



GENERAL CERTIFICATE OF SECONDARY EDUCATION
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EXAMINERS' REPORTS

GCSE SCIENCE/ADDITIONAL SCIENCE BIOLOGY/CHEMISTRY/PHYSICS

JANUARY 2008

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Statistical Information

GCSE

The Examiners' Report may refer in general terms to statistical outcomes. Statistical information on candidates' performances in all examination components (whether internally or externally assessed) is provided when results are issued. As well as the marks achieved by individual candidates, the following information can be obtained from these printouts:

For each component: the maximum mark, aggregation factor, mean mark and standard deviation of marks obtained by *all* candidates entered for the examination.

For the subject or option: the total entry and the lowest mark needed for the award of each grade.

Annual Statistical Report

Other information on a centre basis is provided when results are issued. The annual *Statistical Report* (issued in the second half of the Autumn Term) gives overall outcomes of all examinations administered by WJEC.

BIOLOGY 1

Foundation Tier

General Certificate of Secondary Education

January 2008

Chief Examiner: Morton Jenkins

Principal Examiner: A. Gravell
Mrs. K. Coupland

There was an indication that candidates from some centres may not have been able to perform to their full potential on this paper and it may have been more appropriate for them to have been entered for the Higher Tier paper.

- Q.1** (a) (i)-(iii) Most candidates performed well on this question with very few Candidates gaining less than 2 out of 3 marks.
- (b) Some candidates found difficulty with this question. Common errors included stating that the leaves grew larger to get more light as opposed to stating that the difference in light intensity in different regions of the tree resulted in a range of leaf sizes. Mistakes were also made when candidates failed to realise that the leaves were genetically identical as they were from the same tree.
- Q.2** Most candidates scored well on this question. If they experienced difficulty it was with the first two choices. It was obvious that a few candidates did not understand the concept of fossil formation.
- Q.3** (a) (i) Most candidates gained both marks. Those that didn't failed to describe the adaptations fully, i.e. **big** back feet and **thick** fur.
- (ii) Most candidates came up with the idea of camouflage but a surprisingly high number of candidates failed to read the question carefully enough and gave the summer adaptations of the snowshoe hare.
- (b) (i) The more able candidates gained this mark because they realised that water supplies are limited in hot deserts.
- (ii) Very few candidates stated that the spines protected the cactus from being eaten by animals. Protection from being eaten by predators was a frequent incorrect answer as was protection from being eaten by prey.

Q.4 This topic had been very well covered by some centres with many candidates gaining 5 marks or higher.

- (a) The labelling of the skin presented difficulty for some candidates; the main difficulty being the inability to distinguish between the sweat pore, duct and gland.
- (b) Generally well answered.
- (c) This question presented difficulty for the weaker candidates. The role played by the blood capillaries and sweat glands in conserving heat in cold conditions was poorly understood.

Q.5 On the whole this question presented difficulty for most candidates. It contained difficult concepts for foundation candidates but nevertheless is one that needs to be addressed.

- (a)-(c) Only the better candidates could supply the answers required for these questions.
- (d) Poorly answered - environmental factors that cause gene mutations were not known.
- (e) More than 50% of the candidates opted for the correct answer.

Q.6 Of the lower demand questions this was considered to be the most difficult but was well answered in many cases.

- (a) Many candidates produced a clear and accurate line graph gaining the full 3 marks. Chief Examiners have, over the last 5 - 6 years, clearly made the point that graphs should be drawn in pencil. This led to a reduction in the number of graphs being plotted and drawn in Biro. Unfortunately this trend seems to have reversed during this exam series. When drawn in Biro any attempt at correcting errors resulted in the graph becoming unclear and untidy, often to such an extent that examiners cannot award full marks.

It needs to be stressed that candidates can achieve full marks for graph work if they adhere to certain guidelines. The plots must be accurately drawn on the intersection of the lines and started from the first plot, in this case 0 minutes. There should be careful joining of the plots, (this question required the plots to be joined with a ruler), with the lines going exactly through the centre of the plots. Pencil work would help as mistakes could then be rectified.

- (b) (i) Most candidates gained this mark. It is difficult to understand why some candidates gave the incorrect answer when both the table and the graph showed a decline in blood glucose level. Some candidates described the overall trend in the graph instead of recognising the immediate effect of insulin.
- (ii) The answer, by a simple mathematical addition, could have been obtained from the table of results. It is therefore, once again, difficult to understand why so many candidates gave the incorrect answer. Many candidates did not take the reading **after** the injection.

- (c) (i) Generally well answered.
 - (ii) The simple answer required here was that the chocolate bar contained sugar. Only the better candidates realised this.
 - (iii) Generally well answered.
 - (iv) I. Well answered although the spelling of diabetes posed a problem for many candidates.
II. Only the best candidates gave both answers correctly. Most gained one mark for blood. The spelling of urine was a problem for some candidates.
- Q.7**
- (a) The very surprising thing here, and in (b)(ii), was that many candidates did not know the names of the male and female sex cells.
 - (b) (i) The best candidates completed this correctly and gained both marks. Many candidates did not know that the male sex chromosomes are XY. Error carried forward (ECF) was applied to the marking of the chromosome content of the gametes.
 - (c) One mark was awarded for the correct gametes and one for the mechanics of the cross being correct. The better candidates gained both marks for the Punnett square. ECF was not applied from part (b)(i) to part (c). However, if the gametes in the Punnett square were incorrect, ECF was applied to the F1 genotypes, i.e. the candidates could still gain one mark for correctly completing the mechanics of the genetic cross.
 - (d) This caused difficulty for all but the best foundation tier candidates. It was clear that mitosis and meiosis were not understood.
- Q.8**
- (a) This was well answered.
 - (b) Many gave Ready Meal B and showed the correct method for calculating the GDA for salt. Some candidates found the calculation difficult or left the answer blank. Also some candidates did not read the question carefully enough and failed to underline the correct meal even though they calculated the correct salt content.
 - (c) (i) Generally poorly answered even though the answer was a straight forward addition of $1.7 + 1.4$. This seemed to be due to the candidate's inability to recognise monounsaturates and polyunsaturates and unsaturated fats. (3.3 was also an acceptable correct answer to this question).
 - (ii) I. Only the better candidates gained marks for this question. The difficulty here seemed to lie in the fact that the candidates had to use two separate tables of data in order to be able to perform the calculation. The calculation was a relatively simple one, $8250 \div 876$. In many instances the answers indicated that calculators were not available. Many candidates lost a mark here by rounding down the answer to 9. This would not have given enough energy.
II. Only the better candidates knew that excess energy is converted into fat (or glycogen).

Higher Tier

- Q.1** (a) & (b)(ii) Generally well answered although far too many candidates did not know the names of the male and female sex cells. A common error was to answer XX or XY.
- (b) (i) Most candidates answered this successfully. Error carried forward (ECF) was applied to the marking of the chromosome content of the gametes.
- (c) There was one mark for the four gametes being correct and one mark for the mechanics of the cross being correct.
- Well answered, although a few candidates didn't attempt the question. Some candidates started with dihybrid gametes. If the gametes were incorrect the candidates could still gain one mark for completing the mechanics of the cross correctly, i.e. ECF was applied to the marking.
- ECF was not applied from the answer in part (b)(i) to the Punnett square.
- (d) Better candidates gained a mark here although it was frequently incorrectly answered or not attempted. Some sense of centre bias here.
- Q.2** (a) This was well answered.
- (b) Generally well answered although some candidates failed to show how they arrived at the correct answer thereby losing the second mark.
- (c) (i) Generally well answered, although some candidates failed to realise that monounsaturates and polyunsaturates are both unsaturated fats. (3.3 was also an acceptable correct answer to this question).
- (ii) I. Most candidates realised that the calculation involved was $8250 \div 876$, giving an answer of 9.4. A large number of candidates rounded this answer down to 9.0, which would not give enough energy. This answer was not credited. There was evidence that some candidates did not have a calculator available.
- II. Generally well answered.
- Q.3** (a) Most candidates could extract the correct answers from the stem of the question and gained both marks.
- (b) Most candidates were aware of the reasons for public concern over GM crops.
- (c) The examiners expected the candidates to name the GM crop plant given in the specification, i.e. Soya. Many candidates answered other GM crop plants and their answers were credited. However, far too many candidates seemed to guess the name of a GM crop plant which often resulted in an incorrect answer in part (ii). Most candidates realised that the benefit to the farmer was through increased yield and therefore increased profits.

- Q.4** (a) Generally well answered although some responses lacked the precise detail required, e.g. 'a recessive gene' was insufficient to gain the mark.
- (b) (i) As in question 3, candidates had to extract precise detail from the information provided in the passage, although here a diagram was also provided to assist the candidates. The difficulty for some candidates was the inability to extract the correct detail, i.e. the liposome joining with the cell membrane. The better candidates gained both marks.
- (ii) Most candidates were familiar with the ethical issues raised by animal testing.
- Q.5** In this question the flow chart illustrated the effects alcohol consumption has on the body. In their responses the examiners required the candidates to focus in on the precise piece of information that would correctly answer the question. In the most part candidates scored highly, but far too many candidates included large parts of the flow chart in the hope that one of the points they included would be the correct answer. This method of answering the question failed to score.
- Q.6** (a) A standard recall question which was often poorly answered. The candidates experiences two main problems:
- Firstly, a lack of knowledge relating to the anatomy of the reflex arc and, secondly, the inability of the candidate to provide clear, straight and accurate arrows from their labels. This skill seems to have been lost. More often than not the arrows fell well short of any structure the candidate was intending to label, leaving the examiner unable to award the mark. The arrowhead needed to land fairly precisely on the intended structure to gain the mark.
- (b) Of the candidates who knew the reflex arc there were many good answers with correct references to the impulses to the effector being affected.
- (c) Generally well known. Frequently seen incorrect answers were kinetic energy and electricity.
- Q.7** (a) (i) Better candidates referred to both the fall and subsequent rise in the oxygen concentration and gained the mark. Far too many candidates only described the fall in oxygen concentration and failed to score.
- (ii) Very few candidates understood the effect that dilution had on bacterial numbers.
- (iii) Generally well answered although far too many answered 3km. Many candidates came up with the answer of a lack of oxygen.
- (b) Only the better candidates referred to indicator species. Again, a sense of centre bias here.

Q.8 (a) Generally well answered.

(b) (i) Very well answered.

(ii) Few candidates gained all five marks. Most candidates understood the effect air pollution had on the distribution of the two forms of the moth. Many candidates had trouble expressing themselves with enough clarity to score well. Some candidates think that the moths spontaneously change from one form to another - 'when pollution occurs the moths change from light to dark'; 'when pollution occurs natural selection occurs and the moths change colour'; 'the moths change colour by survival of the fittest'.

Another common error in candidates' accounts was the failure to indicate whether the response was referring to the light form of the peppered moth or the melanistic form.

In this type of question, candidates also need to make reference to the fact that in natural selection, the individuals with the advantageous genes pass them down to their offspring.

(c) (i) Most candidates identified that the light form would increase but then many failed to give the correct explanation of less predation or better camouflage.

(ii) Very poorly answered - few candidates understood the importance of variation to species survival during times of environmental change.

BIOLOGY 2

Foundation Tier

Chief Examiner: Morton Jenkins

Principal Examiner: A. Gravell
Mrs. K. Coupland

- Q.1** Following the usual pattern of the foundation paper, questions 1 - 3 were designed to allow the potential F and G grade candidates to show positive achievement. Marks for question 1 were high, with the maximum being the norm. Occasionally, a mark was lost in part (c) where candidates failed to state that predators could be poisoned by the cane toads.
- Q.2** Where as question 1 tested simple comprehension, question 2 tested basic recall, with the clues to the answers given in the question's stem. Despite the clues, there were many candidates who failed to gain high marks. *Cell membrane* and *cell wall* were often confused and the function of the cell membrane was not known by a significant number of candidates.
- Q.3** This was very well done by the vast majority of the candidates. Credit was given to those who correctly entered names in the trophic levels of the pyramid. Also, credit was given if candidates entered only the numbers correctly.
- The mark for part (a)(iv) was given for any correct statement relating to any trophic level.
- (b) Often, the mark for recognising sunlight as the source of energy was not given.
- Q.4** Logical interpretation of data and recognition of the significance of fair testing were tested. More candidates who were potentially Grade E (and above) achieved more positively here than F and G candidates. The toxic side effects of the herbicides were not often known.
- Q.5** The method used to demonstrate energy release during respiration has been well tried and tested for many years. Those who had experienced this laboratory procedure scored high marks. It emphasised the need for a practical approach to this topic. The question discriminated well and there was a good spread of marks. Only the better candidates recognised bacteria/fungi as respiring in the flask with dead peas. Consequently only these knew the role of the disinfectant in part (d)(iii).
- Q.6** Questions 6 and 7 were designed for potential D and C candidates and so appeared on both tiers.
- (a) Foundation candidates often failed to recall the correct names of the digestive organs.
- (b) As in previous years, questions relating to enzymes were poorly answered. This was disappointing because similar questions have been set many times and so there is no lack of available practice materials.
- Q.7** It was mainly the potential Grade C candidates who gained high marks on this question relating to photosynthesis. Again, there is no lack of practice questions from past papers. This form of question has been set many times on previous occasions. Full marks were rare.

Higher Tier

- Q.1** The first two questions also appeared in the foundation tier. It was not surprising to see a much better performance by candidates entered for the higher tier than those entered for the foundation tier. However, it was disappointing to see such low marks for question 1(b) awarded to many higher tier candidates. Students obviously have difficulty in understanding fundamental principles of enzyme action set in a practical context. Perhaps the situation could be improved if more practical activities were carried out.
- Q.2** Many higher tier candidates coped well with this question. Full marks were often given because there was evidence that candidates could interpret the results of the investigation and that they recalled the answers to parts (d) and (e).
- Q.3** Designed mainly for Grade C candidates, this question produced a good spread of marks and met the criteria for testing several skills, including comprehension, knowledge and understanding. Marks were sometimes lost in part (e) where answers were too vague and general to gain credit.
- Q.4** This question was aimed at C and B candidates. The majority scored all of the available marks. It tested basic knowledge and understanding of oxygen debt in anaerobic respiration.
- Q.5** The question relating to osmosis was purposely set in a context which should be familiar to students who had experience of practical work in this topic. It was pleasing to see high marks and, although designed for A and B candidates, many potential Grade C candidates also did well. The usual errors were statements which suggested that solutions could pass through selectively permeable membranes. Some candidates showed a tenuous and insecure grasp of the concept of a diffusion gradient in relation to water.
- Q.6** Even though the requirements for knowledge and understanding of the nitrogen cycle have been reduced to the minimum in the new specifications, many candidates failed to gain high marks for parts (a) - (c). The specifications clearly state that the action of urease should be known but very few were familiar with it. The performance in part (d) was much better. Most of the better candidates understood the principles of eutrophication.
- Q.7** This proved to be the easiest question on the paper. Most obtained the available marks for interpreting data, substituting for the given equation and for recalling basic facts relating to energy flow in a food web.

CHEMISTRY 1
Foundation Tier
General Certificate of Secondary Education
January 2008

Chief Examiner: D.W. Jones

This paper seems to have been well received by most candidates, with very few questions not attempted.

- Q.1** A very well answered question with most candidates gaining both marks.
- Q.2** (i) Many candidates gave the incorrect answer of E in part II.
(ii) This part was often ignored and a considerable number used the wrong key.
- Q.3** A very well answered question with the majority of the candidates gaining at least 4 of the 5 marks available. The main source of error was part (v) where C often wrongly appeared showing that many students are confused by the terms 'Groups' and 'Periods'.
- Q.4** (i) 'Reactants' and 'products' were often given reversed in part I; and in II a large number of the candidates thought that the oxygen came from the cylinder.
(ii) The common error encountered here was the use of charcoal instead of carbon.
- Q.5** (a) Parts (i) and (ii) were usually very well answered.
(iii) Poorly answered. The statements 'building tall chimneys' or 'adding limestone to lakes' were incorrectly chosen by the majority of candidates.
(b) Many stated incorrectly 'the closer proximity of areas A and C to the town' and 'the closer area D was to the arrows' in their answers.
- Q.6** (i) Although most of the candidates gave the correct answer in part I, a considerable number gave the initial acid temperature of '21°C' instead of the increase in temperature as asked for in part II.
(ii) Most of the candidates gave the unacceptable reasons: to avoid 'breakage' or 'the glass from cracking'. A number also mentioned safety reasons for which no marks were given.
(iii) Although most gave the correct word equation a few random mistakes were seen.
(iv) This question was poorly answered with only a handful of candidates able to recognise that the reaction was exothermic.

- Q.7** (i) Generally well answered although the elements in potassium hydroxide were occasionally incorrectly given as 'potassium and hydroxide' or 'potassium, hydrogen and oxide'.
- (ii) Again very well answered although ' h_2CO_3 ' sometimes appeared.
- (iii) I. This question was reasonably well answered. However, some candidates, left one of the charges in and not the other, e.g. ' Li^+Br ', which lost the mark.
- II. Poorly answered.
- Q.8** (a) (i) Part I was very well answered but a few of the candidates gave the volume of hydrogen (40) instead of the time the reaction stopped in part II.
- (ii) Well answered by the majority of the candidates.
- (iii) Poorly answered. Incorrect answers included - 'adding more acid or magnesium' and 'increasing or decreasing the volume of hydrogen'
- (b) The vast majority of the candidates repeated the three labels of the diagram and were therefore only given 2 of the 3 marks available.
- Q.9** In general this was poorly answered and for the majority of the candidates was the lowest scoring question of the paper.
- (i) I. The answers here were often very vague and failed to gain any marks.
- II. Only the better candidates were able to give the correct answer here.
- (ii) Weak answers were seen here with a considerable number of candidates incorrectly stating that the 'plates were moving apart with volcanoes coming from the gap created'
- (iii) I. Very few marks were given here. Common, unacceptable answers one of the plates being either 'bigger' or 'heavier'.
- II. Once again, candidates struggled to give a response that deserved a mark here.

Higher Tier

Although some excellent scripts were seen from a considerable number of candidates, it was apparent that some very weak candidates had also been entered for this exam.

Q.1 This was a well answered question. Common unacceptable answers seen in (a) part (iii) were 'to stir', 'increase the amount of magnesium' and 'add more acid'. The Higher candidates were able to extract the answers from the information in (b), allowing them to gain all three marks.

Q.2 Part (i) was generally well done, although the spelling of 'igneous' left much to be desired. Part (ii) was not so well answered with incorrect descriptions such as the 'plates moving apart with the appearance of volcanoes creating mountains', 'plates being rubbed together' and 'plates overlapping or sliding over each other'. Part (iii) was disappointing with a considerable number of candidates incorrectly stating in part I. that the 'density of plate B was greater than that of A'. A considerable number failed to gain the mark available in part II. by simply mentioning that 'the plates rubbed together'.

Q.3 For most of the candidates this was by far the best answered question of the paper. The main errors seen were in the following parts:

- (i) III. Giving 'potassium' instead of sodium.
- (iii) II. Giving 'sodium' as the metal A.
- (iv) Giving 'H' instead of H_2 in the symbol equation.

Q.4 Only a few candidates gained high marks in this question

- (i) Commonly seen incorrect answers here included '1.8' and '0.05'.
- (ii) Although many candidates were able to gain the first mark, only a small number received the second mark for stating 'taking the average of the obtained values'.
- (iii) Strong candidates gained the mark available here but many of the others simply restated the percentage values quoted in the table.
- (iv) This question was poorly answered. Many failed to mention limewater and most made no attempt at comparing the time needed for the limewater to go milky.

- Q.5** Many candidates found this question challenging with very few high marks seen.
- (a) (i) Well answered by the majority of the candidates.
 - (a) (ii) Only strong candidates were able to explain the term 'precipitate'.
 - (b) (i) Very few candidates could provide the correct formula for ammonium sulphate. Some of the commonly seen unacceptable answers included ' NH_4SO_4 ', ' $2 \text{NH}_4\text{SO}_4$ ' and ' NH_8SO_4 '.
 - (b) (ii) Well answered.
 - (c) (i) Poorly answered. Wrong answers included ' MgOH ', ' Mg_2OH ' and ' MgOH_2 '.
 - (c) (ii) Most candidates struggled to gain this mark. The main reason was in giving 'hydrogen' instead of water as one of the products.
- Q.6**
- (a) (i) The most common incorrect numerical value given was 4375. The candidates had neglected to include the C-C bond energy value of 347 in their calculation.
 - (a) (ii) Well answered by the majority.
 - (a) (iii) The main problem with the answers here was the omission of the negative sign.
 - (b) Most of the candidates answered this question well, although some of the weaker candidates gave rather vague, unacceptable answers such as 'less pollution'.
- Q.7** Strong candidates answered this question well but the weak ones were unsure how to solve the problem. Many attempted to use the reactivity of potassium, sodium and silver to try to name the unknowns. Others failed to gain the available marks by referring to sodium chloride as 'chlorine' and potassium iodide as 'iodine'. Some identified the unknowns as compounds that were not included in the question, e.g. 'barium sulphate'. A number simply restated the information in the table:- 'A reacts with B to give a white precipitate' in the hope of gaining some marks.

CHEMISTRY 2

Foundation Tier

Chief Examiner: David E. Reeves

This paper was very well answered with the majority of candidates gaining more than 50% of the marks available. However, the weaker candidates did not read the questions fully before attempting to answer. Recall questions gave some cause for concern and a significant number of candidates were unable to give correct scientific terms where required, even when provided in a box.

- Q.1** Very well answered with most candidates scoring at least 4 marks. The most common error was to state that a smart material was a material that changed rather than state that the properties changed.
- Q.2** Most candidates correctly identified the structures, with only a small minority scoring fewer than 3 marks. Approximately 50% were unable to correctly name graphite and diamond as different forms of carbon - although most could give one of them.
- Q.3** Fairly disappointing in that a significant number of candidates were unable to name both metal ions that caused hardness in water. Calcium was generally better known. In (ii), the majority of candidates were able to identify the factors that made this a fair test. However, only the better candidates were able to correctly assign the order A,C,B and gain both marks. Most got a mark for placing C in the middle.
- Q.4** (a) This was disappointing with guesswork evident. Only the better candidates scored well here. Charges were generally better known than the masses
- (b) This was better understood.
- Q.5** (a) This was very well answered with even the weaker candidates able to perform the calculation.
- (b) Candidates were able to state that plastics were non biodegradable. However, the second mark proved difficult to gain. Responses tended to be vague and generalised.
- (c) This was done well by the better candidates. However, weaker candidates had little or no understanding of this aspect of Chemistry. Monomer was a frequent response for (i) whereas ethane was often given in (ii)
- (d) The use of PVC was generally well known although a significant number incorrectly gave 'windows' rather than 'window frames'. Only the better candidates knew the uses of PTFE, e.g., non-stick **coating** on saucepans.

- Q.6** Air as a source of nitrogen was well known. However, only the better candidates knew the meaning of a reversible reaction. A reaction you can reverse was a common response as were vague statements such as can go back to original **products**. In (b) most candidates were able to identify C as not being produced from ammonia but only the better candidates correctly identified B as being produced from ammonia and sulphuric acid. The better candidates were also able to provide reasons for their choices. The most disappointing aspect of this question was the word equation. **Ammonia solution** was often given as a reactant and **ammonia sulphate** rather than ammonium as the product.
- Q.7**
- (a) Most candidates correctly identified the relative reactivities of carbon, iron and aluminium but were unable to offer an explanation. References to displacement rather than reduction were common. A mark was only awarded for displacement if it was qualified, e.g., in terms of removal of oxygen.
 - (b) Better candidates were able to perform the calculation but once again it was disappointing to see so few correct responses for recycling being better than extraction. The most common error was to say that it was cheaper.
 - (c) Only the better candidates correctly calculated the cost. Most common error was to merely add up the cost per tonne of each material, forgetting about the amount needed.

Higher Tier

This paper was very well answered with the majority of candidates gaining more than 65% of the marks available.

- Q.1** Very well answered with most candidates scoring at least 6 marks. The most common error was in (b)(ii) where candidates merely referred to it as containing equal amounts of N and S, or giving just one element. Also a number of candidates referred to A in (i) as it contained nitrogen. The word equation was generally well known, although a significant number gave ammonia solution as a reactant or ammonia sulphate as a product.
- Q.2** Well answered overall although as at Foundation Tier, references to displacement were common with few recognising that reduction was the process taking place. Environmental problems were better known here, although references to conservation of the ore were often seen.
- Q.3** Very well answered although a significant number of candidates were unable to explain why the atom has no overall charge in terms of equal numbers of protons and electrons. Protons are positive and electrons are negative was the most common incorrect response, together with responses that referred to them cancelling each other out.
- Q.4** Smart materials were generally well known although weaker candidates were unable to provide a clear general definition. They often stated that the material changes rather than its properties. References to specific smart materials were common as was the use of the vague term 'special properties'. Thermochromic paint was well known although weaker candidates did refer to light. Shape memory alloys were not so well understood with many candidates referring to moulding or merely changing shape without referring to regaining it.
- Q.5** Very well answered although weaker candidates did have difficulty drawing a smooth curve and as a result lost marks in the calculation.
- Q.6**
- (a) Clear diagrams showing the situation before and after are still not being seen. It is still common to see charges associated with the atom and electrons being shown in two places at once. However, this was generally well answered by the better candidates with full marks being gained for showing electronic configurations before and after together with the charges on the ions.
 - (b) The better candidates scored well here. It was pleasing to see higher-level answers in terms of the number of bonding electrons and van der Waals forces. However, weaker candidates often referred to graphite having space for electrons to move rather than it possessing free moving electrons. A common mistake was to refer to a free electron.
 - (c) The majority of candidates were able to recognise the carbon nanotube. However, potential uses were not well known - the exception being miniature electronic circuits.

- Q.7**
- (i) It was pleasing to see a significant number of candidates being able to perform this calculation with even the weaker candidates gaining a mark for a correct M_r answer this question well.

 - (ii) The majority of candidates were able to calculate the total amount of reactants. However, despite knowing the expression used to calculate atom economy, a surprising number of candidates were unable to decide which figures were to be used - some randomly selected their figures. The main weakness here was in being able to explain the importance of having a high atom economy. A significant number of candidates are confused between atom economy and yield.

PHYSICS 1

General Certificate of Secondary Education

January 2008

Principal Examiner: C. Neill

General Observations

A minority of centres entered some candidates inappropriately for the higher tier paper instead of the foundation tier. The demands of the higher paper require that the candidates have a good knowledge of the specification, are adept in applying their knowledge to new and unusual situations and can apply mathematics to physics to a standard that equates to that of a good mathematics candidate. Being mindful that many pupils sit this paper in year 10, it puts a heavy demand on them and they need to be fit for the task.

On the higher tier paper, candidates were asked to choose and write down equations that are given on page 2 of the paper on no fewer than six occasions - the 6 potential marks could prove to be the difference of 2 grades in some instances. It was a matter of concern that a small number of candidates repeatedly failed to quote the equation correctly, often failing to give the equation a subject. This seriously affected their ability to earn marks on the paper as a whole.

Candidates in some schools are still being disadvantaged by not being provided with calculators for their physics examinations. Higher tier candidates can expect to have to handle large numbers, sometimes in standard form, and need to be taught how to do this - in addition to being supplied with scientific calculators.

Foundation Tier

- Q.1** This was a straightforward question on which many candidates earned all 3 marks. The main failures were drawing more than 3 lines and "the energy from moving water on the surface of the sea" being joined to the "hydroelectric" box on the right hand side.
- Q.2** Parts (a) (i) and (ii) were often correctly answered but the weaker candidates continue to fail to demonstrate an understanding of critical angle refraction. Part (b) of the question asked for one application of total internal reflection. Answers such as "mirrors" and "seeing around corners" abounded whereas a simple learned statement of "optical fibre communications" or similar would have secured the mark.
- Q.3** Candidates find it difficult to separate the concepts of conduction, convection and radiation. The second part of the question asked for ways of reducing the use of fuels to heat the room. Weaker candidates gave the shiny foil and black painted radiator as outlined in the question - obviously gaining no marks.
- Q.4** This question was generally well answered with the exception of the last part. Balanced inward and outward forces acting on the Sun meant to some that the Sun does not move!

- Q.5** Reading information from the graph and undertaking some simple mathematical operations on the data was generally well done but many candidates were unable to clearly express a use for artificial satellites.
- Q.6** This was the best answered question of the early ones on the paper. The mathematics of (b) (ii) proved too demanding for some.
- Q.7** 3 marks were awarded for three or all 4 correct answers, 2 marks for two correct and 1 mark for just one correct.
- Q.8** The numbers were straightforward to apply to the equations and the cost of 60p was frequently achieved. For (a) (iii), candidates needed to state that cycle A took only half the time of cycle B. An advantage to the **environment** required that an answer of "using less fuel in making electricity" was given rather than "less electricity" is used - or a similar response.
- Q.9** The question was well answered.
- Q.10** The general pattern of temperature change with distance was usually identified but candidates seem to have lost the ability to describe that the change is not uniform or non linear. The best described that the line was falling less fast (references to time dependence did not earn credit). In (b)(ii), a significant number of candidates fail to identify Mars and confused it with Mercury (same initial?)
- Q.11** Amplitudes of 4 or -4 were marked correct in part (i). Candidates often counted 9 waves instead of 10 in part (ii). Very rarely was there an adequate definition of the word "frequency". The equation was usually quoted and used correctly.
- Q.12** Candidates usually identified the pattern between the quantities in the table, but rarely could they explain why foam and fibre glass are good insulators of heat.

Higher Tier

- Q.1** In common with the performances on question 10 on the foundation tier, candidates often earned just 1 mark on part (a). In general performances on the question as a whole were no better than those of candidates on the foundation tier.
- Q.2** Similar observations to those on question 11 on the foundation tier paper. The higher tier candidates performed no better!
- Q.3** Part (b) was answered better than answers given on question 12 on the foundation tier.
- Q.4** The use of the power - voltage - current equation is contained in the part of the specification associated with transmission of electrical power. As a consequence, it is likely to be associated with big numbers. Index notation will be used, if appropriate, in these situations and candidates need to be trained in the use calculators to express such numbers. Part (a) (ii) required candidates to do more than recognise that 400 000 volts is eight times bigger than 50 000 V. If they did pursue that avenue, then they needed to relate it to reducing the current by a factor of 8. Rarely could candidates clearly give two reasons for using high voltages in the transmission of electrical power. Part (c) proved to be demanding mathematically, but one of the two marks on offer was awarded for substituting the numbers into the equation - as it always is. Numbers are then easier to manipulate rather than algebraically manipulating the written equation.

- Q.5** This was by far the best answered question on the paper. Parts (a) and (b) were very accessible and errors began to creep in more often at part (c) of the question. It is intended that these questions on energy savings are taken on board by the candidates and that from them they learn to be energy conscious. This question shows that the energy efficient light bulbs pay for themselves over and over again and will provide a useful teaching tool. Part (d) should encourage discussion and pupils should be encouraged to address their answers directly to the effect on the environment about switching to low energy bulbs in any of three respects: a reduction in use of energy resources; a reduction in waste products from power stations; a reduction in waste because of fewer lamps being discarded in any period. The last part of the question was not often well answered.
- Q.6** Candidates were often clueless as to how to answer this question- probably because they were unfamiliar with the trigger information given. Given the black/grey/white nature of the diagram it was not essential that candidates interpret the lines as absorption lines and in any case this is not on the specification. The wording of the questions was chosen to be as helpful as possible. One of the two first marks was on offer for stating that the wavelengths in the upper diagram were bigger than those in the lower one - obvious from the diagrams. What does increased wavelength (towards the red end of the spectrum) say about the movement of galaxies? Not that they are expanding but that they are moving away from us - and so on. The content is thereafter totally in line with the wording in the specification and such questions will continue to be asked with or without the stimulus material.
- Q.7** The distance - speed - time calculation involved big numbers, but that was not the source of difficulty for students answering this question. It was a failure to recognise that the laser signal passes to the moon and back again (in spite of the inclusion of the helpful arrows on the diagram!). The distance travelled is double the distance to the moon but very few candidates recognised the fact or the need to introduce a factor of 2 into the calculation. Only one mark out of the three was earned by the majority of candidates. In the second part of the question, total internal reflection was not identified; reflections in the diagram often went at bizarre angles, with candidates having no feeling for anything approximating to equality of angles when reflection occurs. A small percentage of candidates identified total internal reflection and could answer the conditions under which it occurs.

PHYSICS 2

Foundation Tier

Principal Examiner: R.P. Davies

General Comments

Most candidates use given equations correctly. When an equation is asked for, not all follow the instruction to write it down in the form it appears on page 2, with some omitting the subject. Graph work continues to be good. Some marks are lost through careless interpretation of given data.

Many candidates demonstrated a positive performance on the paper, the mean mark being 38.3. Attainment can be further improved by encouraging candidates to:

- Read all information carefully.
- Understand the implication of instructions in bold print.
- Examine tabulated data carefully - sometimes there is a clue in the columns that are given or there are lines to show where to complete the gaps.
- Show all working in calculations.

Specific Comments

- Q.1** Most candidates responded correctly to the first 2 parts of the question but many thought the car speeded up for 40s, forgetting to subtract the initial 10s where the car travelled at constant speed.
- Q.2** Knowledge of insulation and the role of the earth wire were well known. However, there was confusion between mcb and rcd.
- Q.3** (a) The majority of candidates answered parts (i) and (ii) correctly but a surprising number thought food was a source easily breathed in.
- (b) This was interpreted well by almost all candidates.
- Q.4** (a) Even though the standard symbols were used (indicated by V and A), the names of the meters were not well known. Terms such as voltameter and ampmeter were not accepted.
- (b) Some candidates failed to plot (0,0) but were not penalised. Others plotted points at 2, 4, 6 & 8 V instead of at 2, 6, 8 & 10 V. A near-perfect straight line was expected for the third mark. Double lines and kinked lines failed to gain credit. Answers to the remainder of the question depended on the values from candidates' graphs.

- Q.5** (a) (i) The varying units in the table caused a problem for some candidates. Identifying the shortest half life as 61 minutes was also accepted here.
- (ii) Iodine was a popular incorrect response here.
- (iii) Mostly correct answers seen. (b) The most common pair of responses seen were X and Y instead of Y and X.
- (c) The completion of the tables caused few problems for candidates.
- Q.6** (a) The majority of candidates could use the equation correctly to arrive at the correct answer.
- (b) (i) Many named X as resistance or wind resistance. Neither response was credited. Acceptable responses were drag, air resistance or friction.
- (ii) The fact that X increases with speed was well known.
- (iii) Many candidates thought that when the forces became balanced the sprinter suddenly stopped.
- (c) Again, majority of candidates arrived at a correct answer. However, some show correct working and a correct answer in the space, but then write an incorrect answer on the dotted line, penalising themselves one mark. This needs to be addressed by centres as part of exam technique.
- Q.7** (a) Mostly correct responses seen.
- (b) Many candidates just added all the currents in the table together to arrive at their answer. They did not identify the correct combination of lamps from the circuit diagram.
- (c) Some used their response from (b) in this calculation. Others used the correct current value from the table, and rounded correctly to arrive at the acceptable response.
- Q.8** (a) Candidates interpreted the graph correctly but failed to make a comparison in their response.
- (b) Candidates who failed to give a correct response in (i) could gain credit in (ii) through an ecf.
- (iii) There was a wide margin of acceptable speeds here.
- (iv) This response depended on their answer in (iii).
- Q.9** (i) Most candidates gave two responses referring to avoiding health risks. Very few referred to the implications of decay time.
- (ii) All candidates followed the instruction to select three methods but not all gave a different disadvantage for each so it was quite common to see harmful / expensive given three times. Candidates who selected method 1 had difficulty explaining that the waste was not contained or was still exposed.

Higher Tier

The vast majority of candidates use given equations correctly. When an equation is asked for, not all follow the instruction to write it down in the form it appears on page 2, with some omitting the subject. Others attempt to manipulate the equation before writing it down but if this is incorrect they do not earn credit. Substitution into an incorrect equation does not gain credit either. Graph work continues to be good. Some marks are lost through careless interpretation of given data.

Many candidates demonstrated a positive performance on the paper, the mean mark being 34.3. Attainment can be further improved by encouraging candidates to:

- Read all information carefully.
- Understand the implication of instructions in bold print.
- Examine tabulated data carefully - sometimes there is a clue in the columns that are given or there are lines to show where complete the gaps.
- Follow instructions to write down equations as they appear on page 2, substitute values and finally manipulate, thereby showing all working in calculations.

- Q.1**
- (a) Mostly correct responses seen.
- (b) Some candidates added all the currents in the table together to arrive at their answer. They did not identify the correct combination of lamps from the circuit diagram.
- (c) Some used their response from (b) in this calculation. Most used the correct current value from the table, and rounded correctly to arrive at the acceptable response.
- (d) Candidates responded well here. Few referred to mcb's being cheaper because they do not need to be replaced when activated. However a large number of fuses would need replacing for cost to become a disadvantage.
- Q.2**
- (a) Candidates interpreted the graph correctly and made a comparison.
- (b) Candidates who failed to give a correct response in (i) could gain credit in (ii) through an ecf although most answered correctly.
- (iii) There was a wide margin of acceptable speeds here.
- (iv) This response depended on they answer in (iii).
- Q.3**
- (i) Most candidates gave two responses referring to avoiding health risks. Very few referred to the implications of decay time.
- (ii) All candidates followed the instruction to select three methods but not all gave a different disadvantage for each so it was quite common to see harmful / expensive given three times. Candidates who selected method 1 had difficulty explaining that the waste was not contained or still exposed. Answers to other methods were expressed well.

- Q.4** (a) This part was probably one of the most poorly answered on the paper. There was confusion between ammeters and voltmeters, and Z was identified as a lamp, led or resistor.
- (b) (i) The word carefully was in bold print. Even so, some answers were very brief. Some candidates failed to refer to the fact that current was zero until 0.56/0.58. Most stated that current increased with voltage, but only a minority mentioned this was a non-uniform increase.
- (ii) Some candidates lost the first mark either by not writing a complete equation or because of incorrect manipulation. Those who wrote down a correct equation usually earned both marks for the calculation.
- Q.5** (a) The vast majority wrote down the equation correctly. However, some were careless in substituting information - where did some of the numbers come from?
- (b) (i) Some subtracted correct values to arrive at the correct answer but others added KE and PE from (a).
- (ii) Some candidates did not realise this required the KE formula and wrote down speed = distance/time. During the manipulation, some candidates forgot about 0.5 and others the fact that a square root was needed.
- (c) Candidates ignored the statement 'before the bungee rope starts to stretch' and their responses revolved around forces in the rope. Some think weight changes as speed increases. A minority earned both marks here.
- (d) There was an array of values seen in the table - rare to see a KE value of zero. Acceptable responses for PE were 0 or 33 000J since it did not state GPE.
- Q.6** (a) (i) Most candidates knew that it took 25 minutes for something to halve but were sometimes vague about what this property was.
- (ii) Few candidates mentioned an imbalance between neutrons and protons. Many referred to electrons in their response.
- (b) (i) Most referred to the suitable half life but few mentioned the penetrating property of gamma radiation.
- (ii) The trigger for some candidates was the word 'fraction'. Their response was to calculate $8.4/84 = 1/10$. Other candidates correctly determined the number of half lives by calculating $84/8.4=10$. Others followed this method: $1 \rightarrow (8.4) \frac{1}{2} \rightarrow (16.8) \frac{1}{4}$ etc arriving at an answer of 1/512 because they counted the 1 as the first half life.



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