GCSE EXAMINERS' REPORTS

GCSE (NEW)
SCIENCE DOUBLE AWARD

SUMMER 2018

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SCIENCE DOUBLE AWARD

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BIOLOGY UNIT 1 FOUNDATION

General Introduction

The overall impression gained by examiners of this paper is that many candidates appeared to be unprepared for the degree of challenge that they faced with regard to the recall of basic content and with the requirement to interpret, analyse and draw conclusions from data. Many answers were immature, suggesting a lack of experience at answering GCSE examination questions.

Many candidates had problems with extended writing, often hampered by a very poor level of literacy and an insufficient body of knowledge and understanding necessary to answer direct questioning or to construct coherent and comprehensive answers. Despite this, a pleasingly high proportion of the entry this year produced well written accounts on the Quality of Extended Response (QER) question, which forms 10% of the marks available.

Failure to use the comparative term (e.g. 'more/ less', 'higher/highest') once again resulted in lost marks. Many candidates do not seem to appreciate that substantial clues as to how to answer questions are often to be found in the text and diagrams. Candidates would be well advised to avoid using the term 'amount' when a reference to a specific measurable quantity, such as volume, concentration or mass is required. Poor basic numeracy continues to handicap a substantial proportion of the entry.

Q.1 (a) (i) Many candidates had access to a ruler, made an accurate measurement of the line and gave the correct answer of 40 to match the units given on the answer line.

(ii) A large proportion of the candidates then *multiplied* their answer in (i) with the given magnification rather than divide the length by the magnification. Candidates should be encouraged to check their answer on these mathematical questions to ensure that it makes sense. In this case, the answer often seen (i.e. 16000 mm or 16 m) for the length of the cell should indicate that the wrong mathematical computation had been selected.

(b) About half the entry were able to recall the name of structure P (vacuole), or at least a close phonetic version of it. Note that 'vacule' is not phonetic, so was not allowed.

(c) Many candidates scored at least one mark for correctly relating structure to function of the cell parts. Only a very few had the knowledge necessary to score three or all four marks.

Q.2 (a) A large proportion of the answers seem to have been selected from the list at random.

(b) (i) Very few candidates selected the correct enzyme (X) from the choice of three (X, Y and Z), presumably due to lack understanding of the relationship between pH values and acidity and/or inability to interpret graphs.

(ii) Very few candidates selected the correct pH range at which all three enzymes are active, probably due to the same lack of understanding shown by many in (i).

(iii) Many candidates gave the answer 'mouth' as the saliva producing structure. This was allowed. The preferred and correct answer of 'salivary gland' was rarely seen.

Q.3 (a) This question amounts to an extended Cloze comprehension exercise in which all the answers to parts (i) to (iv) must be answered by selecting the key word or short phrase from the passage. In order to assist candidates in completing the task, they are instructed to use **only** the information in the passage. The skills to accomplish the correct answers are twofold. Firstly, the candidates must have sufficient knowledge to at least recognise and understand the key terms and secondly, possess the ability to extract those terms from the text in order to avoid irrelevant or confounding information. The mean mark of 1.8 for the section out of a possible total of 5, shows that most candidates found all four parts to be very challenging indeed. Many simply lacked the knowledge of trophic relationships and/or resorted to introducing their own ideas, not evidenced by the text. Another very common error was to indiscriminately copy out whole sentences from the passage.

(b) (i) Percentage calculations remain beyond the majority of candidates.

(ii) There is an error carried forward allowance in this part so that any answer to part (i) that was correctly multiplied by 117 would score in part (ii). Many candidates did not show the mathematical skill required to gain the mark.

Q.4 (a) (i) The majority of candidates successfully subtracted 16.0 from 20.9 to give the answer of 4.9.

(ii) Only a minority were able to recall the term respiration.

(b) The topic of breathing was poorly known by many candidates.

(i) Candidates are instructed to **draw an arrow on the diagram** on the healthy alveolus to show the direction of movement of oxygen through the alveolar lining. The vast majority were unable to execute this basic task. Multiple arrows which remained within the alveolar air sac, such as indicating circular or bi-directional movements and arrows originating from outside the diagram were all common.

(ii) Most candidates picked out at least the labelled difference between the two diagrams (hardened lining to capillary) and several also pointed out that the alveolar lining also appeared thicker, or hardened. The third mark was for a reference to the resulting reduction in *diffusion*, a term seen very rarely indeed.

(c) There was considerable confusion in most candidates about the direction of travel of molecules across membranes.

Q.5 (a) (i)&(ii) Only a few candidates knew that the primary harmful effect of diets high in sodium chloride is raised blood pressure. The mark was also given for heart or kidney disease/failure. Most candidates pointed to cancer as the main harmful effect of smoking cigarettes.

(b) (i) The data in the bar chart show the results of a questionnaire taken by young people in Wales during 2016, about how trying e-cigarettes affected their smoking habits. The question asks candidates to use all the results in the bar chart to form a judgement about just *how* successful the trial was in helping the young people to cut down or stop smoking. It was hoped that candidates would appreciate that the trial was a qualified success. Descriptions such as quite/partly/partial success' were credited. Examiners were then looking for a discussion that isolated and referenced the two positive outcomes in a consecutive or combined account and then, a comment about the remaining two outcomes that were either neutral or negative.

Many candidates scored at least two of the available four marks and several presented well structured, logical justifications of their evaluation. Commonly however, some stated that the trial was successful or very successful – i.e. an unqualified success. Others asserted that it was not successful. Many simply gave the percentages of each bar in sequence or at random, showing no logical sequence to their account.

(ii) The question asks how a new survey could be made more *representative* of the population of Wales. Examiners were looking for suggestions that would widen the range of people involved – such as 'all age groups/all areas of Wales'. Most answers were too vague, such as 'ask older people' or confused with the idea of the fair test, such as 'all the same age'.

Q.6 (a) The Quality of Extended Response (QER) at Foundation Tier appears in the Low Demand section of the paper and so the challenge to the candidate is adjusted accordingly. The accounts seen by examiners showed that the majority of candidates had taken part in, and could recall, at least some of the detail of this specified practical investigation which helped to raise the mean score to 3.2 out of 6. There were several well sequenced descriptions of the method, gaining top band. However, the demands of extended writing remain beyond many at this level and it appears that a significant proportion of the entry had no knowledge of the method. Use the mounted needle to obtain the cheek cell sample was disturbingly common, and many described placing the sample on the *cover slip*, then adding the glass slide. It is clear that the use of a mounted needle to lower the cover slip is not widespread practice in centres. Candidates could still gain maximum marks in cases where there was no reference to this procedure, providing they lowered the cover slip in such a way as to prevent the formation of air bubbles.

(b) The quality of biological drawing remains very poor indeed. Less than 30% of candidates drew an acceptable diagram of one cheek cell as seen down a microscope, despite considerable latitude being given by examiners.

The remaining 15 marks on this paper are allocated to Standard Demand questions.

Q.7 (a) Given the evidence from Q. 6 that most candidates do seem to have at least seen a microscope, it is disappointing that very few could properly explain how to select a magnification of x100 on the given instrument. Several candidates appeared not to have been exposed to a microscope at all.

(b) Only 10% of candidates could state that the function of structure **A** (coarse focus knob) was to focus, answers such as 'to see it more clearly/to zoom in' were common.

(c) (i) The advantage of cell specialisation being efficiency was almost unknown.

(ii) The term 'tissue' for a collection of cells grouped together was seen in a very small minority of cases.

(iii) The definition of the term 'organ' was so rarely seen, the mean mark for the question is 0.0.

Q.8 (a) (i) Most candidates were not able to interpret the stacked bars at all, while many others understood the principle involved but made errors in reading the values.

(ii) Most candidates correctly picked out 1987 as the final year in which sewage sludge was disposed of at the '12 mile' dump site.

(iii) Rather than using the evidence in the diagram (Map 2) most answers were characterised by vague suggestions about 'waste/the dump getting too close to the shore/being unsightly/causing a smell'. The evidence from the tracking of the buoys indicates that the sewage dumped at the 106 mile site would not wash up on the shore.

(b) This question proved to be inaccessible to all but the most able candidates, so that the mean score was 0.0.

(c) Many candidates scored the mark here, most often for oil or plastic.

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

BIOLOGY UNIT 1 HIGHER

General introduction

Performance was generally below the standard expected on a higher tier GCSE biology paper. Knowledge of cells, tissues and organs, bacterial decomposition, osmosis, photosynthesis and respiration was often inadequate.

The interpretation of graphs is often left wanting and many candidates struggle with relatively simple *x* and *y* axis scales. Many struggled with the relatively straightforward mathematics calculations on this paper.

Many seem to lack the ability to study tables, charts and diagrams in order to extract relevant details to answer questions. All of these failings mean that marks are often not awarded. On this paper there were 5 given graphs, 2 maps, 3 diagrams, 3 tables and 3 relevant photographs. These illustrative features have always been part of biology and biology exam papers. Students need plenty of practice in interpreting questions containing these features.

Candidates must not change scientific terms, given in questions, to ones of their own. For example, question 2 referred to sewage sludge; in candidates' answers many had changed this to waste or rubbish. This is not acceptable and often means that marks are not awarded.

Candidates also need to understand that if they are going to use scientific notation or symbols these must be correct. Answers in which incorrect notations or symbols appear will not be credited. For example:
CO_2 is the correct notation for carbon dioxide – cO_2, CO2, and CO^2 are not acceptable.
pH is a correct notation – ph, Ph and PH are not acceptable.

There is evidence that candidates do not read questions carefully enough, missing essential detail or instruction in the question and lose marks. For success in examinations, practice in reading questions is almost as important as the contents of the specification. To illustrate the point question 4(c) asks how someone could alter their **diet** in order to lose weight. Far too many answers referred to exercise, jogging, taking up more sport or going to the gym.

Q.1 (a) Most candidates gained the first mark for selecting the ×10 objective lens. For the second mark it must be clear that the method of calculation of magnification is understood, i.e. **power of eyepiece lens × power of objective lens.** It was insufficient to state that the eyepiece lens was ×10 and the objective lens was ×10 and that gives ×100. A clear indication of 10 × 10 was needed.

(b) The function of **A** (the coarse focus control) was not well understood. Most candidates knew that **A** altered the height of the stage but the reason for this was needed i.e. to focus the microscope or to bring the muscle cells into focus.

(c) (i) The specification states: ***Specialised cells are more efficient in performing specific functions … .*** A reference to efficiency in the answer was required but was very rarely seen.

(ii) Tissue was generally known

(d) The meaning of the term organ was often poorly explained. The main problem was in the use of the word *tissue.* The answer had to make it clear that **different** tissues were working together here.

Q.2 (a) (i) Generally well answered although far too many candidates had difficulty in selecting which parts of the stacked bars to use in the calculation.

(ii) Well answered

(iii) Responses were generally of low standard.
This question is about preventing sewage sludge washing up on the coast/coastline/beaches/land of New Jersey/New York/east coast of the USA. Candidates who referred to sewage sludge as waste or rubbish did not gain credit. The function of drifting satellite tracked buoys was poorly understood as was what **Map 2** illustrated. Only a few candidates realised that the buoys recorded the currents/water movement around the 106-mile dump site and if the buoys didn't end up on the coast then neither would the sewage sludge. This lack of understanding is illustrated in answers such as 'the 106-mile dump site was chosen so that the buoys would not get washed up on the coast' or 'the 106-mile dump site was chosen because there are fewer people living there'.

(b) The fact that sewage sludge is decomposed by bacteria/microorganisms was poorly understood. Few candidates mentioned that during this decomposition the bacteria would increase in number and therefore there would be more bacteria using oxygen for respiration.

(c) Approximately half the candidates gained a mark here. Unsurprisingly in today's climate, plastic was the most commonly seen acceptable answer followed by heavy metals and nuclear waste. The question asked for one **group** of industrial wastes and therefore answers referring to specific items were not credited. Answers, seen more frequently than they should have been included New Jersey, New York, buoys and the Atlantic Ocean.

Q.3 Some good responses seen here with candidates gaining marks in the top and middle bands. Many candidates understood emulsification of fats but the site of the action of bile was often stated as the stomach. The increase in surface area of fat globules was frequently omitted from answers, as was the effect that bile had on the pH of the small intestine.

The action of lipase on fats was generally well known, as were the products of its action. Again the site of action of lipase was often incorrect and included the mouth, stomach, liver and pancreas. It was expected that lipase was described as breaking down, digesting or hydrolyzing fat to fatty acids and glycerol and not just **turning** fat into fatty acids and glycerol. Glycerol was often misnamed and lipid was sometimes used for lipase. Amino acids were sometimes incorrectly named as one of the products of fat digestion.

Q.4 (a) Half the candidates gained a mark here. 4 was the most often incorrect answer seen here.

(b) (i)&(ii) Well answered. Two marks were awarded for the correct calculation of Peter's BMI. If the answer was incorrect then one mark could be awarded for the use of the correct figures in the calculation. One mark was awarded for the allocation of the correct major BMI category to both Sharon and Peter. If the calculation of Peter's BMI was incorrect in part (i) error carried forward (ECF) was allowed for the allocation of his BMI category.

(c) Most candidates gained one mark for 'reducing the intake of fats or carbohydrates in the diet'. Answers which stated 'don't eat sugars' or 'don't eat fats' were not credited. Nor were answers which specified the removal of named items of food from the diet, e.g. 'eat less potatoes/fast food/or eat fewer items from well known fast food outlets'. Candidates must learn to read questions more carefully. Many candidates referred to taking more exercise when the question specifically asks for two ways in which Iorwerth could alter his **diet**.

Q.5 (a) Generally well answered.

Two marks were awarded for the answer -7.9. Some candidates omitted the minus sign and were awarded 1 mark for 7.9. If the answer was incorrect then 1 mark was awarded for the correct method of calculation, i.e.

$-4.8 \div 60.9 \times 100$

(b) (i) Generally well answered. The line was expected to be drawn with a ruler, passing through the centre of the plotted points and not to extend beyond the last plotted point. ECF was allowed here from the answer given in part (a).

(ii) Less than half the candidates gained this mark. There was confusion with regard to where on the graph this reading was to be taken from. Many candidates clearly lacked understanding of what the graph showed with many giving the incorrect answer of 10.8%. This indicated that they knew where to obtain the answer on the graph but they couldn't read the horizontal axis scale.

(c) Osmosis is a topic that previous years' candidates have shown a good understanding of. The current cohort of candidates found this question very difficult. It was essential that the candidates stated the difference in the **concentration** of water on both the inside and outside of both **Egg 3** & **Egg 5** and the direction in which the water moved. If this was stated correctly 2 marks were awarded. A correct reference to the **water** moving by osmosis would then gain another mark. The 4th mark was awarded for a correct reference to the **water** moving through the semi/selectively permeable membrane (the cell membrane/outer membrane of naked egg).

There were far too many instances of candidates incorrectly referring to solutions or sugar or sucrose moving through the SPM by osmosis. Many candidates attempted to answer the question by simply quoting the data in the table. This gained no marks. A straightforward definition of osmosis gained no marks. Knowledge of osmosis had to be applied to this naked egg scenario.

(d) Generally well answered with half the candidates gaining the mark. Six solutions (including pure water) were available in this investigation. The graph and table showed that placing the naked egg in a solution of 0%, 5% or 10% sucrose solution would increase its mass/size. Solution concentrations between 0% and 5%, or between 5% and 10% were not available in this investigation and didn't gain credit if given as an answer.

Q.6 (a) Photosynthesis is not well understood and often confused with respiration. Statements about the gases exchanged during photosynthesis and respiration often appear in the same answer.

In this question the 1st mark is awarded for the candidate stating that oxygen is produced during/is a product of photosynthesis. Simply presenting the word equation for photosynthesis was insufficient to gain the mark. If candidates are presenting the chemical notation for oxygen then it must be O_2 and not o2, O2 or, as frequently seen, O^2. The incorrect notation fails to gain marks. The 2nd and 3rd marks were awarded for stating that if oxygen production increased the **rate** of photosynthesis was increasing (ORA – or reverse argument). This question relates to the **rate of photosynthesis** and not to whether the plant is photosynthesising or not.

(b) Limiting factors is in bold on the specification. Candidates found this question very difficult. This question [and part (c)] required careful and detailed examination of the table on page 16. The candidates were expected to note that in readings **2**, **3** and **4** increasing light intensity or CO_2 concentration had no effect on O_2 production/the rate of photosynthesis. Therefore neither of these factors is limiting. Recognizing this for either of these two factors gained 1 mark. The 2nd mark is awarded for identifying temperature as being limiting.

The answer for this question must **not** be obtained from reading **5**.

(c) Generally poorly answered.

Observation of readings **6**, **7** and **8** show that increasing the light intensity or temperature has no effect on O_2 production/the rate of photosynthesis. Therefore neither of these factors is limiting. Recognizing this for either of these two factors gained 1 mark.

The 2nd mark is for stating that CO_2 concentration must therefore be the limiting factor.

(d) Generally well answered. Most candidates referred to preventing a relevant gas entering or leaving the apparatus.

(e) Many candidates gained at least one of the two marks available. The responses had to make it very clear that the candidates were referring to the **external** or **ambient** or **room** light intensity and temperature. If the reference to either of these two factors was ambiguous then marks were not given. If the problem recognized was the ambient light intensity changing then most found the solution straightforward – enclose the apparatus in a dark room or cupboard. The solution to ambient changes in temperature were less easily solved and most candidates referring to temperature struggled with a solution.

Q.7 (a) Generally well answered. Pulmonary vein was better known than tricuspid or right atrio-ventricular/(AV) valve.

(b) (i) Many found this difficult. Both answers needed to be correct for the 1 mark. The most common incorrect answer was 2.6 kPa for the reading of the left atrial pressure. This was due to a failure to understand the vertical axis scale.

(ii) Again, many candidates found this question difficult. Care was needed here; some candidates were not awarded the marks because their answers referred to the right and left **sides** of the heart e.g. 'the muscle on the left side of the heart is thicker than the muscle on the right side of the heart'. Most knew that the blood pressure in the left ventricle was high**er**/great**er** than in the right ventricle and most knew the reason for this. Two marks were available here and better candidates gained both. What was often omitted from answers was any reference to the relative thicknesses of the muscular walls of the two ventricular chambers.

Q.8 (a) Poorly answered. Equations were very often a mixture of aerobic respiration, anaerobic fermentation and anaerobic respiration in muscle tissue. Oxygen, water, carbon dioxide and ethanol frequently appeared in the answers. The mark for the equation was often lost because ATP was either omitted as a product or substituted with the term energy.

(b) Again generally poorly known with many answers incorrectly referring to the fact that oxygen isn't used or an oxygen debt occurs. Reference to the incomplete breakdown of the glucose molecule and to fewer molecules of ATP being produced was required for the 2 marks.

(c) (i) Most candidates knew that something called an oxygen debt occurred but answers often indicated that they didn't know what an oxygen debt was. (An explanation of oxygen debt wasn't required even though some attempted one.) A correct reference to an oxygen debt gained the first mark. The 2nd mark was gained by stating that **oxygen** was required to break down lactic acid. Examiners would prefer to see lactic acid broken down rather than 'got rid of'. The following example of an answer gained only 1 mark – 'because an oxygen debt has built up and lactic acid needs to be broken down'. The mark is awarded for oxygen debt but the reference to lactic acid breakdown requires mention of the involvement of oxygen.

(ii) Very poorly answered. Reference to **more** oxygen getting to the cells/tissues/organs/muscles was required. Oxygen gets to its destination **quicker** was accepted.

(d) Many candidates gained 1 of the 2 marks available. Examiners were hoping to see reference to **more** haemoglobin being available but this was rarely the case. This would have gained 1 mark. The 2nd mark was for **more** oxygen being carried by the blood/**more** oxygenated blood or **more** aerobic respiration.

SCIENCE DOUBLE AWARD

GCSE (NEW)

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CHEMISTRY UNIT 2 FOUNDATION

Q.1 (a) (i) Poorly answered. Common errors were to omit the positive charge for the proton and to give the mass of a neutron as 0.

(ii) Poorly answered. Common incorrect answers were 7 and 3 showing that candidates had used the Periodic Table rather than the diagram as instructed.

(b) (i) Well answered.

(ii) Well answered.

(iii) Well answered.

(iv) Few candidates gave the correct formula, which reflects a lack of understanding of chemical formulae at Foundation Tier level. The most common incorrect answer was LiO_2.

Q.2 (a) Many candidates gained 1 mark for the question however, many referred to the same volume of soap, which is the dependent variable in this investigation. Candidates still refer to repeating the experiment as a method of fair testing, which is a concern. Some also referred to the fact that three water samples were used made it a fair test.

(b) (i) Most candidates gained at least 1 mark here. A minority did not show their working.

(ii) Very well answered.

(c) Very well answered.

(d) Na^+ was a common incorrect answer here, however the majority of candidates answered correctly.

3. (a) Well answered. The most common error was to subtract 14 from 20 rather than add them.

(b) Very well answered.

(c) (i) The majority of candidates gained both marks for the correct answer. Some thought that the volume had to be cubed and surprisingly, some did not attempt the calculation.

(ii) Poorly answered. Candidates forgot to multiply the oxygen A_r by four, resulting in an M_r of 72.

Q.4 (a) Poorly answered. Many candidates misinterpreted the question, resulting in **two** pairs of solutions being given e.g. **A** and **C**. No credit was awarded for simply stating that no reaction has occurred.

(b) (i) Poorly answered. Many candidates gave the test for hydrogen or oxygen.

(ii) Very poorly answered. The most frequent errors were $NaCO_3$ and NaC.

(c) (i) Poorly answered with many not attempting the question or again giving **two** pairs of solutions.

(ii) Poorly answered with only a minority of candidates gaining the mark. Lilac and red were the commonest incorrect answers.

Q.5 (a) Very poorly answered. Very few candidates gave the correct formula. A quarter of candidates did not attempt the question and the most common incorrect answers were H_2O and H_2O_3.

(b) (i) Well answered. A minority of candidates had difficulty interpreting the scales and gave an answer of 44 s.

(ii) Many identified the best catalyst as being lead oxide, however the explanation which followed was often disappointing. Candidates did not compare lead oxide to the other catalysts, e.g. lead oxide produced oxygen more quickly than the other catalysts, so gained no credit.

(iii) Poorly answered.

(c) (i) The majority of candidates referred to greater surface area, however few described the increase in collisions required for the second mark.

(ii) Well answered.

(iii) Well answered.

(iv) This question was very poorly answered. Many candidates mentioned the conversion of harmful gases but without reference to the data given in the table. Those who did use the data tended to give general statements rather than quote specific values from the table.

Q.6 Most candidates scored a lower band mark for this QER question. The increase/decrease in oxygen and carbon dioxide levels during respiration and photosynthesis was usually poorly explained. Very few referred to these two processes balancing the levels of oxygen and carbon dioxide in the atmosphere.

Middle band answers showed a better understanding of this idea but did not adequately describe the effect of increase in combustion of fuels.

Q.7 (a) (i) Most candidates scored at least 1 mark for the graph. A fairly challenging scale prevented some from gaining both plotting marks.

Errors were often made at 1950 and 2010. A large number of candidates joined the points with a ruler which gained no credit.

(ii) Well answered. Many candidates gained both marks by giving a simple description and stating the year where the decrease begins.

(iii) Generally well answered.

(b) Very poorly answered. A large number of candidates did not attempt the question. Did they not know the chemical formula for water?

Q.8 (a) (i) Poorly answered. Candidates stated that values increased but neglected to say that this happened on going down the group.

(ii) Poorly answered. Many just quoted the temperatures from the table, without relating to the state of selenium at 400°C. Those who gave the correct state often did not refer to the melting point and the boiling point.

(iii) Poorly answered. A minority of candidates correctly recognised the properties of both metal and non-metal. Many stated that selenium was a semi-conductor as their only explanation.

(b) (i) Poorly answered with almost a fifth of candidates not attempting. The most common incorrect answer was 118 when candidates added the A_r values of one of each atom.

(ii) Very poorly answered. As in part (i) of the question, many did not attempt this calculation. Some of those who did so correctly lost one mark for incorrect rounding of the final answer.

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CHEMISTRY UNIT 2 HIGHER

Q.1 (a) (i) Most candidates scored at least 1 mark for the graph. A fairly challenging scale prevented some from gaining both plotting marks. Errors were often made at 1950 and 2010. Most candidates were awarded the plotting mark for drawing a suitable curve.

(ii) Well answered.

(iii) Generally well asnwered.

(b) Many candidates gained 1 mark for the correct formula of water. The balancing of the equation was disappointing. Some candidates seemed to have been trained to write 2 in every box rather than try to count the atoms present on both sides.

Q.2 (a) (i) Well answered with most candidates referring to an increase down the group.

(ii) Many candidates recognised the correct state for selenium however the reasoning was often not well expressed. Just quoting the temperatures from the table or referring to only one of melting point and boiling point gained no credit.

(iii) Poorly answered. Only a minority of candidates correctly recognised the properties of both metal and non-metal. Many stated that selenium was a semi-conductor as their only explanation.

(b) (i) The majority of candidates gained the mark. The most common incorrect answer was 118 when candidates added the A_r values of one of each atom.

(ii) Well answered. Some candidates lost 1 mark for incorrect rounding of the final answer. A few candidates used a different M_r to that calculated in part (i).

Q.3 (a) (i) Surprisingly poorly answered. Many candidates selected **A**, **D** & **F** stating that they have the same numbers of protons and neutrons and other gave **A** & **D** because they have the same numbers of protons, neutrons and electrons.

(ii) Poorly answered. Only a minority of candidates recognised the correct ions. Some candidates referred to the ion table rather than using the data given in the question.

(b) Poorly answered. Some candidates correctly stated the definition of isotopes and gained 1 mark. Very few explained using the given carbon isotopes which was necessary to gain the second mark. Reference to electrons and ions was common.

Q.4 (a) Many candidates gained 1 mark for calculating the total distance. The commonest error was not converting 0.97 % into 0.0097. Many also had difficulty expressing their final answer in standard form as was required.

(b) (i) Poorly answered as many candidates referred to Wegener's theory of continental drift. Only a few candidates gained more than 1 mark.

(ii) Surprisingly poorly answered. Only a minority of candidates gained both marks. Many candidates referred to a destructive boundary and plates colliding.

Q.5 (a) Well answered. Many candidates recognised the factors that would increase the rate, however few achieved full marks. Only the best candidates referred to a greater chance of successful collisions which was required to score full marks.

(b) The majority answered this question correctly. Candidates failed to gain credit for vague statements such as 'start and end at the same point' without reference to the volume of gas.

Q.6 Many candidates achieved a middle band mark for this QER question. They generally gave a correct description of the trends in reactivity but significant numbers focused on examples of Group 1 reactions with water and oxygen and Group 7 displacement reactions. These were not required and gained no credit. Reference to electronic structure tended to be vague in middle band responses but the best candidates scoring top band marks described increasing numbers of shells and decreasing strength of the attraction between nucleus and outer electrons on descending a group.

Q.7 (a) (i) Well answered. Most candidates gained credit for a method enabling identification of the soft water sample but fewer referred to boiling in order to differentiate between samples with temporary and permanent hardness. Many candidates made no reference to shaking the samples in order to observe lathering.

(ii) The majority correctly recognised **Z** as temporary hard water but did not refer to hydrogencarbonate in their reasoning. Reference to calcium ions and magnesium ions was common but not creditworthy.

(b) (i) Very poorly answered. Some candidates answered without using the term 'ions'.

(ii) Very poorly answered. Only a minority of candidates made reference to the lack of sodium ions.

(c) Many candidates gained credit for the correct M_r of $CaSO_4$. Converting 184 mg into 0.184 g proved beyond many. Credit was lost when the final answer was not given to three significant figures.

Q.8 (a) (i) Very well answered.

(ii) Poorly answered. Candidates referred to the impact of lead on the body or lead being a poisonous metal. To gain credit, candidates needed to link these points to lead entering the water supply.

(iii) Most candidates gained one mark but a minority considered the data very carefully and gained both.

(iv) Well answered.

(b) (i) Few candidates gained this mark. Some simplified the required 6, 2, 6 to give 3, 1, 3 which is incorrect as the equation includes one oxygen molecule. As seen in 1(b), some candidates wrote a 2 in every box, which shows their lack of understanding of balancing equations.

(ii) A significant number of candidates did not attempt this question. Many gained one mark for correctly calculating the mass of oxygen, however few candidates managed to work through to the correct formula. The most common error seen was to round up or round down the 1:1.5 ratio to 1:2 or 1:1 rather than doubling to give 2:3 and therefore the formula Pb_2O_3.

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

PHYSICS UNIT 3 FOUNDATION

This was the second examination of the Double Award Unit 3 specification which means that there were some candidates re-sitting the paper along with those sitting the qualification for the first time.

The percentage of candidates attempting the questions varied from 99.1% down to 74.3%, a range of 24.8%. The questions which had the lowest percentage of attempts were 5(c), 5(d) and 6(a). This significantly reduced the mean mark of these question parts.

There was an obvious trend, in that a large number of candidates couldn't recall definitions or physics facts which are clearly identified in the specification. Assessment Objective 1 (AO1) questions was highlighted as an area on which many candidates lost a considerable number of marks. It was evident, from the statistics, that questions 3(a), 5(c) and 7(a) were the least accessible items on the paper. These question parts were AO1 driven and candidates who had spent time learning their "book work" prior to the examination scored highly. In some numerical questions, quite a few candidates failed to show their workings or incorrectly rounded their final answer. On occasions, the poor quality of some candidates' handwriting made answers difficult to read and numerical workings difficult to follow.

Q.1 (a) (i) Almost all candidates attempted this question part. However, many failed to follow the instruction to use one of the phrases given and proceeded to make up one of their own. Decreasing wavelength was a popular phrase suggested by candidates. Although the statement is correct it wasn't one of the phrases included in the question.

(ii) Generally well answered. Phonetic spelling of infra-red was accepted.

(b) (i) Generally well answered. Despite the word "gamma" being present in the diagram, phonetic spelling was accepted.

(ii) Most candidates identified that ionising e-m radiation may cause cancer.

Q.2 (a) (i) The majority of candidates gained the mark.

(ii) Having selected the correct equation from page 2, many candidates failed to identify they needed to substitute their answer from (a)(i) into it. Frequently 12/2 or 12/6 was seen.

(iii) Some candidates understood the meaning of the command word "state" in the question and correctly quoted their previous answer. Many candidates tried to calculate another current.

(b) (i) Usually well attempted by candidates**.** However, there were a few candidates who missed out the question. Although the instruction was to underline the correct phrase or word, candidates were not penalised if they indicated their answer by other methods. No marks were awarded if two or more had been selected.

Q.3 (a) This was a poorly-answered question. Correct explanations of how heat loss by conduction, convection or radiation could be reduced by cavity board were rarely seen. Some candidates noticed the shiny silver surface labelled on the diagram and correctly made the link to radiation being reflected back into the house. Frequently the three heat transfer methods were confused.

(b) (i) Many candidates showed a good understanding of payback time and interacted with the claim successfully. Candidates who failed to say they "disagreed", based on their correct answer, were limited to 1 mark. It was pleasing to see a variety of correct approaches to this question.

(ii) Generally, most candidates calculated at least one of the values correctly. Some candidates failed to fill in the table as instructed. Values not written in the table were not credited.

(iii) Many candidates decided, incorrectly, to use the CO_2 saving column data as evidence for their selection of mid-terraced house. Identifying that the mid-terraced house had the lowest carbon footprint was key to attaining the explanation mark.

Q.4 (a) (i) Well answered by the majority of candidates.

(ii) Usually correctly answered. However, some candidates ignored information given on the diagram and measured the dimensions using their ruler. No credit was given for this.

(iii) Generally well answered by candidates. It was clear that most candidates understood what a cube is and proceeded to calculate its volume correctly.

(iv) Substitution into the equation was generally good with a high percentage of candidates calculating the cheese density successfully. The unit mark was rarely awarded.

(b) (i) Some candidates realised that it was a good practice to check results but failed to remember that a mean could be calculated or anomalous results identified.

(ii) This part was generally badly answered. Candidates neglected to mention that the ruler in the diagram had a poor resolution. "More accurate" statements were not credit worthy.

(c) Most candidates attempted this part. Generally well answered by the majority.

Q.5 (a) A few candidates missed out the question but it was generally well attempted. Although the instruction was to underline the correct phrase or word, candidates were not penalised if they indicated their answer by other methods. No marks were awarded if two or more had been selected.

(b) (i) Some good attempts at this question part were observed. Generally candidates selected the correct equation from page 2 but then struggled with substituting a time, in seconds, into it. Many missed the '× 6' multiplication factor needed to attain full marks. Occasionally the 230 V was incorrectly selected and used.

(ii) Many candidates successfully calculated the current by selecting the power and voltage from information given.

(iii) Very few marks were awarded on this question part. Surprisingly, many candidates didn't recall the value of the current in the earth wire would be zero when the hand drier was operating normally.

(c) Candidates struggled with this question. Very few could explain role of the rccb.

(d) A few candidates scored full marks on this question. However, the majority of candidates found it difficult or missed it out completely.

Q.6 (a) Only a small selection of candidates could correctly describe a transverse wave.

(b) (i) Quite a few candidates calculated at least one of the values correctly. Some candidates failed to fill in the table as instructed. Values not written in the table were not credited.

(ii) This part was poorly answered by candidates: they either misunderstood the question or failed to follow the instruction and use the data provided in the table.

(iii) Candidates' skills in graph plotting were varied. Some excellent graphs were observed. However, the majority either struggled with the scale, drawing the best fit curve or both.

(c) (i) Some candidates were able to read the wave speed correctly from their graph and proceeded successfully through the question. Many candidates didn't use the graph, as instructed, but substituted the 2.0 m depth into the equation as wave speed.

(ii) Very few could explain whether the statement was correct or not. Many missed out this part.

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

PHYSICS UNIT 3 HIGHER

The entry for this paper was seven and a half thousand from throughout Wales from a total candidature of around thirteen thousand six hundred so these contain the majority of school pupils sitting in their year group.

The mean mark was low at less than 30%, which brings into question the suitability of the entry policy of some school science departments. There is little about which the candidates can be congratulated, except perhaps for their willingness to attempt the questions in the paper with none of the questions showing a figure of less than a 90% attempt rate.

The standard of answers was poor over all with (predictably), those to question 5 showing the lowest success rate. This included the QER question but both parts were poorly answered. Mathematical skills were not of the standard expected and, when coupled with poor graph skills, limited subject knowledge and weak technical language skills, many candidates were not able to demonstrate positive achievement on this paper.

There was a serious mismatch between the standards demanded by the exam paper and the abilities of the young people presented for examination.

Q.1 The graph-drawing skills proved to be the candidates' strongest ally in answering this question and even those were not particularly strong!

In the early parts of the question, there was abundant failure to demonstrate knowledge that a transverse wave involves vibrations that are at right angles to the direction of wave travel. Neither vibrations nor the orientation of them was mentioned in amongst the irrelvancies that were often presented as an answer.

There was little evidence of a calculator's being used by the vast majority of the candidates to find the square root of 1.5 and nor in the multiplication of 1.87 by 3.13 to earn the two marks in part (b)(i).

The majority did not understand the statement at the top of page 5 and hence were not able to investigate its validity by basing answers on depths of 1.0 and 4.0 from the table – the only figures presented that have a ratio of 4:1 as required by the question.

Graphs consisting of a series of straight-line segments in a question that demands a curve be drawn, will not be credited. This was the case for the majority of candidates. A significant number of candidates either used the speed values from the table to construct their scale or omitted the 2 value from their depth scale (most common) or plotted values of $\sqrt{d}$ instead of d.

There was frequent failure to realise that part (c) required candidates to refer to their graph to get the wave speed for a depth of 2.0 m so all marks were often lost here. There were, however, many good answers to this part.

The majority of candidates again failed to show that they knew how to interrogate the statement in the last part of the question.

Q.2 Some physics knowledge should be demonstrated when tackling questions on a higher tier exam paper but over 80% showed that they did not know the advantages of a ring-main domestic power circuit. Both parts of 2 (b) and 2 (c) were poorly answered, with far too many failing to realise that the last part of this question involved a two-stage calculation. (The power-voltage-resistance equation is not included in the specification).

Q.3 Candidates' ability to apply principles of electricity to the circuit that was presented in question 3 was very poor. Disappointingly few had any idea of how to proceed, even using the structure that was in place.

Q.4 Throughout this paper there are examples where a command of basic language is required to concisely make a point in answer to a question. Parts (a)(i) and (iii) fall into this category and many candidates gave answers that failed totally to come to grips with the questions: a comparison between the gas and electricity bills is not expected to rank as a reason for the answer to (i) and startlingly few candidates recognised that the idea of payback time would be being **reduced** by an increase in the unit price of gas.

In answer to the last part of the question, it was rare to find fifty pounds divided between three hundred units of electricity, thus giving a cost of 17 p per unit. In the few cases where the correct figures were used, answers rounded down to 16 p were often given.

Q.5 In part (a), the changes in density of water on each side of the water in the beaker and the reason for it (increase in volume followed by a decrease in volume) were hardly ever seen. Answers were generally irrelevant and meaningless.

In responses to the QER question, answers often mentioned the existence of free electrons in copper but few knew what they actually do. As ever, it was rare to find a well organised passage that had explicit and detailed facts included. The term "particles" was often used without the candidate defining what these particles actually are.

Q.6 This was written in the style of PISA questions. Again, candidates tended to write large amounts without making the main point required.

In part (a)(i) it was obvious that many candidates did not understand the information contained within the stacked bar chart. One wrote in answer to this part of the question "oil made the biggest contribution from the start of the graph to the end" – presumably because the oil component of the chart appeared on the top of each bar. A common answer was that the use of coal hardly changed at all in the production of electricity, although the chart showed that it declined sharply.

Many candidates clearly did not appreciate that nuclear power stations are chosen to run 24/7 for reasons of start-up time and that they produce no CO_2 whilst generating electricity – which is the matter of the whole question! None having been built and none closed down is a very obvious answer to offer but was rarely seen in scripts.

There were many good answers to part (a)(iii) but lots of candidates tied themselves in knots handling the information.

In answer to (b)(i), candidates were required to assess which two quantities to base their answer on and how to perform the required calculation. Many knew that the efficiency equation was the one to use but based on which quantities to create their fraction? Only a small number of candidates managed to get the correct answer..

The last part was a free response part to the question in which the candidates had to assess where we are now in making progress to the end target for carbon reduction against the fraction of time left to make further headway towards the final goal. It was very poorly answered.

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

BIOLOGY UNIT 4 FOUNDATION

General Introduction

Candidates at Foundation Tier score marks most freely on short answer questions, particularly with objective testing and cloze comprehension exercises, which now constitute a relatively small proportion of the paper. There are now more questions calling for uncued recall and longer answers on which Foundation Tier candidates generally struggle. Most candidates had problems with extended writing, often hampered by a very poor level of literacy and an insufficient body of knowledge and understanding necessary to answer direct questioning or to construct coherent and comprehensive answers. It is for these reasons that almost all candidates had difficulties on several parts of the paper and particularly on the Quality of Extended Response (QER) question, which forms 10% of the marks available.

Failure to use the comparative term (e.g. 'more/ less', 'higher/highest') once again resulted in lost marks. Many candidates do not seem to appreciate that substantial clues as to how to answer questions are often to be found in the text and diagrams. Candidates would be well advised to avoid using the term 'amount' when a reference to a specific measurable quantity, such as volume, concentration or mass is required. Poor basic numeracy continues to handicap a substantial proportion of the entry.

Q1. (a) (i) Most candidates scored both marks for correctly describing the trends shown in the graph, though several confounded their answer by simply describing the distribution of the trees.

(ii) Most candidates followed the instructions in parts I and II, correctly labelling the vertical axis, then plotting and constructing neat, accurate bars, originating at the spaces indicated on the horizontal. However, many also made basic errors such as missing the unit from the title, or indeed failing to write a title at all. The mean mark of 2.8 out of 3 confirms that most candidates at this level are proficient at producing simple graphical representation of numerical data.

(iii) This question tests understanding of the term hypothesis and simply requires candidates to copy the first sentence at the start of part (ii), as many did. Other candidates went a step further and made a prediction as to how light intensity would affect the number of plant species – which also gained credit. It was disappointing that a large number of candidates seemed not to understand the term hypothesis and gave irrelevant or unintelligible responses.

(iv) Although well answered by some, once again there was a large number of idiosyncratic responses. Often, answers focused on the trees, or simply stated that the patterns of the graph (L.I.) and the bar chart matched. Commonly, candidates spoiled their answers by omitting 'species' from their answer and asserting that there was a greater number of *plants* found in the higher light intensity.

(v) Less than half the candidates scored the mark here, most usually for 'water'. Simple references to weather, such as 'rain', which was seen a lot, did not score.

Q.2 (a) This question proved to be the least well done of all the low demand questions on the paper, yielding a mean mark of 0.3 out of 2.

(i) Only a few candidates were able to recall that the hedgehog belongs to the Animal Kingdom.

(ii) Some candidates recognised that *Erinaceus* is the Genus. A more popular answer was to write the full binomial name.

(b) Some candidates wrote reasonable answers as to why the scientific name is used in preference to common names, but answers were often too vague, or confused. Hardly any candidates made the comparison between the unique scientific name and the multiple common names, as was heavily cued in the question.

Q.3 (a) (i) Very few candidates successfully recognised both of the correct terms – 'stimuli' and 'impulse' – in the correct order. Most candidates selected from the more general words 'signs', 'messages' and 'signals'.

(ii) Very few candidates indeed could recall both terms in this uncued part of question (a) – namely 'neurones' and 'brain/spinal cord'. However, many scored one mark, most usually for 'brain'.

(b) (i) This question proved to be very challenging. Candidates at this level generally fail to make full use of data and confine their answers to generalisations, such as 'old people don't hear very well', which, though it may be true, is not supported by the data. In order to score a mark, candidates had to include a specified distance from the buzzer in their answer, such as 'up to 15m groups', or 'hearing deteriorates more in older people than in Year 11 pupils after 15m'.

(ii) The idea of fair test is now well known by candidates. Most scored the mark, most usually for 'same buzzer'.

(iii) Suggestions here for what else Jed should have done to make sure he did a fair test included 'same length of buzz/teachers of the same age/no background noise', all of which scored, though commonly, candidates wanted to *extend* the investigation to include other age groups.

(iv) Candidates were asked how Jed would increase his sample size and how it would improve his confidence in his conclusion. Many candidates scored the mark for adding more people, but very few indeed stated that this would provide a more representative sample of the pupils and teachers. The most common responses were to do with reliability or accuracy.

Q.4 (a) (i)&(ii) In this two-part question, a few candidates were able to recall the term 'chromosomes' and somewhat more scored for 'DNA'.

(b) Many candidates at this level find genetics to be very challenging, so part (b) is heavily structured and cued in order to provide some support.

(i) I and II. Many candidates scored at least one of the marks here for recognising the correct genotype and a few got both correct.

(ii) The meaning of the term 'phenotype' remains unknown to almost all candidates. The most common answers by far were to do with the genotype.

(iii) Very few candidates indeed had an understanding of the term 'heterozygous'. A few scored one mark for the idea of dominant/recessive, or that there are different alleles.

Q.5 (a) (i) About 10% of the candidates were able to define the term 'pathogen'.

(ii) Most candidates scored at least one of the two marks available, for how pathogens are spread from person to person, most usually for 'coughs/sneezes/touch/sexual transmission'. Vague responses such as 'sharing a mug' or 'food' were commonly seen and did not score.

(b) (i) Very few candidates indeed could name an antibiotic. The most common offering by far was 'paracetamol'.

(ii) There is widespread confusion in the population on the topic of bacteria and resistance. Only a minority of candidates chose the correct response in this question.

(iii) I Most candidates picked out June 15th and July 15th as being the period during which the increase in total number of bacteria was fastest. A common error was to omit the date within each of the two months.

II The question asks candidates to use the data up to and including the June 15th sample to make the prediction upon which the safety officer based the advice that people should stay out of the water. Many candidates pointed out that there was a steady increase in total numbers, but very few expressed the idea that the safety limit was likely to be crossed before the next sampling date. A large number of candidates discussed the issue in retrospect, showing a misunderstanding of the question. A very common error was to state that the number of *species* increasing, rather than the number of bacteria.

(ii) I Pleasingly, many candidates studied the correct data source (i.e. the table) and gave the correct answers for both marks.

II Part I above, was intended to cue candidates to their answer here; that species B was showing signs of rapid increase in numbers towards the end of the sampling period and therefore monitoring should continue into October. This question proved to be very challenging but, a few candidates did spot the potential problem and got the mark.

Q.6 The Quality of Extended Response (QER) at Foundation Tier appears in the Low Demand section of the paper and so the challenge to the candidate is adjusted accordingly. Candidates are told that mitosis and meiosis are two types of cell division. They are given two diagrams (A and B) and the information that the diagrams show the start and result of both types of cell division in a cell with four chromosomes. The question asks the candidates to use the diagrams and their own knowledge to describe the two types of cell division. They are then given further guided instruction by means of three bullet points.

A response that merely answers the instruction to 'describe what you can see at the start and the result for each type of cell division' (i.e. requiring no knowledge at all) would gain sufficient credit to put the candidate into middle band (i.e. potentially 3 marks, or 50% of the total). It is thus disappointing that a great many answers failed to write this simple piece of description. In fact, 15% of the entry did not attempt it all and the mean mark of 2 out of 6, confined the average performance on QER once again to bottom band. Many answers were very vague, confused, poorly constructed and often just unintelligible. Commonly, answers included reference to 46 and 23 chromosomes, rather than the 4 and 2 chromosomes stated in the question and shown in the diagrams. It remains a very common misconception that one function of mitosis is to repair damaged *cells,* which makes no sense. However, there were also some well organised accounts that gained middle band and several that went on to demonstrate sufficient knowledge to access top band, with a score of six in some cases. It is pleasing that most candidates who used the terms 'mitosis' and 'meiosis' (either by copying from the stem of the question or from memory) did so with correct spelling as is required.

The remaining 15 marks on this paper are allocated to standard demand questions.

Q.7 The passage concerning diabetes is followed by two, single-mark comprehension questions and two questions (totalling five marks) that call for recall of knowledge from the specification.

(a) (i) The passage states that success in how diabetes is managed is dependent on an early diagnosis. Examiners were looking for the idea that the earlier the condition is detected, the sooner it can be treated or managed. The idea that diabetes might be prevented was allowed, but not cured. Many candidates scored the mark. Some answers were too vague, such as: 'so you can do something about it', or inconsequential, as in: 'people would know whether they have diabetes or not.'

(ii) Although 'certain lifestyle choices' can increase the risk of developing type 2 diabetes, other risk factors, given in the passage, are beyond control. Many candidates picked out one or more of these risk factors, most usually 'more likely to occur if it runs in your family', and cited it as a reason why type 2 diabetes cannot be prevented in all individuals.

(b) Candidates are asked to *explain* one way in which 'looking after your own health can reduce the risk of developing type 2 diabetes. Most answers related to diet, and pleasingly, most candidates who took this approach focused on sugar/carbohydrates. Previously, answers tended to discuss specific food items, such as 'potatoes, bread or junk food', none of which would score. A reduced or low sugar/carbohydrate diet scored the mark but 'cut out/no sugar/carbohydrate' did not score. Other acceptable measures included *regular* exercise, or *keep* fit. Very few candidates indeed went on to give the explanation as to why these measures would help reduce the risk – namely to avoid obesity, or lose weight, so failed to score the second mark.

(c) The mark scheme for this question is structured to help candidates access the marks if they provide an account of the effect on blood glucose levels if the liver failed to respond to insulin.

In most cases, candidates seemed to have little idea of the processes involved. However, there were also several candidates who scored at least one mark, most usually for realising that glucose would not be turned into ✓(something) and a few scored a second mark for realising that the molecule in question is glycogen, often spelt correctly, as required. Very few went on to write that 'as a result, blood glucose levels would *remain high,* or *continue* to rise. 'Glucose goes up' – a common response, did not score.

Q.8 (a) (i) The mean score of 0.1 out of 2 marks shows that very few candidates could calculate the percentage increase in mean mass.

(ii) Most candidates at this level did not understand the concept of variation in mass. The question asks at which of the two sites do the snails show the greater variation in mass?. The vast majority opted for either:

- site B because it had the tallest bar, or
- site A as there were more snails at each mass: the idea of *spread* in the data was very rarely seen.

(iii) Some candidates showed an understanding that bias in the investigation was reduced because the scientists sampled at random. However common errors were to state that the *sites* were chosen at random, or even that the scientists picked random snails.

(iv) A more difficult concept in science is the importance of other scientists carrying out the same investigation to test reproducibility. Mark earning answers were seen occasionally and included 'to compare results/see if they get the same results'.

(b) The question asks candidates to use their knowledge of natural selection to explain the long term advantage of genetic variation to *Cepaea nemoralis* in a changing environment. Almost all of the candidates who attempted this question gave very confused accounts which completely missed the point but sometimes even then could get one mark, most usually for the idea of survival. A common error was to assert that the snails adapt *to* the changing environment, thus espousing a Lamarckian philosophy. Examiners were looking for the idea that genetic variation within a species might provide individuals with adaptations or characteristics that gave them a selective advantage in the changing environment, as proposed by Charles Darwin and others. However, even those with a limited understanding could still have gained all three marks for writing that snails with a characteristic✓ could survive better✓ than those without and they would then reproduce✓.

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

BIOLOGY UNIT 4 HIGHER

As in previous years there is evidence that candidates do not read questions carefully enough, they miss essential detail, or instructions, in the question and lose marks. For examinations, instructing students in how to read questions is almost as important as teaching them the contents of the specification.

In Question 1 many of the answers could be obtained by **carefully** reading the article on page 2. It seemed that far too many candidates simply skimmed through the information in order to 'rush on' with their answers.

In Question 2 a **careful** study of the graph and a greater attempt to try and understand what the graph showed would have resulted in more marks being awarded.

In Question 3 candidates are instructed to use the letters **R** and **r** in their answers. Some candidates choose to use other letters and lose marks.

In Question 7(b) candidates are instructed to **'use only the diagram'** to answer the question. Many candidates ignored this instruction and include totally irrelevant information in their answers.

In Question 8(b) (iv) candidates are asked to calculate to **two** significant figures. This instruction was totally ignored by many candidates or they didn't understand the meaning of 'two significant figures'. [***Use an appropriate number of significant figures in calculation*** - Page 74 GCSE Science (Double Award) Specification].

Principal Examiners very rarely ask exam candidates to draw anything on biology papers anymore. On the diagram of the skin (Question 6(a) Page 13) candidates were asked to label 2 structures. The guide lines (labeling arrows) were very often poorly drawn and ambiguous with regard to what they were meant to be pointed at. Not once were guide lines seen which were drawn with a ruler. If they had been then it is almost certain that they labeling would have been more precise and therefore more marks would have been awarded.

Q.1 (a) (i) Responses were generally of poor quality. The reason why people at high risk of developing diabetes should be tested regularly is to **prevent** the disease developing. To treat diabetes **early** was an acceptable answer. To obtain an early diagnosis was a commonly seen unacceptable answer as was to treat diabetes quicker.

(ii) **No** was required. Most gained the mark by referring to age, ethnicity or to the disease running in families. Reference to lifestyle choices or a healthy lifestyle negated any correct answer given.

(b) Generally a poorly answered question.

Far too many candidates made reference to eating a balanced or healthy diet – this was insufficient to gain the mark. **Reduction** of sugar/glucose, carbohydrate or fat in the diet was required. Stating that a high sugar diet could cause diabetes was not enough. A reduction of sugar in the diet was required. This was the same marking point as **regular** exercise/keeping fit. Exercising was not enough to gain the mark.

Very few candidates stated that reduction of sugar/carbohydrate/fat in the diet would reduce the risk of becoming obese or would reduce obesity. This was the second marking point which very few candidates obtained.

(c) Generally not very well answered. Candidates talked about homeostasis, negative feedback, excretion of glucose in the urine, excessive thirst, insulin injections etc. None of this was needed. Examiners were looking for answers stating that glucose would not be changed/converted (1 mark) into glycogen (1 mark) so would remain at a high level in the blood (1 mark). For this third marking point it maybe worth noting that blood sugar level is raised in everyone following a meal containing carbohydrate, because many thought that it only did so when the liver failed to respond to insulin. Reference to glucose not being **broken down** failed to score as did glycogen being spelled incorrectly.

Q.2 (a) (i) Many struggled with the calculation of percentage increase.

$$\frac{12.3}{16.8} \times 100$$

- was a very commonly seen incorrect method of calculation. If the answer was correct then 2 marks were awarded. If the method of calculation was correct but the answer incorrect, 1 mark was awarded for the method. Some candidates rounded down rather than up.

(ii) Many candidates struggled with a correct explanation here. Candidates could refer to the number of bars in the graph, or refer to a greater spread of mass and gain the mark. However if they referred to the masses of snails shown in the graph then the figures used had to be accurate and comparative. It was insufficient to say – **A** because the masses ranged from 10.0 – 14.9 g. They would have to add – whilst in **B** the masses ranged from 15.0 – 17.9 g.

An answer such as – **A** because of the number of bars shown in the graph – was insufficient to gain the mark, a reference to data would be needed here.

Many candidates concentrated on the number of snails shown in the graph but this was irrelevant.

(iii) Well answered.

(iv) Performance was generally poor.
Examiners looked for answers which related to verification/confirmation of results or reproducibility.
Most candidates referred to one the following which failed to gain credit - to get accurate results / for repeatability / reliability / validity / fair testing / a better average.

(b) There were some good answers seen here with many candidates gaining all 3 marks.

However, it is important that candidates understand that the snails already have adaptations, which are selected for in the changing environment. Thus they gain an advantage and are more likely to survive. Many candidates stated that in the changing environment the snails developed an adaptation – this statement failed to gain credit.

An adaptation being an advantage for survival was better known, as was the need to reproduce.

To state that the snails pass on their genes/alleles is insufficient to gain credit. They must state that the **advantageous** gene/allele is passed on.

Q.3 For this 7 part question an average of 8% of the candidates left the answers blank i.e. they failed to attempt the question. Amongst this relatively large percentage of candidates, knowledge of genetics was poor.

(a) (i) Generally poorly answered. Very few candidates understood that the offspring are obtained very quickly and that it is the offspring which are analysed in genetics experiments.

Answers which were commonly seen but didn't gain credit included – they reproduce quickly; large numbers of offspring produced; it's a quicker time to investigate.

(ii) Very few correct responses. Candidates did not understand that the more offspring available to analyse the greater the confidence in the results.

A great many different incorrect answers. The more commonly seen included - more flies to study; it doesn't matter if some flies die because there's plenty to investigate; the results are more accurate and reliable.

(b) (i) Very well answered.

(ii) Well answered.

A number of candidates crossed **Rr** x **Rr** or **RR** x **Rr**. In these cases they lost the gametes mark but could still pick up 1 mark if the mechanics of the cross was correct. If other letters were used, other than **R** and **r** then the gametes mark would be lost but the mechanics mark could still be obtained. The exception this rule was the use of the letters **X** and **Y** or **F1** and **F1.**

(c) (i) Far too many candidates had this question wrong. All answers had to be 3:1 to gain the 1 mark available. Incorrect ratios of 2:1 and 4:1 were often seen. Some gave a ratio of 1:3 for all answers.

(ii) About a third of the candidates gave the correct answer.

Some candidates stated that no offspring were produced – this answer needed qualification such as the F1 parents were sterile or the F1 parents didn't breed.

(iii) Some found this very difficult. A few candidates had the correct answer stating that the table had been filled in incorrectly, or the figures had been reversed and entered in the wrong columns.

All sorts of answers were given such as the eye colour of the F1 parents was reversed or a mutation occurred.

(iv) Very well answered.

Q.4 Generally well answered with most candidates being placed in the top or middle bands.

Most were familiar with the main components of the reflex arc:

- sensory neuron
- spinal cord or coordinator (not brain and spinal cord)
- relay neuron
- motor neuron
- effector/muscle

Recalling these 5 components in the correct order put the candidates into the middle band. In order to achieve top band candidates needed at least another two of the following correctly placed:

- stimulus + receptor
- (electrical) impulse (not electronic)
- synapse (correct position)
- contraction of effector/muscle withdrawing the hand

Q.5 (a) Very well answered.
An answer of 39.1 was awarded 1 mark only as the candidate was expected to turn this into a whole number. The correct method of calculation with an incorrect answer was awarded 1 mark.

(b) Many candidates struggled to gain the mark here.
Carrying out the investigation in the same conditions was not enough to gain the mark. The conditions had to be stated – damp day or early in the morning.

A surprising number of candidates stated that they sampled each area only once. This answer was incorrect as each area was sampled twice.

Unacceptable answers included: sampled in the same weather conditions; sampled the same number of snails; used the same equation both times and they sampled the same areas.

(c) Most gained the first mark by stating that the white ink spot made the snails more easily seen by the song thrushes. A comparative answer was required – the snails were **more** conspicuous, **less** camouflaged or **more** easily seen.

Use a different marking technique was insufficient to gain the second mark. Candidates had to suggest a suitable alternative marking technique. Mark with ink which came off after a certain time, failed to gain a mark as did reference to the use of biodegradable or invisible ink.

Q.6 (a) Generally well answered with the labeling of the erector muscle causing most difficulty. It seemed that some candidates were unfamiliar with the diagram.

The label arrows on the diagram had to be unambiguous, for example – an arrowhead or line landing on the junction of the sweat gland and the start of the sweat duct failed to score.

(b) (i) Well answered with most candidates gaining both marks. It was expected that the candidates rounded their answer to whole seconds.

(ii) Some found this difficult. Reference to the volume of sweat produced was required rather than to the speed or the rate of sweating or to changes in the colour of the cobalt chloride paper. These answers failed to score. For example – the hotter it is the faster you sweat = 0 marks.

(iii) Not well answered. Very few candidates studied the table sufficiently well enough to realize that each volunteer was subjected to one temperature only and therefore no comparison could be made between the different volunteers.

(iv) Only a few candidates understood the purpose of the colour standard – it shows when the cobalt chloride paper has absorbed as much water vapour as possible. (This then determines when the timer can be stopped for each volunteer.)

(c) Generally well answered. Most gained the mark for sweat but fewer said that the sweat evaporated. It was acceptable to state that the water in the sweat evaporated but not just water evaporated.

(d) About a third of the candidates gained the mark here. Far too many failed to refer to mitosis (correctly spelled) in their answer. Examiners were looking for reference to uncontrolled mitosis.

Answers such as radiation from the sun and exposure to UV light were not credited.

Q.7 (a) Some candidates scored all 3 marks. But, many descriptions were ambiguous, often confused and lacked essential detail.

Candidates were expected to study the diagram and use the information found in it to explain what happens if a foreign antigen enters the body. Many candidates used very little of the information in the diagram in their explanation. The reason for this is difficult to understand.

Very rarely do candidates refer to the production of large numbers or clones of lymphocytes and memory cells. They don't understand that the initial production of large numbers of lymphocytes is a slow process. Antibody production was commonly seen but stating that they kill/fight/attack antigens failed to gain credit.

It is difficult to understand why many candidates referred to **a memory cell** being produced.

Candidates understood that during a second encounter with the same antigen the response against it would be more rapid but this answer had to reference the involvement of memory cells.

(b) Many candidates struggled with this question. Responses were expected to compare Population 1 and Population 2. Far too many candidates made a simple statement such as – if you are vaccinated you won't catch measles or if you're not vaccinated you'll catch measles. The question is not about the individual. Candidates were expected to state what they could see on the right-hand side of both the top and bottom part of the diagram.

The instruction in the question was to **use the diagram only.** Therefore references to memory cells, lymphocytes, phagocytes, white blood cells, the immune response, antigens and antibodies etc were not credited. Using **only the diagram** you are left with describing the number/proportion of people who contract the disease in the unvaccinated and vaccinated populations.

Q.8 (a) (i) Most candidates had a general understanding of the meaning of the term invasive species and gained a mark. However the second mark seemed more difficult to obtain. Answers such as – they can take over an area; they compete with other wildlife; they affect biodiversity; they ruin the food chain; they harm native species – were insufficient to gain the mark.

(ii) Generally well answered.

Commonly seen errors included – writing the scientific name exactly as it appeared on the public information notice; starting the specific name with an upper case **V**; misspelling the scientific name; reversing the specific and generic names.

(iii) Generally well answered

(b) (i) Generally well answered.

Both the route and date were required for the mark. A commonly seen error was to state that the shrimp arrived in the river Rhine in 1994. The actual arrival date was 1993 but 1992 was an acceptable answer

(ii) Very well answered.

(iii) Poorly answered. Even after gaining credit in the previous question many candidates stated that the shrimp crossed the through the waters of the English Channel by some means or another.

A few candidates suggested accidental travel by birds and gained the mark. Very few suggested that the shrimp or its eggs travelled on the fishing equipment of British anglers fishing the rivers of mainland Europe or European anglers fishing the rivers of Britain.

(iv) Generally well answered with most candidates gaining one of the two marks available. Some candidates lost one mark for failing to answer to two significant figures. Could it be a failure on their part to read the question or were they unfamiliar with the term ‘significant figures’?

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

CHEMISTRY UNIT 5 FOUNDATION

Q.1 (a) (i) Attempted by nearly all candidates with the majority correctly naming water as the product. Common errors included carbon dioxide, oxygen and hydrogen.

(ii) Attempted by nearly all candidates with the majority correctly identifying neutralisation as the correct answer. Incorrect answers were equally chosen from the three incorrect choices.

(b) (i) Attempted by nearly all candidates with the majority correctly identifying the two correct times. Incorrect responses commonly included 3:20 (result 2); 4:30 (the mean) and 5:36.

(ii) Attempted by most candidates with the majority giving the correct time in seconds. Common incorrect responses included 268s or 272s.

(iii) Attempted by most candidates with the majority correctly referring to brand 3 taking the shortest time or being the quickest/fastest to neutralise the acid/turn the indicator green. Other correct responses included saying that brand 3 was faster/quicker that the other two brands or that it has a faster time than the others. Incorrect responses lacked any comparison (e.g. 3 was fast/quick) or made reference to surface area or temperature.

Q.2 (a) (i) Attempted by nearly all candidates with around half gaining the mark. Incorrect responses varied and included references to energy only; heat being taken in/absorbed, a warm/hot reaction; having a high temperature and giving off flames.

(ii) I Attempted by nearly all candidates with around half correctly identifying aluminium as being oxidised. Incorrect responses were varied and included chromium; aluminium oxide; chromium oxide and oxygen.

II Attempted by nearly all candidates with around half correctly identifying that oxygen was lost, taken away or removed. Incorrect responses included oxygen being gained; aluminium taking the oxygen and 'to make something smaller'.

(iii) Attempted by nearly all candidates with the majority correctly identifying that aluminium is more reactive than chromium. Incorrect responses included saying that aluminium is very reactive or that chromium is not very reactive (without a comparison) or that they had different reactivities.

(b) (i) Attempted by nearly all candidates with less than half of the all responses being awarded any marks. Very few candidates were able to explain the observations in terms of the reaction taking place. However, a number of responses were awarded 1 mark for identifying that the solution turned blue combined with the idea that a solid was formed on the wire. No credit was awarded when there was no reference to the silver or copper(II) nitrate.

(ii) Attempted by the majority of candidates but very poorly answered in general. Only a minority of the responses were awarded any marks. The majority were unable to give the correct formula for silver nitrate and were therefore not awarded any marks. Most candidates who gave the correct formula for silver nitrate were then able to correctly balance the equation.

Q.3 (a) (i) Attempted by most candidates with around half being able to correctly complete the bonding diagram. Incorrect responses included the use of double headed arrows, movement of electrons from chlorine to magnesium, movement of more than 2 electrons from magnesium, movement of just 1 electron and movement of electrons from the inner shells.

(ii) Attempted by nearly all candidates with less than half being awarded any marks. There were very few candidates who gained both marks. Incorrect responses included 2:8:8 and 2:8:2 as the electronic structure for the magnesium ion and −2, +1 and +2 as the charge on the chloride ion.

(b) (i) Attempted by nearly all candidates with around half being able to correctly draw the covalent bonding diagram for a chlorine molecule. Incorrect responses included the use of an ionic bonding diagram and drawing the full electronic structure of just one chlorine atom.

(ii) Attempted by nearly all candidates with around half being able to correctly name covalent bonding. Incorrect responses included ionic bonding and metallic bonding.

Q.4 (a) (i) Attempted by nearly all candidates with only a small number being awarded the full 2 marks. Around half of responses gained 1 mark for mentioning marine life of some description, millions of years or pressure. Incorrect responses included references to life/plants/animals in general (without reference to sea/ocean/marine) and inappropriately short time periods (hundreds/thousands of years).

(ii) Attempted by nearly all candidates but very poorly answered in general. Only a minority were awarded the mark for correctly referring to non-renewable as meaning it will run out, is finite or that it cannot be replaced or remade. Common incorrect responses included cannot be re-used, cannot be changed back, cannot be renewed and is not sustainable.

(b) (i) Attempted by nearly all candidates with only a very small number being awarded the full 2 marks. A minority of responses were awarded 1 mark for correctly giving fractional distillation or boiling points.

(ii) Attempted by nearly all candidates with the majority correctly identifying crude oil as a mixture.

(c) Very poorly answered in general. Only a minority of the responses were awarded any marks. Some gained 1 mark for correctly finding the M_r value of butane. A significant number of candidates did not attempt this question.

(d) (i) Attempted by the majority of candidates but very poorly answered in general. Only a minority of the responses were awarded the mark for correctly identifying propene.

(ii) Attempted by the majority of candidates but very poorly answered in general. Only a very few candidates were able to identify all of the hydrocarbons in both parts of the question for 2 marks. There were a small number of candidates who were awarded

1 mark for correctly identifying one correct hydrocarbon in both parts of the question.

(e) Attempted by the majority of candidates with only a very small number of responses being awarded the full 2 marks. Around half of responses were awarded 1 mark for correctly naming both landfill and incineration (without adequate explanations) or giving a more complete answer for either landfill or incineration. Responses not credited included references to throwing plastic into the ocean/sea/street, recycling/re-using/putting in the bin, damage to animals or their habitats, global warming or pollution (without mentioning the gases involved) and the smell from landfill.

Q.5 (a) Attempted by the majority of candidates with around half of responses correctly recognising that all of the fuels burn very easily or that they all burned the same. Responses gaining no credit included those saying that the burning of the fuels was not relevant to the investigation and that the students did not need to burn the fuels.

(b) Attempted by nearly all candidates without around half of responses identifying the correct order from the list. Incorrect responses were randomly distributed, suggesting those candidates simply guessed.

(c) Attempted by the majority of candidates but poorly answered in general. The majority of responses were not awarded any marks. Very few were awarded both marks for correctly identifying fuel **C** and then going on to saying it contained both SO_2 and CO_2, or saying that **C** was the only fuel that emitted SO_2.

(d) Attempted by nearly all candidates with the majority of responses correctly calculating the cost efficiency of fuel **B**. Some candidates gave the wrong answer having selected the correct values suggesting that they had no calculator.

(e) Attempted by nearly all candidates with the majority of responses being awarded 1 mark for two correct choices from the list. Only a very few responses gained 2 marks for correctly identifying all 4 correct choices from the list.

Q.6 Poorly answered in general. Most responses were awarded lower band marks for correctly naming or describing the process taking place in one or two of the stages or for describing one or two of the observations made during the preparation. A small number of responses were awarded middle band marks for correctly naming each stage of the preparation as well as describing the observations. The very few top band responses also included an explanation of each of the stages. Only the best candidates included a suitable equation. A significant number of candidates did not attempt this question or gave responses that were not worthy of any marks.

Q.7 (a) Attempted by nearly all candidates with most being awarded 2 or 3 marks. The points at 20s and 60s were often incorrectly plotted. Marks were also lost for not using a ruler to draw the line of best fit and for not drawing the line from the origin.

(b) (i) Attempted by most candidates with the majority of responses being awarded 2 marks for correctly calculating the percentage error. A significant number gained 1 mark for correct working but gave no final answer as they had no calculator.

(ii) Poorly answered in general. Only a very few responses correctly referenced the copper falling off the electrode or being left in the beaker. Incorrect responses varied and included references to needing more time, the copper(II) sulfate not fully reacting, impurities in the copper(II) sulfate and not enough power during the electrolysis. There were a significant number of candidates who did not attempt this question.

(c) (i) I Poorly answered in general. Only a very few responses were awarded 2 marks for recognising the aluminium ions as being positive and the cathode as negative and then stating that opposites attract. Many responses were awarded 1 mark for recognising that opposite charges attract. Responses gaining no credit included those not identifying aluminium as ions or Al^{3+}, not identifying the cathode as being negative and getting the charges the wrong way around. A significant number of candidates did not attempt this question.

II Very poorly answered. The majority of candidates who attempted the question were unable to give the correct products and were therefore not awarded any marks. However, most candidates who gave these were then able to correctly balance the equation. There were a significant number of candidates who did not attempt this question.

(ii) Only a minority of responses gained the mark for the correct formula of potassium carbonate. A significant number of candidates did not attempt this question

Q.8 (a) Very poorly answered in general. Only a minority of the responses were awarded the 2 marks for calculating the energy released as 3466kJ. A small number were awarded 1 mark for having the answer within their working but then going on to use this number in unnecessary further calculations. A significant number of candidates did not attempt this question.

(b) The majority of responses were awarded 1 mark for the energy value calculation (either for the correct answer or in the majority of cases by error carried forward). Only a very few responses were awarded the second mark for the correct explanation. Incorrect responses included stating that energy is given out without any reference to energy being taken in and saying that the value was positive for an exothermic reaction. A significant number of candidates did not attempt this question.

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

CHEMISTRY UNIT 5 HIGHER

Q.1 (a) Attempted by nearly all candidates with most being awarded 3 marks. The points at 20s and 60s were sometimes incorrectly plotted. Marks were also lost for not using a ruler to draw the line of best fit and for not drawing the line from the origin.

(b) (i) Attempted by nearly all candidates with most being awarded 2 marks for correctly calculating the percentage error. A significant number of responses were awarded 1 mark for correct working but gave no final answer suggesting that the candidates had no calculator.

(ii) Attempted by most candidates but poorly answered in general. Only a very few responses correctly referenced the copper falling off the electrode or being left in the beaker. Incorrect responses varied and included references to needing more time, the copper(II) sulfate not fully reacting, impurities in the copper(II) sulfate and not enough power during the electrolysis.

(c) (i) I Attempted by nearly all candidates. The majority were awarded 1 mark for recognising that opposite charges attract. There were a significant number who also correctly identified the charges of the aluminium ions and the cathode to gain the second mark. Incorrect responses included not identifying aluminium as ions or Al^{3+}, not identifying the cathode as being negative and getting the charges the wrong way around.

II Attempted by nearly all candidates but very poorly answered in general. The majority of candidates were unable to give the correct products and were therefore not awarded any marks. However, most candidates who gave these were then able to correctly balance the equation.

(ii) Poorly answered in general. Only a minority of candidates were awarded the mark for the correct formula of potassium carbonate. A significant number of candidates did not attempt this question.

Q.2 (a) Attempted by nearly all candidates with around half being awarded the 2 marks for correctly calculating the energy released as 3466kJ. A significant number were awarded 1 mark for having the answer within their working but then going on to use this number in unnecessary further calculations.

(b) Attempted by nearly all candidates with the majority being awarded 1 mark for the correct energy value calculation (either for the correct answer or in many cases by error carried forward). Only a very few responses gained the second mark for the correct explanation. Incorrect responses included stating that energy is given out without any reference to energy being taken in and saying the value was positive for an exothermic reaction.

Q.3 (a) Attempted by most candidates with the majority being awarded 1 mark for either linking fraction size to boiling point, fraction size to the position it is collected in the column or boiling point to the position it is collected in the column. Only a minority were awarded the full 2 marks for correctly linking fraction size to **both** boiling point and the position it is collected in the column. Generic descriptions of fractional distillation (e.g. the size of the chain determines the boiling point and so determines where the fraction comes out of the column) gained no credit. Some candidates described the patterns incorrectly (e.g. the smaller molecules have higher boiling points; the larger molecules condense at the top of the column) and others described fractional distillation as 'breaking apart' the hydrocarbons.

(b) (i) Attempted by nearly all candidates with around half of the responses being awarded the mark for the formula C_4H_8. Incorrect formulae often had the correct number of carbon atoms but the wrong number of hydrogens e.g. C_4H_{10}; C_4H_4 and C_4H_{16}.

(ii) Poorly answered in general. Only a minority of responses were awarded the mark for giving both heat and catalyst as the reaction conditions needed for cracking. Many gave only one of these conditions which gained no credit. Some named a random chemical process e.g. oxidation, cracking. A significant number of candidates did not attempt the question.

(iii) Attempted by nearly all candidates with around half correctly recognising that smaller fractions are more useful and in greater demand. Other correct responses included reference to making monomers/plastics and to conserving crude oil supplies. Incorrect responses included describing cracking as separating the crude oil into useful parts.

No credit was awarded for 'unlocking the full potential of the crude oil'; 'making the oil more useful'; 'making more oils from crude oil' or 'making sure none of the crude oil is wasted'.

(c) (i) Attempted by nearly all candidates. Less than half correctly defined the term isomer.

Responses not credited mainly consisted of inadequate or vague descriptions, e.g. different ways of drawing the same hydrocarbon; the same molecule arranged in different ways. Some candidates defined isotopes.

(ii) Attempted by nearly all candidates but responses varied significantly. A minority of were able to draw both isomers correctly for 2 marks. The majority were awarded 1 mark for correctly drawing one of the isomers – usually methylbutane. The second isomer given was very often also methylbutane (or pentane) drawn with different bond angles. Credit was lost when bonds between atoms were omitted. Weaker candidates included double bonds or hydrogens bonded to more than one carbon.

(d) Very poorly answered in general. It was evident that being able to deduce a simplest formula (specified as content in Unit 2) had only been remembered by a minority of candidates. Of those that did remember the method, most were awarded 3 marks for correctly working out the simplest formula and identifying it as an alkene. There were a significant number of responses that were awarded 1 mark for correctly calculating the mass of hydrogen in the compound.

A significant number of candidates did not attempt this question.

Q.4 (a) (i) Attempted by most candidates but poorly answered in general. Only a very few were awarded the 2 marks for recognising the need for knowing whether or not there was an excess and that this was to ensure all of the acid was neutralised. The majority of correct responses were awarded 1 mark only for suggesting that the potassium carbonate is or should be in excess. Weaker candidates had little idea where to start and some referred to fair testing.

(ii) Attempted by nearly all candidates but very poorly answered in general. Only a very few responses were awarded the 3 marks for correctly giving the formulae of the reactants, the formulae of the products and then going on to balance the equation correctly. There were a small number of responses that were awarded 1 mark either for the correct formulae of the reactants or the products. Very few candidates who gave the correct formulae of both the reactants and the products failed to balance the equation. Incorrect formulae for potassium carbonate (e.g. KCO_3) and potassium chloride (e.g. KCl_2) were common as was the omission of water or carbon dioxide as products.

(b) (i) Attempted by nearly all candidates but very poorly answered in general. There were only a very few that correctly recognised that the point of neutralisation could have been overshot. No credit was given for reference to an excess of acid without mention of the end-point. Again, weaker candidates stated that repeating was necessary to ensure a fair test.

(ii) Attempted by most candidates but very poorly answered in general. The majority of responses gained no marks. A very few responses correctly gave the ionic equation for the formation of water and went on to identify the source of the ions. Incorrect responses included full equations and symbol equations with charges next to each species.

(iii) Attempted by nearly all candidates but answered poorly in general. Only a minority of candidates were awarded the mark for correctly sketching the energy profile of an exothermic reaction. Some gave the diagram for an endothermic reaction.

(c) (i) Attempted by nearly all candidates but answered poorly in general. Only a minority of candidates were awarded the mark for recognising that both salts contained potassium and that both would give a lilac flame. Incorrect responses included references to flame tests working with metal ions but not salts! Weak candidates stated that 'the flame test only works with hydrogen/oxygen'.

(ii) Attempted by nearly all candidates but poorly answered in general. Only a very few responses were awarded 2 marks for correctly giving a test that could be used to tell the salts apart. Approximately equal numbers used barium chloride and silver nitrate.

A significant number of responses were awarded 1 mark for giving the test without the correct observations. Incorrect responses included the limewater test, the 'squeaky pop' test, references to filtration, evaporation or distillation and the use a pH indicator.

Q.5 (a) (i) A significant number of candidates did not attempt this question. Around half of the responses were awarded 1 mark for correctly calculating the mass of copper formed as 1.39 g. Only a minority were able to use this value to show that the percentage yield was 109 %. Incorrect responses included calculating the mass of oxygen lost from the copper(II) oxide and using the wrong A_r values. Some used apparently random values not given in the question.

(ii) A significant number of candidates did not attempt this question. Only a very few responses were awarded the mark for recognising that the reactants were impure, that the charcoal had reacted with the air or that the charcoal was in excess. Incorrect responses included 'not heated for long enough'; 'more heat/energy needed'; 'masses not weighed accurately' and 'reactants were lost because the reaction was too violent'.

(b) (i) A significant number of candidates did not attempt this question. Only a very few responses were awarded 2 marks for correctly giving a balanced symbol equation for one of the reduction reactions that takes place. A few responses were awarded 1 mark for the correct formulae of both the reactants and products without correct balancing.

(ii) Attempted by the majority of candidates with many being awarded 1 mark for correctly calculating 22 % of the mass of the iron ore. Only a very few went on to correctly use this figure to calculate the percentage of iron in the iron ore for 3 marks. Very few candidates who were awarded the second marking point failed to calculate the final answer.

Q.6 (a) Attempted by nearly all candidates with the majority correctly choosing the correct answer from the list. Box 4 was by far the most common incorrect answer.

(b) Attempted by nearly all candidates with around half of responses being awarded 1 mark for either mentioning unsaturated fats being present or the bromine reacting with the double bond. Only a very few correctly linked the unsaturated fats in the oils to the bromine water reacting with the double bonds. Incorrect responses included references to alkenes and to the bromine water not having a strong enough colour to make the oil coloured.

(c) Attempted by most candidates although responses varied significantly. Only a very few were awarded 3 marks for correctly using data from the table to prove that the statement was incorrect and that the new oil contained approximately 25 % saturated fat. The method these candidates used varied but all were credited for obtaining this result. Credit was not given to responses that simply agreed or disagreed with the statement without using the data in some way to support the answer. Some calculated this value and then failed to refer to the original claim.

(d) This was attempted by the majority of candidates. Only a minority were awarded 2 marks for correctly identifying the new oil as having the least amount of saturated fat and for linking this to there being less chance of high cholesterol or heart disease. A significant number of responses were awarded 1 mark for reference to it lowering cholesterol / reducing heart disease or for saying it had lower saturated fats than the others.

Q.7 A significant number of candidates did not attempt this question. The majority of responses were awarded lower band marks for either attempting to describe or draw the ionic bonding in magnesium chloride or for attempting to describe either the melting point or conductivity of magnesium chloride. There were a significant number of responses that were awarded middle band marks. These commonly gave the correct ionic bonding diagram for magnesium chloride as well as some attempt to explain either the melting point or conductivity of magnesium chloride. A very few responses were awarded top band marks. In these examples, good explanations for both the melting point and conductivity of magnesium chloride were seen. Some potentially good answers were spoiled by incorrect use of 'atoms' and 'ions' and reference to intermolecular forces. Weaker candidates included diagrams showing covalent or metallic bonding.

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

PHYSICS UNIT 6 FOUNDATION

Not one question part was attempted by all candidates. Knowledge and understanding of radioactivity and of a specified practical investigating terminal speed were very poor. Candidates are generally more successful in completing calculations especially ones involving a single stage and given an equation. They are less successful when required to write a description or explanation of any length.

Q.1 (a) Mean mark – 1.6

Nearly all candidates spotted the pattern to obtain the missing value for thinking distance. However some then used a similar method to determine the overall stopping distance value. They did not realise a value in the bottom row is the sum of the two values above it.

(b) Mean mark – 1.1

This was generally not well answered. There was no recognition which distance would be affected in each scenario.

Q.2 (a) Mean mark – 0.8

This part was not attempted by approximately 17% of candidates. Of those that did attempt it, a minority gained both marks.

(b) Mean mark – 2.2

(i) & (ii) Most candidates earned credit here for recognising that the temperature decreased with distance from the Sun and could identify the planet that did not follow the pattern.

(iii) The main error was to ignore the minus sign when deciding on a temperature.

(iv) Most candidates decided that the suggestion is true. Typically they compared a gas giant e.g. Jupiter, with a rocky planet e.g. Venus, which supported their answer. However, they were required to examine the data to also find other pairs of planets that disagreed with the suggestion. Few did this. It should be noted that to earn both marks a concluding statement about the validity of the suggestion is needed.

Q.3 (a) Mean mark – 1.0

(i) The introduction to the question included a statement about Hooke's Law no longer being obeyed beyond point E. From the answers given, it is very doubtful that the majority of candidates noticed this.

(ii) A minority of candidates realised that this force would extend the spring beyond its elastic limit. Even fewer stated that the consequence of this would be permanent elongation.

(b) Mean mark – 3.4

(i) Candidates are more secure in completing calculations especially when the equation is provided. On this occasion, they had to obtain data from the graph to substitute into the equation, and most did this successfully.

(ii) Few candidates understood how a smaller spring constant would affect the steepness of the line.

Q.4 (a) Mean mark – 0.8

Candidates could usually calculate one of the answers correctly.

(b) & (c) Mean mark – 2.5

(b) To respond to these parts candidates were required to extract the appropriate information from the table as well as select equations from page 2. Many candidates were unable to do this.

(c) Despite the question asking for 'one **other** way', it was surprising how many candidates stated 'use an electric car'.

Q.5 (a) Mean mark – 1.4

(i) The majority of candidates knew what is meant by terminal speed.

(ii) This is one of the specified practicals so candidates should have experience of attempting it. This was not evident from the responses seen. It was rare to see an answer that achieved a mark above the bottom band. The experimental set-up was shown in the diagram but this did not prompt a logical description. It would be very difficult to repeat the experiment from the vast majority of the descriptions given. Some candidates described how they would collect the apparatus and how they would set it up and omitted to say anything about the method they would use to carry out the investigation. Others explained how the terminal speed is affected by weight so heavier cake cases would fall faster. The few who did reasonably describe a method ended by saying 'the time to fall will give the speed' without describing how this is done.

(b) Mean mark – 4.0

(i) The majority of candidates correctly deduced the missing value of terminal speed. However a number thought they had spotted a pattern in the column i.e. 1.7 $\rightarrow$ 2.2 $\rightarrow$??, and inserted 2.7 as their answer ignoring the fact that the next number was also 2.7

(ii) Most candidates were credited with both plotting marks but less managed to join them with a smooth curve.

(iii) Usually candidates could select a pair of time values to match a doubling in number of cake cases. Most were unable to proceed any further. Examples were seen where the difference in times was found and this value compared with 0.5. In other examples, candidates ignored the question and compared values of terminal speed. This is another example of a style of question that must include a concluding statement about the validity of the suggestion to earn full marks.

Q.6 (a) Mean mark – 1.6

Very few candidates identified the three correct statements.

(b) Mean mark – 0.1

Approximately 26% of candidates failed to attempt this question part. Of those that made an attempt, few earned any credit. Some disagreed with the statement because 'beta is blocked by aluminium'. Others agreed 'because beta is blocked by aluminium'. Some even referred to aluminium passing through beta! This was another question requiring a concluding statement to gain all the marks.

(c) Mean mark – 0.5

Approximately 15% of candidates failed to attempt the question.

(i) Most candidates were unable to provide an explanation. There were statements such as 'it takes 29 years for the isotope to live', and 'it takes 29 years to stop working'.

(ii) Few candidates were able to complete the calculation of time. Examples of calculations seen include:

- 29×8
- 29/8
- 90/8

(d) Mean mark – 1.5

(i) Approximately 16% of candidates failed to attempt the question.

Correct answers were seen but they were in the minority. In the majority of responses there was a failure to convert 5 minutes into 300 seconds so common to see answers of 30 cps. Another common error was multiplying the measured count by the time to give answers of 750 and even 45 000 cps.

(ii) The automatic response to a question about improving accuracy is to state repeat the experiment. This earned a mark. However candidates could not come up with another method. Teachers need to be aware that candidates think they get confused when counting and need to 'find better ways of doing it'.

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

PHYSICS UNIT 6 HIGHER

It was clear that many candidates had been correctly entered for this higher tier examination. However, a number of candidates would evidently have been better entered for foundation tier. It was very disappointing that no section of the paper was attempted by 100 % of the candidates. Questions which demanded recall of specification content were very poorly done. It was also disappointing that candidates often performed poorly in questions based around practical work. In calculations candidates often lost marks due to incorrect rounding.

Q.1 (a) Mean mark 2.1

This was done well by higher tier candidates.

(b) Mean mark 0.5

Despite being early in the paper, only 96.2% of candidates attempted this question part. The responses lacked clarity and candidates rarely communicated that the beta count rate would reduce with increasing thickness. This proved to be one of the worst performing sections of the paper.

(c) Mean mark 2.2

(i) It was rare to see a fully correct definition of half-life with many vague answers. Many candidates did not fully answer the question and made no reference to the 29 years.

(ii) The use of fractions caused difficulty for many candidates who, rather than consider fractions, attempted to repeatedly halve 90 or 29.

(d) Mean mark 2.3

(i) Most candidates here recognised that they needed to divide by a time period to determine the count rate, although many did not realise that they needed to convert the minutes into seconds, despite the emboldening of seconds in the question.

(ii) This was reasonably well done and many candidates were able to gain 1 or 2 marks here.

Q.2 (a) Mean mark 0.8

(i) Most candidates gained a mark here.

(ii) Given that this is a specified practical, which really lends itself to discussions about random errors in timing, this was very poorly done, with most candidates unable to explain why repeat readings are taken. It was common to see answers such as to make it fair or to make it repeatable. The idea that it would allow repeatability to be checked or to identify and remove anomalies was lost on most candidates.

(b) Mean mark 4.3

(i) It was surprising to see many candidates evidently guessing an answer to fit the pattern rather than following the instruction to use an equation to complete the table, perhaps because they failed to read the question.

(ii) Very few candidates attained all 4 marks for graph plotting, a skill which should be very familiar. It was not uncommon to see non-linear scales, especially on the x-axis. Most candidates attained the plotting marks, although they should be encouraged to use neat crosses so that the accuracy of their plots can be checked. Plots which are far too large and thick cannot be judged gained no credit. The quality of the curves was generally poor and lines which were obviously too thick, disjointed or 'hairy' could not be credited.

(iii) Most candidates were able to gain the first mark as they correctly identified a pair of masses and their corresponding speeds. It was pleasing to see some candidates go on and attain all 3 marks here but many had no idea what a 'factor' was or how to determine it.

(c) Mean mark 0.4

This was poorly answered, most struggling to identify a sensible improvement to this method despite the fact that all should have done this experiment. There were many vague answers such "Use a laser," or "Use a computer."

(d) Mean mark 0.4

This was one of the worst answered sections on the paper. Where candidates gained marks, it was often for using $w = mg$ although the vast majority failed to convert the mass into kg.

Q.3 (a) Mean mark 1.2

(i) This was a straight-forward question but surprising poorly done by many. Candidates often failed to communicated the idea of forces being equal and opposite.

(ii) This was not well understood with many candidates not explaining the relevance of the 261 years in their answers.

(b) Mean mark 1.5

It was pleasing to find a small number of very good responses to this QER although it was common to see even the very good candidates failing to interact with the information given to them on the HR diagram. However, in many cases candidates did not write coherently, the quality of their written communication being poor and their knowledge was lacking.

Q.4 (a) Mean mark 0.2

This proved to be the worst performing section of the paper. Even despite being given, later in the question, the link between the gradient of the graph and the acceleration, the vast majority of candidates described the line, with answers such as the acceleration increases and then it slows down.

(b) Mean mark 0.9

This was poorly done with most candidates unable to correctly draw a reasonable tangent to the curve, despite this being one of the mathematical requirements. The unit for acceleration was not known by many.

(c)&(d) Mean mark 2.1

(c) It was pleasing to see many good attempts here although candidates could not always determine the area of a triangle.

(d) Most candidates attained at least one of these marks and recognised that the more streamlined car would attain a higher speed.

Q.5 (a) Mean mark 1.4

It was pleasing to see a number of candidates attaining full marks here. Many candidates obtained credit for partial answers but did not interact with the units in the table so were unable to complete the question.

(b) Mean mark 0.6

This was pure recall and was very poorly done with only a tiny number of candidates clearly demonstrating good knowledge.

(c) Mean mark 0.7

Many candidates selected completely random, irrelevant equations here. Where they did attempt to use the kinetic energy equation, most subtracted the velocities from each other, so substituted incorrectly and could gain no credit for the first stage of this multi-stage calculation. However, many were able to correctly complete the second calculation and attain a mark through ecf. It was rare to find candidates who correctly used the kinetic energy equation and then subtracted the values.

SCIENCE DOUBLE AWARD

GCSE (NEW)

Summer 2018

PRACTICAL ASSESSMENT UNIT 7

General observations:

It was pleasing that there was a good spread of marks with the vast majority of candidates attempting most questions. Some positive achievement was seen from candidates across all qualifications and abilities. However, the use of correct scientific, descriptive or comparative language was very poor in many answers.

Section A

Risk Assessment

- Nature of the hazard was not clearly identified (*e.g.* Hot apparatus **can burn**)
- Risk often lacked an action (*e.g.* Acid splashes on skin **whilst pouring into beaker**)
- The control measure was often well answered, but candidates did not get credit for this unless the risk was also correct.

Table of results

- Lots of positive achievement seen with the majority of tables well-structured and logically organised.
- Candidates tended to lose marks for incorrect units or putting units in the body of the table.
- Unclear headings or use of vague terms (*e.g.* ***Amount*** of hydrogen peroxide) were another source of marks lost
- Means were generally calculated well. However, candidates should be encouraged to check that values are sensible and not larger than the values that they are calculated from.

Section B
Graphs

- Many candidates were able to plot graphs correctly, although lines of best fit were often poor. However, it was all too common to see poorly chosen scales that resulted in incorrect plotting and incorrect readings from the graph.
- While candidates should be encouraged to use at least half of the graph paper, the scale should be sensible and linear.
- A significant minority of candidates continue to use overly large dots to plot points, which led to the loss of marks in some cases as plotting accuracy, could not be determined.
- Most candidates were able to correctly link the two variables from the graph. However, they were less able to correctly describe the correct numerical pattern. Many candidates assumed that any straight line indicated direct proportionality and did not understand that the line also had to pass through the origin.

Variables

- Generally, candidates are confident in identifying the independent and dependent variables in different investigations indicating that these terms are well understood.
- Controlled variables were not as well understood and answers often lacked detail in explaining how they were controlled.
- Range - most candidates were able to correctly state the range of either the independent or dependent variable. However a significant minority simply stated all values of the variable.

Instrumentation

- When describing how to control variables or when discussing improvements to the experiment, most candidates failed to correctly name appropriate measuring instruments.
- In most cases, the term resolution was not well understood. Candidates were very poor at stating the resolution of a particular piece of apparatus. They also used vague terms when discussing improvements rather than considering the resolution of apparatus used. Many candidates simply stated, “use more accurate or precise apparatus” and showed no understanding of the meaning of these terms.

Evaluation of quality of data

- Although many candidates seemed to have an understanding of the meaning of repeatability, they were unable to clearly link to their own or given data.
- Similarly, reproducibility was poorly explained.
- The terms accuracy and precision were very poorly understood.

Comments on specific tasks

Investigating the effect of substrate concentration on the rate of an enzyme controlled reaction.

This was a very popular Science (double award) and separate Biology task.

Section A

A significant minority failed to distinguish the variables or lost marks due to poor terminology.

As with the majority of tasks this year the risk assessment was poorly answered with many candidates unable to correctly describe an action which would constitute a risk in the procedure.

The table of results was well constructed and clearly displayed by candidates. However, a significant minority used ‘amount’ instead of volume or percentage instead of concentration.

Section B

(a) The first three parts were well answered but many candidates lost marks in part (iv) with reference to the specific amount required for the controlled variable not included or the apparatus used to measure it was left out. As was the case in section A, many candidates used non-specific terms such as ‘amount’.

(b) As with all graph questions across the suite, poor scale choice led to plotting errors. Some candidates lost a mark by not following the instruction to plot the origin in this question.

(c) (i) Responses showed a good understanding of the relationship but part (ii) was very poorly answered with candidates not using the required superlative describing the **most** concentrated.

(d) (i) This was well answered with 22 being correctly identified but a significant number of candidates produced an imaginary third value to calculate a more suitable mean.

(e) Most candidates gained a mark here, but the majority of answers lacked detail when discussing their own data.

As with other practicals in the suite, candidates confused the terms accuracy and precision. There were many answers which incorrectly focussed on swirling the mixture instead of the apparatus.

Investigating the solubility of Potassium chlorate(V)

This practical was available to separate, Science (double award) and Applied Science (double award) candidates. Candidates who performed the task were able to produce a clear set of results.

Section A

As with many of the other tasks, the risk assessment was often poorly done with candidates not identifying the action that would cause the risk during the experiment.

Section B

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

(d) Many candidates answered this correctly although a significant number failed to identify water as the solvent and correlate this with its freezing and boiling temperatures.

(e) The scale of the Y-axis again proved challenging for many which then often led to plotting errors.

(f) This was generally well answered

(g) Many candidates lost marks by not showing their extrapolation on the graph. Other lost a mark here because of complicated graph scale causing a mis-read of the solubility,value.

(h) As in other improvement questions within the suite, this was answered poorly. Many candidates recognised the identification of crystal formation as a source of inaccuracy but many struggled with the second inaccuracy or confused the terms precision and inaccuracy in their answers.

(ii) I and II were poorly answered with the inability to clearly explain repeatability or reproducibility.

Investigating the resistance of a thermistor
Thermistor task

This proved to be a very popular task for both the Science (double award) and the separate physics qualifications and the method was successfully carried out by the majority of candidates.

Section A

In line with other tasks the risk assessment was often poorly done. Similarly, the table in section A proved challenging and it was common to see 'amps' or 'volts' used as column headings. Many candidates failed to record their measurements to the resolution of the ammeter or voltmeter.

Section B

(a) This considered the variables in the experiment. Identifying the dependent and controlled variables in this experiment proved problematic and very few candidates were able to demonstrate an understanding of the term resolution.

(b) The data handling was often well done, although a poor understanding of rounding often led to candidates losing a mark in (ii).

(c) The main issue with the graph was the scaling and it was very common to see decreasing values on the x axis. The quality of candidates' curves was very poor.

(d) This was generally well done but the evaluation of the results in part (e) to make a judgement was lost on most candidates and most answers did not reference the non-linear nature of the data.

(f)/(g) These considered improvements to the method and ways to extend the experiment. Neither of these sections was answered well and candidates were often very vague.

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