denitrifying bacteria.

(b) There were some well-rehearsed explanations of eutrophication which gained full marks. Marks were lost by candidates not referring to increased growth of plants or by stating that after the plant death stage there are no more plants to produce oxygen so the level of dissolved oxygen decreases. A significant number suggested incorrectly that the increased number of plants use up oxygen or that the nitrate reacts in water to reduce the amount of oxygen.

Question 8 (High Demand)

(a) Few candidates understood that at equilibrium the rate of the forward reaction is equal to the rate of the backwards reaction. The idea that a catalyst will 'speed up a reaction' was well known but the reason for this is that a catalyst lowers the activation energy was rarely stated.

(b) Many candidates just stated that costs would increase when using high pressures without any qualification. There was hardly any reference to increased energy costs when using high pressures. Candidates often gained one mark for stating that at lower temperatures there is a reduced rate of reaction.

Question 9 (High Demand)

(a) Activation energy was generally known to be the energy needed to start the reaction or to break the bonds of the reactants. There were many incorrect attempts to draw the line required. Often the peak height was lower, but the line started or finished at the correct energy level.

(b) A large number of candidates calculated the correct total for the energy required to break the bonds of the reactants. There was often an error when calculating the energy released when the bonds of the products are formed. Many candidates incorrectly subtracted the energy needed to break bonds from the energy released when new bonds form.

Question 10 (High Demand)

(a) The first part was well answered with most candidates suggesting correctly that increasing both the mass and the height would increase the kinetic energy of the pile driver.

(b) Many candidates were able to complete the calculation but several of these lost a mark through the incorrect choice of unit. Those numberical answers which were incorrect either did not know the formula, often using v rather than v^2, or could not transpose the ½ in the formula.

Question 11 (High Demand)

(a) Clear, accurate answers to this question were rare. Most candidates correctly associated the 'big bang' theory with an explosion, but often incorrectly had Earth, planets, stars or the Universe exploding.

(b) The idea that first gas and dust collect together was usually correct, as were references to gravity. That this process generated heat was hardly ever mentioned. The release of vast amounts of energy by nuclear fusion was described poorly. A significant number of candidates incorrectly referred to 'fission'.

Question 12 (High Demand)

(a) Most candidates gained credit for naming the process as 'cracking' but the common error was to name the process as 'polymerisation'.

(b) In part (b) many candidates gave differences that did not relate to structure, or did not compare decane and ethene or referred to octane.

(c) The process of polymerisation was poorly described. The idea that many ethene molecules are involved was hardly ever mentioned. Very few candidates described opening of the double bond so that the molecules could bond together.

Question 13 (High Demand)

(a) Most candidates gained marks for noise/visual pollution or for the unreliability of the wind as disadvantages of using wind turbines rather than geothermal power to produce electricity.

(b) Again, both marks were usually awarded for a correct depth and an explanation that the temperature needed to be at least 100°C to produce steam. Some candidates misread the graph and stated that the 100 °C depth was 4500 m rather than 5000 m.

(c) In part (c) few candidates gained both marks mainly because they made vague statements about non-renewable sources giving more energy.

Paper 1 (3469F) Single Award – Foundation Tier

General

There were sixteen questions on the paper. The first eight questions appeared only on the Foundation Tier and were targeted at grades E, F and G. The final eight questions (termed Standard Demand) were common to Foundation and Higher Tiers. These were targeted at grades C and D.
The marks for Quality of Written Communication this year appeared in questions 6 and 10. In both cases the mark was awarded for the correct use of scientific terms, and in both cases the mark was awarded less frequently than had been hoped.
Some examiners expressed concern about the apparent increase in illegible handwriting this year. Although it is still a very small percentage, candidates should be aware that if the examiner cannot read the script they will not be awarded any marks for that part.

Most candidates followed the rubric instructions correctly. There were however a few candidates who did not. For example, when asked to state **one** example, or give **one** reason, they should not give a list of possible alternatives.

Question 1 (Low Demand)

(a)(i) Most candidates were able to achieve a mark here. However, a common mistake was to read the question as 'Name one material *from* which fossils are formed' rather than '…*in* which fossils are formed. This led to candidates offering the answer 'bones' or 'skeleton'.

(ii) Most candidates gained the mark by explaining that the soft parts were broken down, though better candidates made reference to decay or bacterial action.

(b)(i) Most candidates were able to identify Eohippus as the first animal to evolve, although a significant proportion chose Equus.

(b)(ii) Many answers included correct statements but no comparison. In some cases the candidate's use of language made it difficult for the examiner to discern intent. Many made mention of feet, legs, tail or body, rather than bones or toes. A significant proportion of candidates compared the animals themselves or the feet, rather than the foot bones. A few candidates compared the wrong horses.

Question 2 (Low Demand)

(a) Most candidates could correctly identify the nucleus, but chromosome and gene were often confused with each other.

(b) Ovary and womb were the most common correct responses, closely followed by contraceptive. The most common errors here were to use antibiotic rather than fertility drugs and to reverse fertility and contraceptive drugs.

Question 3 (Low Demand)

(a) Candidates found some difficulty in applying their knowledge of the periodic table to this question. Many made the question more difficult by trying to name the elements, while others gave a wide range of elements in their answers selected from all parts of the periodic table.

(b) This part was well answered by all but the weakest candidates.

(c) In the first part of this question, the majority of candidates believed that the modern periodic table was arranged in order of atomic mass rather than by atomic number. In the remaining parts, group and period were often confused.

Question 4 (Low Demand)

Most candidates usually scored full marks, but weaker candidates tended to confuse the symbols for poisonous and irritant.

Question 5 (Low Demand)

(a) The use of rulers to draw straight lines was sadly lacking in this part – many lines were obviously drawn freehand. Most candidates who had drawn the line emerging from the block in the correct quadrant then went on to draw the refracted ray in the correct place. Common incorrect responses included drawing down the normal line, or showing total internal reflection, despite the question saying that the ray emerged.

(b) The most common answer to the first part was 'reflection' rather than speed and in the second part 'diffraction' was a common incorrect answer. A significant number of candidates elected to insert words of their own rather than words from the list.

(c) Most candidates referred correctly to heaters or to TV remote controls. Weaker candidates often gave 'mobile phone' without any further elaboration.

Question 6 (Low Demand)

(a) Many candidates gained full marks. A common error was to reverse gamma and ultraviolet rays.

(b) Many candidates referred correctly to ultraviolet light and skin cancer. Some could not distinguish between the effects of ultraviolet and infra red rays.

Only a small percentage of candidates were able to gain the mark for quality of written communication since their explanations did not include three relevant scientific terms such as ultraviolet, infra red, radiation, cancer, cell, mutation.

Question 7 (Low Demand)

(a) Most candidates correctly identified part X as a bulb. Few recognised part Y as a diode, 'resistor, 'LDR', 'LED' 'fuse' and 'switch' all being common answers.

(b) In part (b) surprisingly few stated ammeter. 'Voltmeter' and 'amp meter' were more common than the correct answer.

(c) Since few candidates recognised part Y, even fewer realised that the current would be zero amps.

Question 8 (Low Demand)

(a) A very high proportion of candidates were able to complete the pie chart correctly. However, in some cases, candidates forgot to label the chart or else labelled it in such a way that it was unclear to markers.

(b) Most candidates gave correct responses for sweat and carbon dioxide. Many, however, confused the functions of the liver, the kidney and the bladder.

Question 9 (Standard Demand)

The majority of candidates were able to select correct adaptations in both parts (a) and (b). Weaker candidates gave adaptations which were not in the list such as 'pointed beak for catching fish'

Question 10 (Standard Demand)

(a) Most candidates showed understanding of gender determination.

(b) The inheritance of cystic fibrosis does not appear to be well understood. The majority of candidates referred to the grandparents having the disease and it skipping a generation. Few candidates mentioned 'allele' but many realised that a gene somewhere in the families was responsible for cystic fibrosis. Although some realised that the parents were carriers, there was a lack of accuracy in explanations, and few were clear that one allele must come from the mother and one from the father. Confusion between 'gene' and 'allele' led to few candidates being awarded the mark for written communication.

Question 11 (Standard Demand)

(a) Able candidates usually gave the correct answer, but weaker candidates often did not understand the meaning of 'state' and gave a figure as the answer.

(b) A majority of candidates read the graph correctly, but many failed to include a minus sign in the answer.

(c) Most candidates recognised the relationship between boiling point and atomic number and some also gained a further mark by linking the boiling point to the positions of the elements in the periodic table. Weaker candidates did not understand that the smaller the minus number the higher the boiling point.

(d) Of those who knew neon had 10 electrons, most gave an electronic configuration of 2.8. Incorrect answers usually had the incorrect numbers of electrons. Other common mistakes were to add an extra ring of electrons, or to put the electrons into the nucleus.

Question 12 (Standard Demand)

(a) A majority of candidates tried to use the labels on the diagram to produce a word equation with the result that sugar and alcohol rarely appeared in answers.

(b) Only the more able candidates gave protease.

Question 13 (Standard Demand)

(a) As examiners have noted previously, many candidates do not know how to calculate proportion. Many correctly added all the sectors to give 340, but did not know where to proceed from there.

(b) Most candidates gained the mark, but some included part of the electromagnetic spectrum, whilst others copied terms from the pie chart.

(c) Many candidates managed to gain at least one mark here for stating the correct type of radiation, most then going on to give the correct reason. However several just stated that the radiation was dangerous because it killed the cells, rather than mentioning its penetrating power.

Question 14 (Standard Demand)

(a) Very few candidates appeared to be familiar with this experiment. Many stated that it was the gaps between the atoms that allowed alpha particles through, in spite of the diagram showing the atoms touching. Others stated that the gold leaf was 'not strong enough.'

(b) Rather more candidates were able to obtain a mark in this part – usually for stating that the nucleus was positively charged. Many candidates mistakenly thought that opposite charges repel. Others stated that the gold leaf itself was positive or that electrons would deflect the alpha particles.

(c) Many candidates stated that the atom contains protons, neutrons and electrons, but few were able to elaborate on how these were put together in the atom. Several candidates obtained full marks from a correctly labelled diagram.

Question 15 (Standard Demand)

(a) There were many varied answers to this question and it was often very difficult to follow the candidates' working or logic. However, examiners did see many correct answers.

(b) The energy content of food 'C' was calculated correctly far more commonly than 'B'. Many candidates had failed to notice, in the information given, that 'fats release about twice as much energy as carbohydrates or proteins'. This oversight meant that they failed to double the number given in the table for fat.

(c) Many candidates could explain that food was digested but few went on to state that the products were absorbed into the blood. Many candidates seemed unsure of the position of the small intestine in relation to the stomach and large intestine and a very large percentage thought the main function of the small intestine was to prepare the food for removal from the body.

Question 16 (Standard Demand)

(a) The more able candidates often referred to the heating of crude oil, and the fact that different fractions have different boiling points. References to condensation at different temperatures were rare.

(b) The ability to interpret Sankey diagrams seems to be a rare commodity at this level. Part (ii) was answered correctly more frequently than part (i).

Paper 1 (3469H) Single Award – Higher Tier

General

There were sixteen questions on the paper. The first eight questions were common to Foundation and Higher Tiers. These were targeted at grades C and D. The final eight questions were targeted at grades B to A*.
This year the majority of candidates were able to score very respectable marks, with very few questions left un-attempted. The majority of candidates probably left the examination with a sense of positive achievement.

The marks for Quality of Written Communication this year appeared in questions 2 and 13. In both cases the mark was awarded for the correct use of scientific terms, and in both cases the mark was awarded less frequently than had been hoped. Often the differences between similar scientific / English words are not fully grasped eg 'absorb' and 'reabsorb'; 'refraction', 'reflection' and 'diffraction'; 'gene' and 'allele'.

Question 1 (Standard Demand)

The majority of candidates were able to select correct adaptations in both parts (a) and (b). Weaker candidates gave adaptations which were not in the list such as 'pointed beak for catching fish.'

Question 2 (Standard Demand)

(a) The vast majority of candidates at this level showed understanding of gender determination.

(b) Many candidates answered in terms of general inheritance rather than why this particular child inherited cystic fibrosis. Hence many answers contained phrases such as 'one or both parents must be a carrier' or 'then the child is a carrier'. Although Punnet squares and 'knitting needle' diagrams were often used, candidates often failed to identify the child with cystic fibrosis. Confusion between 'gene' and 'allele' resulted in many candidates failing to gain the mark for Quality of Written Communication.

Question 3 (Standard Demand)

(a) The great majority of candidates realized that radon would be a gas at room temperature.

(b) A significant number of candidates missed the minus sign from their answer, or gave the answer '−149'. Many candidates did not appear to understand the scale on the vertical axis.

(c) Candidates should understand that to gain two marks they have to state two facts. Usually, either information from the graph was used (boiling point rises with atomic number) or information from the periodic table was used (boiling point rises down the group), but rarely both.

(d) In the rare cases where full marks were not scored, either nothing was written or additional shells were added (despite instruction to *only* use 'dots or crosses').

Question 4 (Standard Demand)

(a) Few managed to achieve both marks for this part. Many stated wine or grape juice as the substrate and yeast as one of the products.

(b) Most candidates were able to state protease as the enzyme.

Question 5 (Standard Demand)

(a) Most candidates at this level gained at least one mark. Candidates should be encouraged to show all their working. Many candidates with incorrect final answers might have gained credit for correctly calculating the denominator had they shown working.

Parts (b) and (c) were answered correctly by most candidates at this level, only the weakest failing to mention penetrating power in (c).

Question 6 (Standard Demand)

(a) Only the most able candidates gained the mark by referring to space inside the atom. The majority of candidates ignored the diagram and answered in terms of spaces between the atoms.

(b) Although this was frequently answered correctly, often the question was just rephrased eg 'particles bounced off the gold atoms', without adding to the information given in the question.

(c) Most candidates showed good understanding of the structure of the atom, but many failed to make it clear that protons and neutrons are found in the nucleus.

Question 7 (Standard Demand)

Parts (a) and (b) were generally answered correctly, a minority of candidates failing to note that fats give off twice as much energy as carbohydrates and proteins.

In part (c) most candidates referred to digestion and absorption, although blood was often not mentioned. Weaker candidates continue to confuse the functions of the large and the small intestine.

Question 8 (Standard Demand)

(a) Most candidates were able to state that the oil needs to be heated and some were then able to go on and describe how the vapour condensed at different temperatures when the different fractions cooled to their boiling points. Many confused their answers with heating the oil to different temperatures at the start, frequently in a blast furnace or went on to give a description of cracking.

(b) Many candidates scored both marks. A large number worked out the more difficult diesel tonnage and then went on to give an incorrect answer for the seemingly easier bitumen tonnage.

Question 9 (Standard Demand)

The majority of candidates realised that the question was about the effects of carbon dioxide as a greenhouse gas. Many were able to give good answers in terms of there being fewer trees to take in this gas because there will be less photosynthesis and that carbon locked up in the trees will be released when

burnt. Some mentioned the effects of microbial decay. Very few were able to give good answers as to how it acted as a greenhouse gas and most gave descriptions in terms of forming a blanket around the planet that trapped the heat and then reflected it back to Earth. It was rare for a candidate to state (in their own terms) how energy radiated from Earth was absorbed before it can escape into space and then re-radiated.

Question 10 (High Demand)

(a) Only the more able candidates were able to interpret the graph.

(b) At this level, candidates should appreciate the difference between egg production and egg release. Often, candidates referred to eggs being released more often.

(c)(i) Although there were many good answers, many candidates merely copied information about the 'morning-after pill' without commenting on it.

(c)(ii) It was encouraging to note that many candidates this year made good attempts at answering this 'moral / ethical' question rather than resorting to the fall back answers 'God does not like it' or 'It is against religion'.

Question 11 (High Demand)

(a) Most candidates started out on the right lines, but went on to include phrases such as 'more outer shells'. The consequential understanding of relative attraction of outer electrons was often omitted so candidates failed to gain the second mark.

(b)(i) Most candidates referred to the full outer shell, but only the better candidates completed the answer in terms of tendency to lose / gain electrons.

(b)(ii) Very few candidates used all the information in parts (i) and (ii) about the reactivity of Group 0 elements, and therefore failed to realize that radon would be more reactive than xenon because the outer electrons are further from the attractive force of the nucleus.

Question 12 (High Demand)

Part (a) was generally well answered; most candidates were able to state at least two ways of increasing the rate.

Part (b) was generally well answered, most being able to state that the particles were moving faster and many going on to say that this would lead to more frequent or successful collisions.

(c) Most of the able candidates were able to state that activation energy was needed to start a reaction.

Question 13 (High Demand)

Although 'total internal reflection' was given almost universally, only a minority of candidates went on to explain that this was because the angle of incidence is greater than the critical angle. Failure to use these terms resulted in failure to gain the mark for Quality of Written Communication.

Question 14 (High Demand)

(a)(i) Most candidates scored the mark for stating the need for the Earth's gravitational pull, and many were credited for recognising the necessity for speed, although it was clear that few understood why.

(a)(ii) Although many scored this mark by stating that these satellites had an orbit time the same as the Earth's rotational speed, many stated that they travelled at the same speed as the Earth or that their orbit time was the same as the Earth's orbit time.

(b)(i) Most candidates were able to state the relationship that the further away from Earth the galaxy is, the faster it is moving away.

(b)(ii) Overall this was well answered. Most were able to state that the graph suggests that the Universe is expanding and many were able to go on and say that it also suggests that it all started off in the same place or that it provides evidence for the big bang theory.

Question 15 (High Demand)

(a) Only the most able candidates brought an understanding of the functioning of the kidney to the data in the table.
In part (a), three marks could be obtained by stating that glucose is filtered, ions are filtered, and protein is filtered. The remaining two marks could be gained by stating that all the glucose is reabsorbed and some of the ions are reabsorbed. Many candidates confused filtration with absorption.

(b) In part (b), only the very able candidates explained in terms of water being reabsorbed but not urea.

(c) In part (c) there were many good answers. Candidates seemed to be much more confident about the effects of ADH than they were with kidney functioning.

Question 16 (High Demand)

(a)(i) Many candidates were able to recognise that a calculation was not necessary and that the efficiency was the useful output transferred to electricity.

(a)(ii) Many were able to calculate the power at 300W and a significant number calculated it correctly even when they had given an incorrect answer to part (i).

(b) Few candidates were able to state infra red. Most stated thermal, background, gamma, microwaves and other parts of the electromagnetic spectrum.

(c) Many were able to state that the lost energy warms the surroundings or the atmosphere. A large number failed to score by just saying that it was wasted.

Module Tests

346001, 346002, 346005, 346006, 346009, 346010, Double Award 346013, 346015, 346017, Single Award

Each test consisted of ten multiple choice type questions to be completed in 30 minutes. Five questions were common to both Foundation and Higher Tiers. Tests for all modules were available in the Winter, Spring and Summer sessions. Candidates could take the tests in any order and could sit either tier for each test. The tier of the terminal paper determined the tier of award.

Centres received the raw mark grade boundaries obtained in each test series, along with the UMS (uniform mark scores) for each candidate, before the entry date for the next series of tests. Use of uniform marks took account of the varying degree of difficulty of different versions of the tests.

At the end of the course the total uniform marks for all candidates were standardised against aggregations for the written papers and coursework. This process accounted for differences in the ability of the cohorts of candidates taking each test, as measured against their performance on the terminal papers. All marks were then combined in the normal way to give the total mark and final grade boundaries for the subject.

Teachers should note that the uniform marks for each test were more important for a candidate's final grade than the notional, advisory grade for that test. Candidates at grades A* - D tended to achieve slightly higher final grades than indicated by an average of their module test grades.

Centre-assessed component

General

This was the fourth year of the operation of this particular assessment scheme for Sc1. Most centres are now familiar with the requirements for this component and consequently followed the procedures correctly, producing well-annotated and internally moderated work. In a few cases it was apparent that internal standardisation had not taken place. It is a requirement of the Code of Practice, to which all awarding bodies are subject, that internal standardisation should be carried out. This may be achieved by using the exemplar material, published in the 'Coursework Standardising and Guidance' booklet, in the autumn term. It is particularly important that Internal Standardising is carefully carried out in centres that have a large proportion of new members of staff.

Coursework advisers

Each centre is allocated a Coursework Adviser whose role it is to help and assist centres with all matters relating to the setting and marking of coursework for Sc1 assessment. Coursework advisers can comment upon the suitability of proposed investigations and advice on the correct application of the Mark Descriptions. They may not comment upon already moderated work.

Administration

The large majority of centres correctly provided the necessary documentation in terms of the Centre Declaration Sheets and Centre Marks Sheets. There were many cases, however, where the candidate had not signed the Candidate Record Form. This year, moderators were required to inform centres about this, and request that they send a signed Form as soon as possible. If no form was forthcoming – the candidate may get their mark reduced to zero. This procedure resulted in about half of the Candidate Record Forms that were unsigned being returned with a signature. The main cause of the problem appears to be 'school phobic' candidates. Often these are candidates who have completed some coursework in Year 10, but are then rarely seen during the later stages of Year 11. Centres are advised to try to obtain a candidate signature at the time that the work is carried out: this would then alleviate the problem of trying to get hold of such candidates in the summer term of Year 11. Where this opportunity is missed, it may be possible to get a candidate to sign the form when he or she reports for the written paper.

This year there were rather fewer centres that had not submitted their coursework samples by the due date. The due date for the submission of coursework is **always** May 5th. Because moderators have to work to a very tight time-scale, it would be much appreciated if centres could submit their samples before this date if at all possible.

It would be of great help if centres could submit to the moderator a list of their candidates in rank or numerical order. Many centres keep a record of their candidates' work on computer, and it is therefore relatively easy for them to supply the moderator with a rank or order list. If this is not done, the moderator must do it, and for very large entry centres this can be a very time-consuming process.

Some centres are still not correctly completing the reverse of the Candidate Record Form. This must be completed to show (i) the titles of the investigations completed by that candidate, and (ii) which marks have been used to calculate the final overall score.

Annotation of Candidates' Work

Moderators were very impressed with the standard of annotations this year. Good annotation makes it much easier for the moderator to see where and why the teacher believes that a particular mark description has been matched. The custom of writing the code for the mark description in brackets to indicate a partial match is particularly useful. Thus (P.6a) written in the script would indicate that part of the mark description for P.6a has been matched at that point. If the teacher judges that sufficient of these partial matches occur on the script, then that mark may be awarded.

Choice of Suitable Tasks

The majority of centres had chosen suitable tasks for their candidates to investigate. As last year however, the range of investigations tended to be very restricted. Osmosis, Photosynthesis, Rates of Reaction, and Resistance again comprised about 80% of the total. Some centres chose tasks that were not suitable for accessing the higher marks. For example, an investigation that deals with a catergoric variable will not allow candidates to match the Mark Description for A.4b. This Mark Description requires that candidates recognise a pattern or trend in the results and this is not possible with a categoric variable.

Worksheets

The use of worksheets or writing frames is perfectly permissible, providing that they are generic and not specific. A good worksheet should be capable of being used with *any* investigation. Thus, a worksheet that states 'Draw an appropriate bar chart of graph of your results' is acceptable. One that states 'Draw a line graph of your results, with length of wire in cm, on the x axis and current, in amps, on the y axis' is not acceptable. Similarly, cloze statements such as 'The resistance of the wire depends on both its c……. s……. a…….. and its l……' are **not** acceptable.

Application of the Criteria

Most centres took account of the hierarchy principle of the criteria and the Level of Demand arrow – although some centres are still ignoring this. For example, a few centres were awarding high marks in Skill Area P even though a basic method had not been described.

The notes that follow refer to the four Skill Areas. Inevitably these notes concentrate upon the errors made in applying the Mark descriptions, but this should not be taken to imply that there was widespread misapplication – indeed the majority of centres showed that they have a clear understanding of how the criteria should be applied.

Skill Area P

For **P.4a**, it is clear that in some cases the teachers had provided the candidates with a worksheet that gave the details of the method. However, the candidate had not made reference to this in the written account, but had gone straight on to variables that must be controlled (P.6a). This left the moderator in some doubt as to whether or not the candidate actually understood the method that was to be followed.

The Award of **P.6a** comprises three parts – specific knowledge and understanding, the control of variables, and the making of a prediction. In some cases, centres had chosen a type of investigation where a prediction was not appropriate. Whilst this is acceptable, since the Mark Description states 'make a prediction where appropriate', the award of this mark becomes much more secure if centres choose an investigation where a prediction ***is*** appropriate. There were also instances where candidates had quoted some scientific knowledge but had not related this to the plan. The Mark Description states that candidates should '…*use* scientific knowledge and understanding to plan and communicate a procedure.'

The award of **P.8b** has generally improved. Most candidates are now quoting the results of preliminary work, but in some cases are still failing to explain how the results of such preliminary work have influenced the plan. Preliminary work should not be used to test a hypothesis, but should be used to refine details of the intended procedure.

Skill Area O

Most centres had no difficulty in deciding whether or not to award marks up to and including 6 marks. Some centres, however, were rather too generous in awarding 7 and 8 marks in this Skill Area. Some points to consider when considering awarding more than 6 marks are:

- the complexity of the task, eg how difficult was it to assemble and use the equipment.
- the number of different operations that the candidates had to carry out, eg did the candidate have to make up their own dilutions of an acid, or were they provided with a series of stock bottles, all neatly labelled.
- the number of different measurements that the candidates had to make, eg were they using an ohmmeter to measure resistance, or did they have to use a separate voltmeter and ammeter.
- the skill required to make the measurements or observations, eg did it involve a titration with a difficult end point to spot.
- was it a dynamic or a static situation, eg were the candidates simply measuring the length of a piece of wire (static) or measuring the height to which a ball bounces back (dynamic.)
- were the candidates' results generally self-consistent, or were they widely scattered.

Unless several of these points have been matched, it is unlikely that the candidate should be awarded more than 6 marks in this Skill Area.

Skill Area A

Most candidates this year were able to state a simple conclusion. However, in some cases the candidates appeared to have ignored their actual results and stated (in spite of the evidence) that they had found out what they predicted they would find out. In a few cases, the teacher appears to have condoned such statements.

There appeared to be a slight improvement with regard to graphical skills in Skill Area A this year. More candidates this year appeared to be drawing in a line of best fit where appropriate. However, there did appear to be an increase in the number of candidates who were using terms that they had heard associated with graphs, but which they did not properly understand. Thus it was common to read statements such as 'My graph shows a strong negative correlation', but with the candidate failing to explain what he or she

meant by this. The advice from the moderating team is still firmly that the candidates are best advised to use a pencil and paper for drawing graphs, rather than using a computer-based graph-drawing package.

A.8b was often awarded too generously. In some cases, candidates had done little more than to say 'These results prove that my prediction was correct'. Candidates should be encouraged to make a sketch graph of their predicted results in Skill Area P, as this can be used to compare with the achieved results in Skill Area A. A comparison between the two is often helpful in achieving the mark for **A.8b.**

Skill Area E

Moderators felt that there had been an improvement this year with regard to **E.4b**, but the opposite was true regarding **E.4a.** Candidates must clearly identify which results they believe to be anomalous. If no anomalies are present, then candidates should state why they believe this. For example, a statement such as 'All the points on my graph were within 1mm of the best fit line' would be acceptable. Statements such as 'I did not have any anomalous results because I worked very carefully' are not acceptable.

E.6b still proves to be a major stumbling block for both candidates and teachers. It *is* a difficult mark to achieve, and is intentionally so. We would normally only expect A* or A grade students to be able to achieve this mark. Thus this mark should ***not*** be awarded simply for suggesting another variable to investigate.

Summary

The overall impression this year was that the standard of work seen was very similar to that of last year. As the criteria upon which the marks are based is unchanged, and bearing in mind the very large entry size, the Joint Council for Qualifications and the AQA moderators and awarders saw no reason to change the grade boundaries from those of last year. The grade boundaries are therefore as follows:

Double Award

Max mark	A*	A	B	C	D	E	F	G
60	53	47	41	36	30	25	20	15

Single Award

Max mark	A*	A	B	C	D	E	F	G
30	27	24	21	19	16	13	10	7

Mark Range and Award of Grades

Science: Double Award (Modular) (3468)

Foundation tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper 1 3468/1F	90	175	83.6	25.9
Paper 2 3468/2F	90	175	81.9	22.8
Module Tests 3468/M	300	210	102.5	23.9
Coursework 3462/8/C	60	140	82.4	21.0
Foundation tier overall 3468	-	700	350.3	79.7

		Max. mark	C	D	E	F	G
3468/1F boundary mark	raw	90	54	44	35	26	17
	scaled	175	115	93	72	51	29
3468/2F boundary mark	raw	90	53	44	36	28	20
	scaled	175	103	86	70	54	39
3468/M boundary marks	raw	300	173	147	122	97	72
	scaled	210	121	103	85	68	50
3462/8/C boundary mark	raw	60	36	30	25	20	15
	scaled	140	84	70	58	47	35
Foundation tier scaled boundary mark		700	401	340	280	220	160

Higher tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper 1 3468/1H	90	175	86.3	25.5
Paper 2 3468/2H	90	175	83.6	28.6
Module Tests 3468/M	300	210	146.2	19.3
Coursework 3462/8/C	60	140	105.0	16.1
Higher tier overall 3468	-	700	421.4	77.2

		Max. mark	A*	A	B	C	D	allowed E
3468/1H boundary mark	raw	90	63	53	43	33	22	-
	scaled	175	122	103	84	67	43	-
3468/2H boundary mark	raw	90	67	55	43	32	22	-
	scaled	175	130	107	84	62	43	-
3468/M boundary mark	raw	300	248	223	198	173	147	-
	scaled	210	174	156	139	121	103	-
3462/8/C boundary mark	raw	60	53	47	41	36	30	-
	scaled	140	124	110	96	84	70	-
Higher tier scaled boundary mark		700	528	460	395	331	258	221

Provisional statistics for the award

Foundation tier (267,756 candidates)

	C	D	E	F	G
Cumulative %	28.8	56.0	76.8	90.2	96.5

Higher tier (161,758 candidates)

	A*	A	B	C	D	allowed E
Cumulative %	10.2	29.5	60.6	89.0	98.8	99.5

Overall (429,514 candidates)

	A*	A	B	C	D	E	F	G
Cumulative %	3.8	11.1	22.8	51.4	72.1	85.4	93.7	97.6

Science: Single Award (Modular) (3469)

Foundation tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
3469/F	90	175	66.9	22.9
3469/M	150	105	44.8	13.4
3463/9/C	30	70	38.5	11.0
Foundation tier overall 3469	-	350	150.3	40.0

		Max. mark	C	D	E	F	G
3469/F boundary mark	raw	90	54	45	36	27	18
	scaled	175	105	87	70	52	35
3469/M boundary marks	raw	150	87	74	61	48	35
	scaled	105	61	52	43	34	25
3463/9/C boundary marks	raw	30	19	16	13	10	7
	scaled	70	44	37	30	23	16
Foundation tier scaled boundary mark		350	195	166	137	109	81

Higher Tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
3469/H	90	175	69.0	24.3
3469/M	150	105	69.9	9.3
3463/9/C	30	70	50.2	8.6
Higher tier overall 3469	-	350	189.1	35.3

		Max. mark	A*	A	B	C	D	allowed E
3469/H boundary mark	raw	90	64	53	42	31	22	-
	scaled	175	124	103	82	60	43	-
3469/M boundary marks	raw	150	126	113	100	87	74	-
	scaled	105	88	78	70	61	52	-
3463/9/C boundary marks	raw	30	27	24	21	19	16	-
	scaled	70	63	56	49	44	37	-
Higher tier scaled boundary mark		350	255	226	196	166	132	115

Provisional statistics for the award

Foundation tier (27,318 candidates)

	C	D	E	F	G
Cumulative %	13.7	32.4	56.2	78.4	91.0

Higher tier (3,184 candidates)

	A*	A	B	C	D	allowed E
Cumulative %	4.1	14.7	40.4	73.2	94.0	97.0

Overall (30,502 candidates)

	A*	A	B	C	D	E	F	G
Cumulative %	0.4	1.5	4.2	19.9	38.9	60.4	80.3	91.7

Definitions

Boundary Mark: the minimum (scaled) mark required by a candidate to qualify for a given grade. Although component grade boundaries are provided, these are advisory. Candidates' final grades depend only on their total marks for the subject.

Mean Mark: is the sum of all candidates' marks divided by the number of candidates. In order to compare mean marks for different components, the mean mark (scaled) should be expressed as a percentage of the maximum mark (scaled).

Standard Deviation: a measure of the spread of candidates' marks. In most components, approximately two-thirds of all candidates lie in a range of plus or minus one standard deviation from the mean, and approximately 95% of all candidates lie in a range of plus or minus two standard deviations from the mean. In order to compare the standard deviations for different components, the standard deviation (scaled) should be expressed as a percentage of the maximum mark (scaled).