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Examiners' Report November 2007

GCSE 360Science

GCSE

GCSE Additional Science (2103)

GCSE Biology (2105)
GCSE Chemistry (2107)
GCSE Physics (2109)

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November 2007

Publications Code UG019662

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Additional Science 5015
Biology 5027

Overall this paper was well accessed by both foundation and higher tier candidates. Areas which were particularly well understood were recycling including graph interpretation at foundation tier, and fermenters, conservation and the carbon cycle at higher tier. Areas for concern are photosynthesis, DNA structure and protein formation, interpretation of experimental data and cloning. The application of how science works was fair, especially relating to data interpretation, although more information is needed by candidates of the ethics and social problems related to new scientific ideas.

Foundation candidates struggled with the understanding of photosynthesis. Although 70% of candidates were aware that plants get energy from sunlight, only 52% were able to identify that this mainly occurred in the leaves, and only 55% were able to state that the other two reactants required for photosynthesis are carbon dioxide and water.

The structure of DNA was poorly understood, with only 59% of candidates able to identify the structure as a double helix, and only 49% able to correctly identify the linked bases pairs as cytosine and guanine. In addition to this, less than 60% of candidates were able to identify that proteins are made from amino acids.

In comparing the mass of pupils in a class, 62% of candidates believed that the best way would be to compare their dry mass, without considering that these are living organisms and therefore wet mass would be a better comparison.

Candidates appear to be well informed on conservation issues, with 87% of candidates able to identify that only petrol cannot be recycled.

Experimental data proves a problem for all candidates, with only 15% of foundation candidates and 26% of higher tier candidates able to identify the control in an experiment, although 69% of higher tier candidates were able to identify an anomaly in the experiment.

The carbon cycle was well understood by candidates especially in relation to the possibility of global warming, although only 57% of candidates could identify methane as a greenhouse gas.

Active transport is a problem, with 54% of candidates believing active transport is caused by photosynthesis and 38% of candidates believing osmosis is method of uptake of minerals.

The majority of candidates recognised the use of stem cells in being able to develop into any tissue type. However, the creation of a cloned embryo to obtain stem cells was less well understood, with only 37% of candidates able to identify that an electric shock is given after the nucleus is inserted into the enucleated egg cell. The difference between haploid and diploid cells is an area where further study is needed by candidates.

Finally on a positive note candidates are starting to understand the ethical objections to stem cell research, although more work is needed in this area.

Additional Science 5017
Chemistry 5037

Foundation tier

Several questions in the first section on elements and compounds were poorly answered. 43% of candidates thought that covalent bonds contain ions and 33% that atoms of chlorine contain molecules. Only 30% knew that going from Na to Na^+ involves the loss of an electron. Only 27% of candidates could calculate the relative formula mass of water with 50% giving the answer as 17. Correct identification of a simple molecular, covalent compound also proved difficult, with only 27% knowing that it was the one with a low melting and boiling point. Only 16% could identify buckminsterfullerene as an element.

Answers in the second section were generally better, but 33% of candidates believed that all polymers are difficult to dispose of, and 38% thought that plastic bag disposal is a problem because they are biodegradable.

In question 16, 40% of candidates believed that the mass of a catalyst decreases during the reaction. 78% of candidates knew that thermoplastics are softened by heating, but 39% believed that they have cross links between chains. In question 18 only 42% knew the function of plasticisers. Knowledge of cracking was very weak, with almost random choice of answers in question 19. Only 43% knew what an alloy is. In question 22, while 87% knew that diamond is very hard, 31% thought that graphite has a low melting point. The balanced equation proved to be very difficult with only 10% choosing the correct answer. 51% chose option A involving lithium oxide as a product.

Higher tier

As would be expected, higher tier candidates generally performed better than foundation tier candidates on questions 17 to 24, but answers to questions 17, 18, 19 and 23 showed similar problems to those on the foundation tier. The balanced chemical equation in question 25 proved difficult for many candidates, with only 22% choosing the correct answer. 46% chose option B, involving $NaCl_2$ as a product. In question 31, 92% knew that ethene is a hydrocarbon but, despite being given the structural formula, 26% thought that it is saturated. Understanding of dot and cross diagrams was poor, with options A and B being almost as popular as the correct answer. Only 11% chose the correct answer for question 33, with 41% believing that neither statement was correct. This shows a very poor understanding of atom economy since with only one product this must be 100%. Only 31% could identify the correct answer for question 39, with 43% believing that an increase in temperature would increase the yield.

Additional Science 5019
Physics 5047

Foundation tier
Overall the questions were well answered showing that candidates had been well prepared for the examination.

Over 50% of candidates opted for the correct response in 8 of the first 14 questions, and in 6 of these questions over 60% of candidates opted for the correct response.

Candidates seemed secure on some aspects of radiation and its uses, but less than half of candidates knew that gamma radiation is produced when an unstable nucleus breaks down, and that gamma radiation is used to sterilise some hospital equipment.

Most candidates showed good understanding of work done and acceleration, but less than half could identify where a rollercoaster car had maximum gravitational potential energy.

Nuclear power stations were generally well understood by most candidates, but a significant number were unsure of the environmental implications of nuclear power stations.

The common questions were answered well by both sets of candidates, and they all worked well in discriminating between foundation and higher tier candidates. Over 50% of foundation tier candidates chose the correct response in 3 out of the 8 common questions. Over 50% of higher tier candidates chose the correct response in all 8 common questions, with over 65% correct in 6 out of the 8 questions.

Higher tier
Overall performance of candidates in the higher tier paper showed a good understanding of most aspects of the specification.

Candidates were well prepared for questions on speed, velocity and resultant forces, but many candidates failed to use the graph to solve the momentum question.

Questions on background radiation, dangers of radioactivity and half-life were well answered, with an average of 80% choosing the correct responses.

A significant number of candidates used the wrong gain in height in the potential energy question.

Nuclear reactions were generally well understood by most candidates, but a large number were unable to identify the fission products of a U-235 nucleus.

Additional Science 5016F
Biology 5028F

This was the first examination paper of the new specification. The paper consisted of seven questions with questions 6 and 7 in common with the higher tier paper.

Candidates found the questions accessible. Most questions were attempted, with questions 6 and 7 causing problems for some of the less able candidates. It was pleasing to see that candidates answered the earlier questions well where some good understanding of science was seen. Aspects of science new to the specification were examined with mixed response. Some candidates clearly knew the salient details whereas others lacked the key words and science to match the marking points.

1 Coconut palms

This question required candidates to apply their knowledge of plants to uses of parts of plants and photosynthesis.

Candidates found part a) accessible and answered it well. A few candidates chose 'money' for a use of 'trunks'.

Part b) was also well understood. The majority of candidates showed a good understanding of how the leaf arrangement aided plant growth, with many going on to correctly link the arrangement to increased rates of photosynthesis.

2 Photosynthesis

Candidates were required to recall the role of substances related to photosynthesis.

The average mark for this question was 2.4 out of a possible four, with a common error being to link glucose to 'the type of energy used by plants'.

3 Sea lions

This question required candidates to relate structure to function in sea lions.

Most candidates achieved at least two marks on this question. It was pleasing to see many excellent answers linking structure to function. Some candidates, however, tended to restate 'catch' in part a) rather than the idea of being able to hold on to the fish, and narrowly missed the mark in part b) by failing to refer to underwater.

4 Nutrition

This question asked candidates to suggest how and why advice regarding diet had changed. This was a new topic for many candidates.

A good variety of correct responses was seen here, with many good answers correctly referring to 'five a day' and cholesterol leading to heart disease. Less able candidates accessed marks by stating how advice had changed, with more able candidates extending the responses to explain why the advice had changed.

5 Wheat plants

Selective breeding in wheat plants was the context for this question.

Candidates found this question difficult. Although some very good answers were seen, many answers lacked the detail required to give credit.

6 Fertiliser and environment

This cross-over question was about using too much fertiliser and the effects this would have on the environment.

In part a) candidates were asked to describe the effect the fertiliser has on tiny organisms called algae in rivers and to suggest why this effect causes some plants in rivers to die. Many candidates wrongly suggested that the fertiliser was toxic to both algae and plants, with simple 'it will kill it' type responses being relatively common. A significant number of answers caused concern about the scientific understanding of candidates, with dead plants becoming heavier when they absorb oxygen, and dirty oxygen being produced by dead plants which again was heavy.

Foundation tier candidates found this question very difficult, with few scoring any marks. However, where candidates did score marks, they showed an excellent understanding of eutrophication.

7 Skin cancer

This question asked candidates to describe the changes in the pattern shown in the number of cases of skin cancer from 1975 to 2001, as shown on a graph.

Candidates tended to gain one mark in part a) by either stating the overall increase or that there were years when the number of cancer cases increased and others that showed a decrease. Most candidates also misinterpreted the question, and went on to say that males had less cases of cancer than females where they were being asked to comment on the changes in the pattern shown in the graph.

Part b) was relatively low scoring for the majority of foundation tier candidates with some scoring on the living organism mark but few developing their response to explain that it was the way the animals had changed, or their presence/absence that told you something about the environment.

Additional Science 5016H
Biology 5028H

This was the first examination paper of the new specification. The paper consisted of six questions with questions 1 and 2 in common with the foundation tier paper.

The questions were accessible to the candidates and very few unanswered questions were seen. Content that is new to the specification did seem to cause some candidates difficulty, but there were also examples of content carried forward from the previous specifications that are still not clearly understood.

1 Fertiliser and environment

This question was about using too much fertiliser and the effects on the environment.

In part a) candidates were asked to describe the effect the fertiliser has on tiny organisms called algae in rivers and to suggest why this effect causes some plants in rivers to die. There were many correct responses relating to plants not getting enough light. The most common incorrect answer related to plants not getting enough oxygen, with many candidates still making the mistake of implying that oxygen is needed for photosynthesis.

In part b) many candidates gained full marks for stating that 'bacteria break down algae and use up oxygen'. However, fewer higher ability candidates used 'decomposed' or 'decomposers' in place of bacteria but overall, candidates generally had the right idea. Candidates gaining one mark achieved this most frequently by mentioning that bacteria were involved, although some candidates mentioned that 'algae decay' or 'break down'

2 Skin cancer

Question 2 asked candidates to describe the changes in the pattern shown in the number of cases of skin cancer from 1975 to 2001, as shown on a graph.

In part a) many candidates seemed unsure as to what the question was asking and often just referred to the fact that females were more likely to get skin cancer than males and went on to explain why this was the case. Most candidates could correctly identify the rise in cases and many identified that it both rose and fell. There was a tendency to describe the increase by stating the number of cases per 100 000 (male and female) in 1975 and in 2001, reading straight from the axes of the graph rather than attempting any calculation.

Part b) was a good discriminator question that distinguished higher ability candidates from lower ability. It was generally very poorly answered with very few full marks awarded. The most common response gaining just one mark was the suggestion of a 'living thing', although it seemed that candidates had a real problem defining this term without repeating the stem. Only a few full marks were awarded, for responses which very clearly stated (using the example of lichens more often than not) that indicators were living and how these living things were affected by changes in the environment.

3 Hayflick

Question 3 asked candidates about the Hayflick limit and how this applies to stem cells and cancer cells.

Most candidates were able to explain that a normal human cell stops dividing when it reaches the Hayflick limit, but many then lost the mark by saying that the cell died.

In part b) the most frequent response for one mark was 'continue dividing' or similar and for the second mark 'spreading around the body'. Most candidates gained full marks for this question, clearly recognising that cancer cells fail to have a Hayflick limit, and the consequences of this. In general, candidates demonstrated a very good understanding of the way cancer progressed.

It was pleasing to see that a large number of candidates were clear about the embryo being destroyed and/or the rights of embryos in part c). Some candidates seem to believe that an embryo *is* a baby and that *babies* were being aborted to provide the stem cells, or that babies would be harmed.

4 Light intensity

This question was about the effect of increasing light intensity on the rate of photosynthesis.

Part a) asked candidates to describe the effect of increasing light intensity on the rate of photosynthesis, using information from the graph. There were some very clear answers, with many candidates gaining full marks for recognising an increase in the rate of photosynthesis, and then for stating the correct points from the graph where the rate levels. A large number of candidates gave 70 as the point at which the graph levels off, suggesting that attention needs to be paid to accurate reading from graphs. A pleasingly high number of candidates were aware of other limiting factors that caused the increase to level off.

Part b) asked candidates to name one limiting factor and describe how its effect could be reduced. The majority of candidates gained one mark for this, with the most common answers for the limiting factor being temperature or carbon dioxide. In both cases, however, candidates failed to explain clearly **how** this factor could be reduced and gave very vague descriptions such as 'add more carbon dioxide' or 'increase/decrease the temperature', both of which were insufficient to gain one further mark.

Where candidates did gain two marks it was generally for mentioning carbon dioxide as a limiting factor with 'put animals in with the plants' or 'use a paraffin heater' to complete their answer for full marks. Other candidates were given two marks for mentioning 'water' as a limiting factor, with 'add more water' and less frequently 'add a (timed) sprinkler system' as descriptions of how the factor could be reduced. Candidates stating 'temperature' as a limiting factor generally continued to discuss the effect of temperature on enzyme activity rather than state how this factor could be controlled.

The most common incorrect response for this part of the question was candidates stating 'oxygen' as a limiting factor and also 'space/room'. Again, the nature of the responses indicates that this question was a good discriminator between lower and higher ability candidates.

5 Penicillin

This question was about making penicillin by growing the fungus *Penicillium* in a fermenter.

Part a) was about the conditions in the fermenter. Many candidates seem to think that thermometers and other recording devices actually control the temperature rather than just record the changes. Many did not make it clear where the cooling water was going, implying that the cold water was going into the fermenter contents rather than the cold water jacket.

Although there were many references to bacteria, to the pH being neutral, or confusion with temperature, many good responses were seen. An example of a good response would be: 'Because pH6.5 is the optimum pH for *penicillium* to grow at maximum efficiency'.

In part b) many candidates confused aseptic with 'perfect' conditions, whereas credit was given for references to prevention of contamination, stopping the entry of microorganisms There were few references to food sterilisation, filtering of the air, and keeping the fermenter sealed.

6 Cramp

Question 6 asked candidates to explain why the body needs extra oxygen to recover from cramp.

This question proved to be very discriminating, with most candidates able to pick up some marks, but only the more able ones getting full marks. Many candidates were awarded at least three marks with the most common answers referring to 'lactic acid build-up during anaerobic respiration' and the mention of an 'oxygen debt'.

The marking point least awarded was 'oxygen breaking down lactic acid' which failed to gain a fair number of candidates the full marks. Quite a few responses included 'oxygen dept' as opposed to 'oxygen debt'. Other common errors included: 'oxygen dilates the lactic acid', 'breathing anaerobically (without oxygen)', 'using oxygen and lactic acid to make energy', 'oxygen converts lactic acid back into glucose', 'the muscles start to breathe anaerobically'.

Additional Science 5018F
Chemistry 5038F

1 Plastics

In parts a) and b) most candidates knew that a reaction releasing heat was exothermic, with 'endothermic' and 'chemical reaction' being common incorrect answers. It was well known that a catalyst increased the rate of a reaction. The problems with the disposal methods of polymers were well known (or deduced), with almost all candidates obeying the rubric. In part d) very few got four bonds. A common answer was two, perhaps applying to the double bond only, although three was not a common error. Some candidates were unclear in indicating the evidence from the diagram for ethane being an alkene: it would have been acceptable and helpful to ring the double bond.

2 Elements and electricity

Almost all candidates could link the experimental evidence to the conclusion.

3 Carbon

In part a) most candidates could deduce that diamond's bonds were strong. It was pleasing in part b) that many described the layers sliding over each other when graphite is used in a pencil. Others seemed to understand the point but did not express themselves clearly ('it slides'). Very few mentioned about the weak forces between the layers, and quite a few wrote that the layer slid onto the paper. A significant number said that it was soft or smooth, and a few said it was hard. The question referred to the structure so answers such as 'graphite is soft so does not tear the paper' were rejected. In part c) the clue of 'long chains' was not picked up by many candidates. The fame of scientists making a discovery was the favourite advantage, as was riches. Also credited was the idea that uses could be found for the discovery. A lot talked about the structure of the molecule, referring to strong bonds, and a lot talked about its properties: being strong, having a high melting point, etc. These ideas were not credited.

4 Ludwig

The equation was well done, although for some reason a complete reversal of reactants and products was seen. As a word equation was wanted, it was risky giving a symbol equation, although pleasing to see fully correct balanced equations, which scored full marks. An incorrect symbol equation scores zero. Part b) was well understood. In part ii) an interpretation of the diagram was problematic, with many thinking that the circles were hydrochloric acid molecules or zinc particles. In part iii) shaking and stirring do not receive credit.

5 Ammonia

The equation was poorly done, with many having no idea where to put state symbols, even though they were told that all substances were gaseous. The idea of an equilibrium was very poorly done, with many giving no answer. Only a few said that both forward and backward reactions were taking place, and even less said that the rates were equal. Some mentioned balance but often were talking about the equation. Many said the reaction was reversible, without the idea that both reactions occur simultaneously. Many thought that the reaction stopped when equilibrium was reached.

In part c) many candidates got the correct answer for an advantage, where ‘faster growth’ was the most common answer, with ‘improved yield’ also common. A lot said that ‘it prevents animals/insects eating the crops’, presumably confusing a fertiliser and a pesticide. The disadvantage was poorly done. Common incorrect answers were: ‘not organic’, ‘poisons the crop’, ‘not healthy’, ‘the food will contain chemicals’, ‘food doesn't taste good’. The idea that organic food (only) was good for you is rejected.

In part d) a very large number repeated information in the question, ie 'it is a simple molecular covalent substance' or ‘there are strong covalent bonds between the atoms'. Some better candidates got the idea of weak forces, but very few mentioned the energy required to separate the molecules. Some said that nitrogen and hydrogen were gases and hence ammonia was. Quite a number just said it was a gas, a few said it was a liquid, some a solid.

Additional Science 5018H
Chemistry 5038H

This was the first examination paper of the new specification. The paper consisted of four questions with question 1 in common with the foundation tier paper. Questions 1 and 2 were targeted at the C/D level; the remaining two questions were targeted at the A/B level.

Overall it was disappointing to see the number of candidates who were not prepared for carrying out calculations at this level. Some candidates actually wrote on their papers that they didn't have a calculator with them at the time of the examination. The questions on this paper will always be covering the specification items set in a context. Candidates will therefore need preparation in how to apply principles to novel situations as in question 4 on this paper in particular.

1 Ammonia

For part a) many unattempted responses were seen with probably an equal number of correct responses, which was surprising for the higher tier paper. Many candidates appeared confused as to what had to be inserted in the spaces for the state symbols, with many writing atomic symbols such as N or H, and many used these spaces for the balancing numbers. A common misconception was to insert 'aq' for the state symbol for ammonia, despite the question stating 'gaseous ammonia'. It would be unfair to create spaces before the chemical formulae for the balancing as in this case a space would have had to be inserted before the N_2, which would have caused confusion for many candidates. Where candidates are required to balance and/or insert state symbols, this is the format that will be adopted.

In part b) only very able candidates managed the idea that opposing reactions occurred at the same rate or that the amounts of products and reactants remained constant. Too many answers simply said 'it is reversible' or that at equilibrium the reaction started to reverse, giving the impression of an oscillating reaction. Another common misconception was to indicate that the amounts of reactants and products were equal. There was a frequent failure to recognise that the two reactions were occurring simultaneously. In general, the question was poorly answered.

Most answers for part c) were 'grows faster' as an advantage, but too many candidates thought that the prime advantage was that artificial fertilisers were 'cheaper'. The idea of run-off and subsequent water pollution was well understood and 'eutrophication' was often seen. However there were too many vague and unscientific uses of phrases such as 'damages the environment', 'natural', 'not natural' and 'organic' which gained no credit. Equally credit was not given to those who focused their answers on a comparison between organically grown and artificially fertilised crops. A small minority of candidates confused fertilisers with pesticides; another small minority confused fertilisers with fertility.

More able candidates had a sound concept of molecules and weak intermolecular forces in part d). In many cases it was clear that there was confusion between molecules, atoms, covalent bonds and intermolecular forces, with candidates writing about intermolecular forces between atoms or covalent forces between molecules being easy to break. Less able candidates thought that the molecules themselves had to be broken into atoms for the ammonia to melt.

2 Carbon

In part a) a variety of combinations of numbers were seen for the subatomic particles of the carbon given in the question. However, many candidates gave the correct combination. Part a)ii) was generally well answered, although some candidates referred to carbon-14. Weaker answers included different numbers of protons or electrons or different atomic numbers.

There were a variety of good answers in part b)i), with most candidates giving the use for electrical wires, though some answers were very broad, e.g. for building, in cars and aircraft. Recent press reports about the use of Kevlar incorporating carbon nanotubes being used for body armour had been read by several candidates, and this use also gained credit. In part b)ii) it was pleasing to see the number of candidates who knew about delocalised electrons and their link to current flow. One main misconception was that electrons/current would flow easily through the gap in the centre of the tube. Too many answers missed that electrons had to move for electricity to flow, and frequently candidates thought that the nanotubes acted like a pipe for electricity. Several candidates confused movement of ions with electrons, while others thought carbon was a metal or that graphite really was lead (Pb).

3 Propene

Many candidates correctly defined thermoplastic in part a) in terms of reshaping/ remoulding/melting by heat. Common incorrect answers confused thermoplastics with thermosetting polymers, or talked about the formation or structure of the polymer/cross-links. Some simply thought that they were polymers, which conduct heat or were formed by heat.

Only a few candidates were able to draw a correct diagram in part b) understanding that, when a monomer becomes a polymer, the double bonds no longer exist. Most answers showed structures with C=C bonds, or two units of poly(ethene); some candidates showed structure involving hydrogen atoms with two covalent bonds. Another common incorrect answer was simply a long chain of CH_2 groups. A few gained credit by drawing a repeating unit for poly(propene) in brackets (x2). Generally a lack of understanding of polymer structures was evident.

It was very surprising to see so many candidates sitting the higher tier paper who were unable to calculate the formula mass of propene in part c). A minority calculated the formula mass of propanol but other common incorrect answers of 13, 43 or 44 could not be explained. Many of the candidates who were able to correctly calculate the formula mass of propene went on to correctly calculate the atom economy as 70%. Interestingly a significant minority, who were unable to calculate the formula mass correctly, were then able to gain both marks in part 2 when their error was carried forward. In addition, many used 18 for the mass of required product, clearly not understanding what was happening in the equation for the reaction.

The idea of less waste and a more efficient reaction were well known in part c)iii). However, a frequent misconception was that high atom economy was linked to a faster rate of reaction or 'more reactive'. It was disappointing to see only a few candidates giving the answer of 'sustainable development'.

4 Titanium

Most candidates could identify the electrode as the cathode or negative electrode in part a)i), but many incorrect answers involved candidates naming parts of the stem such as 'molten calcium chloride' or 'Ti^{4+}'. More worrying were the contradictory responses of the 'negative anode' variety, which were too frequently seen.

In part a)ii) there were a significant number of well-expressed responses showing good knowledge of ionic bonds being broken leaving ions free to be drawn to the electrodes, with Ti^{4+} ions being discharged to form Ti atoms or expressed similarly. However, many candidates described the movement of 'atoms' and 'molecules' to the electrodes in the molten state. Others equally incorrectly interpreted the question as referring to the kinetic theory stating it would work more quickly at higher temperatures. The lowest level of uncreditworthy response was 'so it will work' or 'so the titanium can be removed'.

Part a)iii) was very poorly answered except by the most able. There were more nil responses than fully correct answers. Common errors were to give the reverse equation, mentioning $4e^-$ on the wrong side of the equation, or involved TiO_2 or e^{4-}. However, several candidates gained credit for $Ti^{4+} \rightarrow Ti$. Most candidates either did not have an understanding of ionic equations (at the electrodes in electrolysis) or even that they needed balancing. Despite the fact that calcium chloride was given as the solvent in the stem of the question, too many candidates attempted to include it in the equation.

In part b) a reasonable number of candidates were able to correctly calculate the empirical formula of titanium carbide as TiC. Many candidates missed the need to subtract the 1g of carbon to get 4g of titanium or multiplied the masses by the A_r values or divided the A_r values by the mass. Others were able to gain some credit for their working despite ending with an incorrect formula such as using 5g of Ti to obtain Ti_5C_4. However, a sizeable number of candidates seemed to have no idea what is meant by the term empirical formula judging by the answers they produced.

For part b)ii) the most able candidates picked up that TiC had an ionic structure. The common answer was that there were strong bonds but did not specify what they were between. There were too many references to intermolecular forces. This question again highlighted the misconception many candidates have about the term inter-molecular forces/bonds. The second marking point was less commonly awarded. Many referred to bonding between 'molecules', rather than ions or atoms. Commonly, comparison with the structure of NaCl was mentioned. Candidates often incorrectly made reference to the uses and or properties.

Hints for revision:

- Read the question twice before you attempt it and once after you have finished to check you have answered it.
- Practise accurate expression, especially in the use of the terms ion, atom and molecule
- Practise calculations of empirical formulae, atom economy
- Practise balancing equations and writing chemical equations
- Practise drawing structures of alkanes, alkenes and polymers
- Be familiar with the idea of ionic equations and practise writing and balancing ionic equations

Additional Science 5020F
Physics 5048F

There was no real evidence of candidates being short of time in this 30 minute examination and so advice might well be towards encouraging candidates to read questions carefully and to check answers thoroughly in the light of some of the comments which follow. As with previous specifications there is still evidence of lack of the use/availability of calculators resulting in candidates losing valuable marks.

1 Charge

Part a) was generally well answered although not a straightforward start for some candidates. Some gave the answer of 'not attract' rather than the positive response 'repel' and for this they gained no marks.

In part b) a considerable proportion of the candidates gained the mark for 'electrons', although answers in part ii) were not always consistent with this.

2 Velocity

Part a)i) showed that many candidates did not appreciate that the gradient of the graph represents acceleration. There were few answers with 'A' marked in the centre of the steady, highest gradient range with most of those gaining credit marking 'A' near the limits of acceptance. In part a)ii) a larger proportion answered correctly, although some marked the end of the race and others marked 'S' before the end of the race.

In part b) an unexpectedly large number of candidates failed to see the link of using the graph to read off velocity at 3.5 s.

In part c) an appreciable number of candidates gained just one mark for the answer of 54 m/s, showing a lack of understanding about when the race finished. A noticeable number took the value for maximum velocity to be the distance travelled, even though they had been given the value of 270 m to use, and hence gained no marks. Others, using a time other than 4.5 or 5.0 s, also gained no marks.

Looking at the incorrect approaches to this question as a whole it seems likely that an appreciable number of candidates assumed that they had been given a distance/time rather than velocity/time graph.

3 Radioactivity

Most candidates gained at least one mark in part a) for showing that they understand penetrating powers of radioactive the radiations, with many gaining both marks.

In parts b)i) and ii), in contrast to part a), responses were mixed as to which radiation to use.

Very few candidates gave the answer that part b)iii) was originally designed for, namely 'that they thought the food might become radioactive'. Most candidates scored because of general statements about the dangers of radiation which were accepted. Those failing to

gain marks often focussed on the bacteria, the nutritional value of the strawberries or effects of radiation on the strawberries, eg suggested mutation of strawberry cells.

Many candidates scored well in part c)i), the most correct answer concerning cancer. Some candidates gave vague answers about killing people for which they did not gain the mark.

In part c)ii) correct answers quoting protective clothes and gloves were common. Credit was given for answers related to sensible precautions which they would have seen a teacher taking when handling sources, or for suitable comments about the storage of the radioactive source when not in use. Answers quoting facemasks were usually less convincing. Answers that were not practical, although candidates clearly had the correct idea, included the wearing of lead suits.

4 Gravitational potential energy

In this question a significant number of candidates squared the 10 in 10 m/s^2, presumably because of the s^2 in the unit, thus giving answers of 750 or 3000. 75 was the most common scoring answer, ie the idea of '4' boxes had been missed. Also, incorrect number work was evident throughout the question, presumably because some candidates did not have calculators. This was particularly noticeable in part c) where 2400/48 often did not give 50. In general, scores in part c) were good. In part b) very few made the link between the work done and gravitational potential energy gained - it was common for the answer to be that of a) divided by 10. Some took the value of the GPE from part a) as the force and multiplied by a distance.

5 Nuclear radiation

A good proportion of correct answers were gained from part a)i). Some gained just one mark since they gave the working, but an incorrect answer. Others failed to score at all because they added all the percentages given getting 100%, and then concluded that there were no non-natural sources.

Part a)ii) was very poorly understood, with a very limited number giving the idea of tracers or quoting gamma camera. A majority mistakenly gave X-rays as an example of radioisotopes. Candidates often failed to focus on 'diagnosis**'.**

In part a)iii) cancer treatment (or suitable description) was usually known, but some candidates lost the mark by adding chemotherapy. X-rays was also a common incorrect response.

Part b) differentiated well. The 1 in 40 million given was often described as a big number, but then this was followed by the conclusion expected for the question. Very few interpreted the figure totally incorrectly, saying that it was a massive risk of death. It was not unusual for the figures for the nuclear industry and heart disease or lightning to be compared which was encouraging. Some candidates missed the point by not relating their answers to the statistics. Some numerical work was expected in the answer in order to gain full marks.

Additional Science 5020H
Physics 5048H

It was evident that candidates were weaker on questions that required explanation and application of theoretical physics. The levels of scientific literacy and mathematical literacy were poor and caused many candidates to lose easy marks.

The lack of a calculator was a problem for many candidates. There were some candidates who failed to write legibly, or in dark blue/black pen, or in the correct spaces.

Centres should consider the advisability of entering C or D grade candidates for a paper where less than 50% of the available marks are targeted at these grades as it gives such candidates little opportunity to demonstrate their abilities in physics.

1 Nuclear radiation

Part a)i) of this question was well answered with most candidates gaining both marks. In part a)ii) few candidates knew about 'tracers'; many wanted to use 'X-rays'. Far too many candidates thought that chemotherapy (in all its various spellings) was a medical use of radioactive isotopes.

Part b) was well answered by candidates of all levels. A few, however, failed to gain all the marks available because they omitted any numerical quotation. Less able candidates sometimes confused the size of the denominator with the overall risk.

2 Forces

While part a) was almost universally correct, a significant proportion of the less able candidates were confused as to which force stays constant as the parachutist falls.

Part c) was a question where precise use of scientific language was important, especially in part i): answers such as 'they are equal' or 'they are balanced' did not gain credit. In similar vein, contradictory answers in c)ii) such as 'terminal velocity is less and she reaches it slower' also failed to gain credit. The explanation was only attempted by the most able candidates. In general, C grade candidates gained either the mark for c)i) or one of the marks for c)ii).

3 Momentum

Surprisingly, most candidates failed to gain credit for part a); they either omitted to read the stem of the question or failed to understand its significance. Many wanted to use 'F = m x a' and used 15 m/s as the acceleration. It was evident that they saw no contradiction in this as candidates often went on to correctly calculate the momentum in part b).

Similarly, candidates seemed confused as to the distinction in parts c) and d)i) as here too the answers were often identical. This may be due to poor literacy skills, and many candidates would be well advised to re-read their answers carefully to ensure that they make sense and answer what has been asked.

In part c) momentum was infrequently seen, with many candidates mentioning that the crate was being pushed forward. Resistive forces were even less frequently mentioned.

In part d)i) answers were incomplete, as many candidates did not make the link between the change of velocity and movement of the crate. Candidates did, however, gain the mark for sensible application of physics in part d)ii).

4 London Eye

Only the more able candidates gained the mark for part a), and only the most able candidates gained the mark for part b). These straightforward application questions were intended to focus the candidates on centripetal forces. It is not surprising therefore that fewer than 5% gained any of the marks for part c). Better answers mentioned reaction forces.

In parts d) and e) it was expected that candidates would be able to gain the mark for substitution into the equations. However this proved not to be the case. In part d) the factors of 16 or 1000 were omitted, sometimes 16 was used twice (16 × 12500 and 16 × 750). In part e) the most common error was to use 30 s instead of 180 s. Candidates did gain credit for carrying errors forward in both parts as long as the working was shown. The combination unit Nm was accepted instead of J but not N/m, m/N or other variants.

360Science - November 2007

Raw Mark Grade Boundaries for GCSE Additional Science Unit Tests

5015/5027	Max mark	A*	A	B	C	D	E	F	G
H	24	21	18	16	14	11	9		
F	24				16	13	10	8	6

5016/5028	Max mark	A*	A	B	C	D	E	F	G
H	30	19	16	13	10	7	5		
F	30				16	13	10	8	6

5017/5037	Max mark	A*	A	B	C	D	E	F	G
H	24	18	15	12	10	7	5		
F	24				14	11	9	7	5

5018/5038	Max mark	A*	A	B	C	D	E	F	G
H	30	17	13	9	6	4	3		
F	30				16	13	10	8	6

5019/5047	Max mark	A*	A	B	C	D	E	F	G
H	24	20	17	14	12	10	9		
F	24				16	13	10	8	6

5020/5048	Max mark	A*	A	B	C	D	E	F	G
H	30	19	17	15	13	11	10		
F	30				20	16	12	9	6

Uniform Mark Grade Boundaries - All Units

	Max UMS	A*	A	B	C	D	E	F	G
H	40	36	32	28	24	20	18		
F	27				24	20	16	12	8

Note: On higher tier papers, the "allowed" grade E is calculated as half a grade width

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