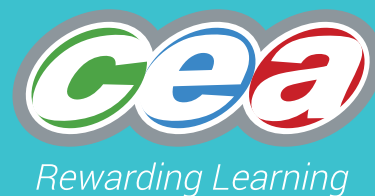


GCSE



**Chief Examiner's Report**  
**Single Award**  
**Science**

Summer Series 2023





## Foreword

This booklet outlines the performance of candidates in all aspects of this specification for the Summer 2023 series.

CCEA hopes that the Chief Examiner's and/or Principal Moderator's report(s) will be viewed as a helpful and constructive medium to further support teachers and the learning process.

This booklet forms part of the suite of support materials for the specification. Further materials are available from the specification's microsite on our website at [www.ccea.org.uk](http://www.ccea.org.uk).



## Contents

<b>Assessment Unit 1</b>	Biology	3
<b>Assessment Unit 2</b>	Chemistry	8
<b>Assessment Unit 3</b>	Physics	15
<b>Assessment Unit 4</b>	Practical Skills	19
<b>Contact details</b>		28



# GCSE SINGLE AWARD SCIENCE

## Chief Examiner's Report

### Subject Overview

These papers had Advanced Information (AI) provided and the benefit of this seemed to be mixed. The AI outlined the topic areas that were tested on the paper, with the additional information stating that low tariff question topics and mathematical content were not included in the AI.

There were some very good marks on both foundation and higher tiers, and it was evident that candidates who revised and practised past papers achieved high marks. There was evidence that some candidates only focused on the topics listed on the AI and disregarded the fact that other topic areas could have been included in low tariff questions – this was particularly evident when definitions were tested.

## Assessment Unit 1                      Biology

### Foundation Tier

#### Unit Overview

Examiners reported that the paper was accessible to all levels of ability. The standard, style and language of questions were consistent with previous papers and examiners felt that candidates of all abilities were able to answer the questions. Overall, candidates performed well on the paper. There was no evidence that candidates had been entered for the incorrect tier of paper. The paper was successful in allowing candidates of differing abilities to respond positively to the questions posed.

**Q1** This question was about biological molecules and food tests.

- (a)** The vast majority of candidates had no problems with linking up the nutrients with the food provided.
- (b)** Majority of candidates identified that calcium was needed to strengthen bones.
- (c)**
  - (i)** Lemon identified as not having any protein, was well answered.
  - (ii)** Biuret was not well identified as the reagent to test for protein. Many candidates answered Benedict's and then went on to choose the colour brick red in the next part.
  - (iii)** Lilac/purple not well known – perhaps indicating a lack of practical opportunities.

**Q2** This question tested knowledge of the male reproductive system and many candidates achieved 5 or 6 marks.

- (a)**
  - (i)** Cervix and vagina lettered well.
  - (ii)** Ovary well identified.
- (b)** Penis and scrotum generally answered well.
- (c)** Sperm ducts answered well.

- Q3** This question was about hormones, what they are and where in the body they act.
- (a)** Candidates were asked to complete the definition of a hormone, the fact that it is a chemical was not well known, but that it travelled in the blood was well answered.
  - (b)**
    - (i)** Candidates were asked to name the two parts of the CNS. Brain was well answered but spinal cord was not with many candidates answering spine instead. It was clear that many candidates thought incorrectly that the terms spinal cord and spine are interchangeable.
    - (ii)** Receptor not answered well at all.
    - (iii)** Muscle/Gland as effector very poorly answered, despite this definition being a direct quote from the specification.
- Q4** This question tested knowledge of respiration and photosynthesis. The energy produced in respiration is passed through a food chain and candidates were required to demonstrate an understanding of this flow of energy.
- (a)**
    - (i)** Exothermic very poorly answered even though the definition has been asked on previous papers.
    - (ii)** The labelling of oxygen and carbon dioxide had varying success, with many candidates getting the order mixed up.
  - (b)**
    - (i)** Photosynthesis answered well.
    - (ii)** Tick for only in daylight was very well answered.
  - (c)**
    - (i)** Mouse/Rabbit were correctly identified as primary consumers by the majority of candidates.
    - (ii)** The arrows question proved to be a challenge. It may have been misinterpreted by the candidates, as it has not been asked in this way before.
  - (d)**
    - (i)** The calculation to give 90KJ was very well answered.
    - (ii)** Mouse using energy by running was correctly answered by many but there were some vague answers given perhaps indicating a lack of understanding of the movement of energy through a food chain.
- Q5** This question tested knowledge of antibiotics, where they come from and what they do.
- (a)**
    - (i)** Despite being asked many times in the past very few candidates mentioned the antibiotic was a chemical that killed bacteria.
    - (ii)** Penicillin was correctly identified by the majority.
    - (iii)** Florey/Chain very poorly answered.
    - (iv)** Candidates correctly understood that flu is a virus and therefore cannot be destroyed by antibiotics.
  - (b)**
    - (i)** The graph was generally well answered, and it was pleasing to note that some candidates used a dark pencil or shaded the bars making it easier for examiners to clearly see the top of each bar. However, several examiners noted that candidates are still not taking enough care when completing the top of each bar.
    - (ii)** The calculation of number of mushrooms was very well answered, even by the less able candidates.



- (iii) Calculating percentage is a common mathematical skill tested on foundation papers, however, this calculation leading to an answer of 10% was not well answered.

**Q6** This question was about Continuous variation. Candidates were asked to define it, give an example, and read information from a graph.

- (a) (i) Definition of continuous variation very poorly answered. Both this definition and that of discontinuous have been asked before.
- (ii) A wide range of examples were provided.
- (b) Causes of continuous variation was not well answered and may indicate a lack of understanding of the question.
- (c) (i) Only a handful identified a histogram. The specification clearly states that histograms are used for continuous variation and bar graphs for discontinuous variation.
- (ii) The most common tree height range was answered fairly well. However, a number of candidates gave 2 ranges, one on each line space.
- (iii) Most candidates answered 105m.

**Q7** This QWC question tested knowledge of the development of the embryo during pregnancy.

- (a) There were 10 indicative points available with candidates requiring 7 or more to get into the top band and so achieve 6 marks.

Point 1 referring to the egg and sperm was awarded to most candidates and with QWC they achieved 2 marks. Point 10 referring to the amniotic fluid was mentioned by a lot of candidates, but the rest of the marking points were only sporadically awarded.

Very few candidates achieved 4 or 6 marks at foundation level, indicating a lack of revision and learning of key facts for this topic.

- (b) Generally, well answered - most candidates understood that alcohol can damage the developing foetus with many stating Foetal Alcohol Syndrome as a resulting condition.

**Q8** This question tested understanding of biodiversity in the real world.

- (a) As is standard in science, to accurately describe a trend reference must be made to both axes. Candidates were required to refer to the number of sheep and the years. Many candidates did not refer to the number of sheep instead producing a vague answer like 'sheep decreased'.
- (b) (i) Biodiversity definition was not well answered, again indicating that standard definitions from the specification worth 1 mark were not revised by all candidates.
- (ii) The first mark was awarded for reference to increasing the variety of habitats, for example planting more hedgerows or leaving margins around the field. The second mark was awarded for identifying the need to reduce the time the sheep were grazing on part of the land, perhaps by fencing off part of the land.
- (iii) This was not well answered. Candidates did not recognise that this was a question asking for the definition of a competitive invasive species. The majority of Foundation candidates left it blank.

## Assessment Unit 1

## Biology

### Higher Tier

#### Unit Overview

The paper was accessible to all levels of ability. The standard, style and language of questions were consistent with previous papers and examiners felt that candidates of all abilities were able to answer the questions. There was a clear difference in how the overlap questions were answered, with higher tier candidates achieving significantly higher marks.

**Q1, 2 & 3** Questions 1, 2, 3 were overlap questions with foundation. These were answered much better by higher candidates than foundation candidates.

In the QWC question (Question 2) which tested knowledge of the development of the embryo during pregnancy there were 10 indicative points available with candidates requiring 7 or more to get into the top band and so achieve 6 marks. This was a clear discriminator question with many more candidates at higher tier level achieving 4 or 6 marks. It is also noted that definitions in these initial questions were better recalled by higher tier candidates.

**Q4** This was the first higher tier only question which tested knowledge of photosynthesis, including the balanced symbol equation.

**(a)** A surprising number of candidates did not get these marks. Many used incorrect notation, for example superscript instead of subscript numbers, or forgot to place the 6 to balance the equation in front of H<sub>2</sub>O.

**(b) (i)** The majority of candidates correctly named the chloroplast.

**(iii)** This proved to be quite challenging with many failing to clearly explain that the function of chlorophyll is to absorb sunlight.

**Q5** This was the genetics question, testing knowledge and understanding of genetic crosses and Punnett squares.

**(a)** A straightforward definition of an allele asked many times in the past was not accurately answered.

**(b) (i)** Genetic cross between 2 heterozygotes was well answered by the majority of candidates.

**(ii)** The majority of candidates correctly answered 25% probability of the recessive trait.

**(iii)** Identifying the Punnett Square has been asked before and it was well answered.

**(c)** A standard definition for mutation was well answered with most candidates achieving at least 1 mark.

**(d) (i)** The majority of candidates identified UV light as the cause of skin cancer with the most common incorrect answer being the vague answer of the sun.

**(ii)** The line graph was well drawn; however, a surprising number did not draw the line at all and simply plotted points. Examiners noted that there are still a sizeable number of candidates who cannot plot points accurately and do not know that a graph in biology should be joined point to point.

- (iii) Candidates were asked to calculate the difference of 20, then put that difference over the original value of 30 and get a percentage of 66.6666. This number needed to be rounded to 1 decimal place for an answer of 66.7. Very few managed to score all 3 marks. A significant number worked out 66.6666 but rounded incorrectly to 66.6. Others did the wrong calculation (most common was 30/50 or 20/50) and a few presented the incorrect answer to 1 decimal place and so achieved the rounding mark only.

**Q6** This question tested knowledge of parts of the nervous system.

- (a) (i) Both the Sensory and Motor neurones were correctly identified in surprisingly few cases. Many candidates incorrectly answered relay or association neurone for Y.
- (ii) Spinal cord was often confused for the spine so several candidates lost this mark.
- (iii) The connection between neurones was only identified by a minority of candidates.
- (b) (i) The majority of candidates correctly read 54 units from the graph.
- (ii) This style of question has not been asked before, yet the more able candidates correctly continued the line up to the right. This most common mistake was to continue the line down to the left focusing on 30 units on the y-axis.
- (c) (i) This part was well answered by a significant number of candidates.
- (ii) The plant hormone of auxin was correctly answered in many cases.

**Q7** This question tested understanding of Evolution by means of Natural Selection in a real-world example. Candidates needed to apply their knowledge.

- (a) In many cases candidates lost marks as the definition of Evolution did not refer to change in a species.
- (b) Darwin was correctly identified by most candidates.
- (c) This was a challenging question and only the most able candidates achieved any marks. Candidates were required to know what Natural selection involves and apply it to this scenario. The better candidates achieved marks for stating that the coloured mushroom survived, reproduced and passed on their genes, but very few were able to gain the mark for explaining that the coloured mushrooms survived because they were not eaten (since animals mistook them for being poisonous).
- (d) Many candidates seemed to lack the language skills to explain clearly that fossils can be dated, and so older fossils can be compared to more recent examples. Many just gave a definition of a fossil.

**Q8** This question focused on genetic engineering and proved challenging. Despite being listed on the Advanced Information many candidates did not appear to know this topic well.

- (a) Only a few candidates mentioned the change in the genome.
- (b) There were some very vague answers given here, with many candidates confusing genetic engineering with genetic screening and the consequences of that.
- (c) Only the most able candidates correctly recognised that the insulin produced by genetically engineered bacteria was Human insulin and so had less chance of allergies or side effects.

## Assessment Unit 2

## Chemistry

### Foundation Tier

#### Overview

In general, candidates performed well. The paper included a good range of topics, covering a large amount of the specification and was a good assessment of candidates' knowledge of Unit 2. The paper allowed for candidates of differing abilities to respond positively with most candidates attempting all questions in a style that showed that they understood all the questions. There was a wide range of marks achieved.

The first seven questions were a mixture of multiple choice, matching pictures to words, single word answers and progressing to writing definitions, explaining some simple procedures and drawing and interpreting graphs. These were mostly well answered. Questions 8 and 9 were more challenging and so discriminated well between candidates of differing abilities. Despite the latter questions being more challenging, many candidates attempted them, and the more able candidates performed well. There was a noted improvement in the standard of answers compared to the previous two years which were impacted by the pandemic, although gaps in knowledge can still be seen, particularly in questions involving chemical analysis and practical skills. Knowledge of key terms and definitions needed consolidation for many candidates.

#### Q1 Fingerprints

- (a) Candidates were asked to match diagrams of fingerprint patterns to fingerprint type. Many candidates confused loop and whorl but were able to label the arch correctly.
- (b) Candidates were asked to name the powder used to collect fingerprints from a white surface. Most candidates were able to answer this correctly.
- (c) Candidates were asked to circle the name given to the branch of science used to fight crime, with most candidates successfully identifying "forensic" as the answer.

#### Q2 Acids, Alkalis and Hazard Symbols

Candidates were provided with the pH values of some household substances.

- (a) Candidates were asked to name an indicator that could be used to test the substances. This was generally well answered. Some incorrect answers included pH probe and litmus paper and some candidates expressed iodine as the answer.
- (b) Candidates were asked to name the strongest acid and weakest alkali from the named substances in the table. This was generally well answered.
- (c) Candidates were asked to complete a sentence to describe water. Again, this was generally well answered.
- (d) (i) Candidates were provided with a diagram of a hazard symbol and asked to name it – this was very well done.  
(ii) Candidates were asked to give one reason why symbols are used instead of words. Whilst better answered than in previous years, there are still too many candidates answering with vague responses such as 'easier to understand/read'.

**Q3 Materials and their Uses**

Candidates were provided with diagrams and properties of three materials used to make garden furniture – plastic, wood and iron.

- (a) Candidates were asked for the definition of synthetic. This was not as well answered as in previous years.
- (b) (i) Candidates were asked to give two reasons why plastic might be preferable to wood. Rather than using the information provided in the table, many candidates chose to provide their own information, such as cheap or flexible, which in this context were not given credit.  
(ii) Candidates were asked to give one disadvantage of using iron to make garden furniture and to explain their answer. While most candidates could provide a valid disadvantage, fewer could provide an explanation.
- (c) This was a simple calculation which many candidates successfully worked out.

**Q4 Periodic Table**

Candidates were provided with an outline of the Periodic Table with some element symbols included.

- (a) Candidates were asked to use only the elements shown to answer the questions. Many candidates used other elements from their Data Leaflet rather than the elements shown in the question.
  - (i) Reasonably well answered.
  - (ii) Reasonably well answered.
  - (iii) Candidates confused Period 2 with Group 2 and as such, answered incorrectly. This was a good question to distinguish between candidates of differing abilities.
- (b) Candidates were asked to give the name of elements in Group 2 – a very common mistake was giving the Group 1 name as Alkali Metals, rather than Alkaline Earth Metals.
- (c) Candidates were asked to circle the answer indicating how elements in the modern Periodic Table are arranged. This was reasonably well answered.
- (d) This part involved a sentence completion regarding the reactivity of Group 0 elements. This was a very good question to differentiate between differing abilities. Many candidates achieved one out of the two possible marks with only the more able achieving both marks available.

**Q5 Neutralisation, Gas Tests and Separation Techniques**

- (a) Candidates were asked to identify the acid used in the preparation of sodium sulfate crystals. Many candidates successfully identified the acid.
- (b) (i) Candidates were asked to name the type of reaction taking place when an acid reacts with sodium carbonate. This was well answered by most candidates.  
(ii) This question was about the test for carbon dioxide gas. This is a common question and was not as well answered as expected.
- (c) Many candidates could not define the term “exothermic”.

- (d) Candidates were asked how sodium sulfate could be separated from water. Many candidates answered “filter it” even though the question explained that the sodium sulfate was dissolved in the water. This was one indication of general practical skills not being as strong as in previous years.

**Q6 Electronic Structure, Atoms and Elements and Bonding**

- (a) Candidates were asked to complete a diagram to show how the electrons are arranged on an atom of nitrogen. This was well done by most candidates this year, and an improvement on similar questions in previous years.
- (b) The formula for sodium nitrate was provided and candidates were asked to identify the number of elements and atoms present in the given formula. This is always a good question to distinguish between differing abilities. Some candidates still confuse the two terms and subsequently get the answers the wrong way around.
- (c) Candidates were asked the name of the type of bonding involved when electrons are transferred between a metal and a non-metal. They were given a choice of three. Only the more able pupils correctly identified “ionic” as the answer.

**Q7 Reaction of Magnesium with Hydrochloric Acid and Drawing and Interpreting a Line Graph.**

- (a) A generous scale allowed the plotting of the points to be well completed by most candidates, however, the drawing of the line still remains difficult for some candidates. Too many candidates are using a ruler to join the points plotted rather than drawing a smooth curve.
- (b) Many candidates were able to describe the trend shown referencing both axes from the graph.
- (c) The test for hydrogen gas was well answered with many candidates able to achieve at least one of the two available marks.
- (d) (i) Very well answered by many candidates. Candidates were asked to work out the volume of gas produced in the first 2.5 minutes using the graph.
- (ii) This question was not well answered, with only a few candidates correctly noting the time the reaction finished. Most candidates incorrectly noted the end point of the line graph.

**Q8 Chromatography**

- (a) This question assessed the quality of written communication on the topic of Chromatography. There were plenty of marking points to be gained so it was surprising at how few marks some candidates achieved. Some did not attempt the question at all. Others confused it with filtration/distillation. Fewer candidates were able to explain why pencil should be used or why the baseline should be the solvent. A few candidates simply described the set up shown in the diagram provided and could not be awarded any marks. There is a marked decline in the standard of written communication including legibility of handwriting. At foundation Tier, very few candidates fell into marking Band A to achieve 6 marks.
- (b) (i) Completing a chromatogram - very few foundation tier candidates were able to draw the results expected for black food colouring even though the diagram should have provided good visual stimulus.
- (ii) This question was reasonably well answered, with many candidates able to identify the most soluble dye.

## Q9 Organic Chemistry

In general, this question proved to be challenging to many candidates.

- (a) Candidates were asked to identify, using the diagram, where refinery gas is collected. Many candidates may have just picked a letter without accurate knowledge of the correct answer.
- (b) Candidates were asked name the process which separates crude oil into the different fractions. This was better answered when compared to previous years.
- (c) Candidates were asked to describe the process of separating crude oil. Several candidates did not attempt the question whilst others misinterpreted the question and incorrectly described how crude oil was formed. Only the more able candidates achieved the full 3 marks available.
- (d)
  - (i) Very few candidates correctly identified the homologous family to which methane and ethane belong. Many candidates gave a group name from the Periodic Table.
  - (ii) Candidates either knew this answer or not, with a number of candidates not even attempting the question.
  - (iii) Many candidates were able to achieve at least one of the two available marks for completing the word equation. Some candidates recorded formulae rather than writing the words and could only be awarded the marks if the formulae were correct.
- (e) Candidates were provided with a table of information regarding percentages of gases found in the car exhaust of a diesel engine.
  - (i) The calculation was very well attempted by the majority of candidates.
  - (ii) Candidates were asked to name the compound that made up the largest percentage. This was very poorly answered with many candidates incorrectly answering nitrogen (largest percentage on the table but an element).

## Assessment Unit 2

## Chemistry

### Higher Tier

#### Overview

In general, candidates performed reasonably well in this paper. The paper included a good range of topics and was a good assessment of candidates' knowledge of Unit 2. The paper allowed for candidates of differing abilities to respond positively with most candidates answering all questions in a style that showed that they understood all the questions. There was a noted improvement in the standard of answers compared to the previous two years which were impacted by the pandemic.

Looking at the marks achieved, it was evident that those at the lower end of the mark range would have been better suited to sitting the examination at Foundation Tier. There was a wide range of marks from very high to very low with a good spread inbetween. Most candidates attempted all questions and there was no evidence that candidates had insufficient time to complete the paper. The common questions (1 and 2) were generally completed to a higher standard than the same questions on the Foundation Tier paper. As with Foundation Tier, knowledge of key terms and definitions were at times weak and in need of consolidation.

**Q1 Chromatography**

- (a) This question assessed the quality of written communication on the topic of Chromatography. There were plenty of marking points to be gained so it was surprising at how few marks some candidates achieved. Some candidates did not attempt the question at all. Many candidates achieved marking Band C with simply naming chromatography. A number of candidates were unable to explain why pencil should be used or why the baseline should be above the solvent. A few simply described the set up shown in the diagram provided and could not be awarded any marks. It is to be noted that there is a decline in the standard of written communication including legibility of handwriting. Only the more able candidates fell into marking Band A to achieve 6 marks.
- (b) (i) Chromatogram – as with Foundation Tier, very few candidates were able to draw the results expected for black food colouring even though the diagram should have provided good visual stimulus.
- (ii) This question was reasonably well answered with many candidates able to identify the most soluble dye.

**Q2 Organic Chemistry**

In general, this question proved to be challenging to many candidates.

- (a) Candidates were asked to identify, using the diagram, where refinery gas is collected. Many candidates may have just picked a letter without accurate knowledge of the correct answer.
- (b) Candidates were asked to name the process which separates crude oil into different fractions. This was well answered at Higher Tier.
- (c) Candidates were asked to describe the process of separating crude oil. Several candidates did not attempt the question whilst others misinterpreted the question and incorrectly described how crude oil was formed. Only the more able candidates achieved the full 3 marks available.
- (d) (i) Very few candidates correctly identified the homologous family to which methane and ethane belong. Many candidates gave a group name from the Periodic Table.
- (ii) The structural formulae for ethane was well answered at Higher Tier.
- (iii) Many candidates were able to achieve at least one of the two available marks for completing the word equation. Some candidates recorded formulae rather than writing the words and could only be awarded the marks if the formulae were correct.
- (e) Candidates were provided with a table of information regarding percentages of gases found in the car exhaust of a diesel engine.
- (i) The calculation was very well attempted by most candidates.
- (ii) Candidates were asked to name the compound that made up the largest percentage. This was very poorly answered with many candidates incorrectly answering nitrogen (largest percentage on the table but an element).



**Q3 Melting Points and Boiling Points of Substances, Changes of State and Covalent Bonding**

- (a) Most candidates were unable to accurately define the term “boiling point”. Many responses did not include the word temperature.
- (b) (i) Candidates were provided with melting points and boiling points of five substances. Most candidates were able to identify the substance with the lowest melting point.
- (ii) Fewer candidates were able to identify the substance that would be liquid at  $-20\text{ }^{\circ}\text{C}$ , with many incorrectly answering ammonia. There may have been a reluctance to give the same substance name for two consecutive answers.
- (iii) Many candidates correctly identified the state of ammonia at room temperature.
- (c) An improvement on previous years. Many candidates successfully defined the term “sublime”.
- (d) Candidates were asked to identify the type of bonding shown in the diagram when oxygen reacts with carbon. Whilst most candidates were able to identify covalent bonding for Part (i) of this question, fewer were able to define a “lone pair” for Part (ii) of the question. Candidates had a general idea of what the answer should be, but written answers were too vague to award the mark.

**Q4 Periodic Table, Atoms and Ions**

- (a) The questions about the work of Mendeleev were well answered. For Part (i) of this question, candidates were asked to give one similarity between Mendeleev’s table and the modern Periodic Table. Most candidates opted for groups and periods. Several candidates referred to these as rows and columns and could not be awarded marks. Part (ii), the sentence completion referring to how Mendeleev ordered the elements, was well completed by most candidates.
- (b) Candidates were given a table of information about Group 7 elements. For Part (i), candidates were asked to give the name of Group 7 elements, and this was very well answered. Part (ii) asked candidates to state the trend shown in the table and again this was well answered by most candidates. Part (iii) asked candidates to predict the melting point of iodine, and whilst the mark scheme provided a range of acceptable answers, very few candidates answered correctly.
- (c) (i) Candidates were asked to complete a table regarding the numbers of protons, neutrons and electrons in an atom of fluorine and their relevant charge. This was well attempted by most candidates, with most achieving at least one of the two available marks.
- (ii) Candidates were asked to explain how an ion of fluorine is formed from an atom. This proved to be a good question to distinguish between differing abilities with only the more able candidates achieving full marks here.

**Q5 Smart Materials and Nanomaterials**

- (a) Candidates were asked the size of a nanometre. This was well answered with a noted improvement in the standard of answering this question over the last few years.
- (b) Defining the term “photochromic” proved challenging to a number of candidates. Many understood there was a change involved to do with colour but only the higher ability candidates gave the precise definition.
- (c) Candidates were asked to name another nanomaterial made of carbon. Several candidates left this unanswered, and the most common incorrect answer given was “graphite”.
- (d) Candidates were asked to give two reasons why some people may be concerned about the use of nanomaterials. This was not well answered even though this question has been on previous papers. Candidates referred to entry to seas/oceans and damaging the environment which was too vague. Many mentioned entering the blood stream but not specifically penetrating cells/causing cell damage.

**Q6 Rates of Reaction**

- (a)
  - (i) Candidates were asked to draw a line graph using the table of results. The points were generally well plotted but too many candidates are still using a ruler to join the dots instead of drawing a freehand curve.
  - (ii) In stating the trend, many candidates identified the first part of the trend, but the second part remains challenging to many. Many candidates stated incorrectly, “the reaction stops”. Candidates need to remember to mention units when identifying numerical values.
  - (iii) Candidates were provided with the formulae to calculate the rate of the reaction and asked to calculate the rate during the first twenty seconds, giving their answer to one decimal place. Most candidates were able to achieve one of the two available marks, losing the second mark for not rounding to one decimal place.
  - (iv) Candidates were asked to predict the volume of gas on doubling the temperature. This was a good question to discriminate between differing abilities. Many candidates incorrectly divided the answer to Part (iii) by 2 to give an answer of 1.8/1.85.
- (b) Candidates were asked to explain, in terms of particles, why the rate of reaction increases when concentration increases. Very few candidates achieved full marks in this question. Many mentioned increased energy and particles moving faster which did not apply to this situation. More candidates are using the term “successful collisions” correctly which is a noted improvement on previous years.

**Q7 Addition Polymerisation and Disposal of Plastics**

- (a) (i) Candidates were asked to define a catalyst. This was a good question for differing abilities. Most candidates were able to achieve at least one of the two marks available. Care is needed with the second part of the answer, “without being used up”. A number of candidates answered, “without taking part in the reaction”/“without being involved in the reaction”.
- (ii) Naming the reaction used to make polythene was very well answered by most candidates.
- (b) Candidates were asked to complete the balanced symbol equation for the formation of polythene from ethene. While this question was generally poorly answered or left unanswered, there was a noted improvement in the standard of answer compared to past paper questions of a similar style.
- (c) Candidates were asked to name one method of disposal of plastics and the problems associated with that method. This was very well answered, with most candidates achieving at least one mark for the method of disposal.

**Assessment Unit 3****Physics****Foundation Tier****Unit Overview**

This foundation tier paper was well received by candidates across the ability spectrum. It was pleasing to see very few blank spaces across most papers. Even the six-mark QWC question was attempted by most candidates.

- Q1** This question was on the Solar System. In Part (a)(i) most candidates achieved the two marks although some candidates knew the two planets, they put them in the wrong order. Part (ii) was very well answered. In Part (b) many candidates achieved at least one mark by getting two of the objects in the correct order. Part (c) was also well answered. Candidates who did not achieve a mark gave either comet or meteor as an answer. Part (d)(i) and Part (ii) were very well answered.
- Q2** This question was on electricity. Most candidates knew the names of the electrical symbols. Part (b)(i) was well answered. Some candidates incorrectly thought this was a parallel circuit rather than a series circuit. In Part (ii) most candidates knew the type of meter, Part (ii) was poorly answered by candidates writing it was 0.3A. Part (c)(i) and (ii) were on resistance and the majority of candidates achieved the two marks. Those who got Part (ii) incorrect used 0.8/2 rather than 2/0.8.
- Q3** This question was on radiation. Although, Part (a) has been asked previously it was badly answered. Candidates thought that foreground was the radiation always around us. Many candidates responded well to Parts (b) and (c).
- Q4** This question was on efficiency. In Part (a) most candidates knew what the term efficient meant. In Part (b)(i) the trend although very straight forward was badly answered. Candidates need to mention both variables to achieve the mark. In Part (ii) the candidates needed to read a value off a graph, this was very well answered, those candidates who gave an incorrect answer wrote 60.2 instead of 62.

- Q5** This question on heat transfer was very well received with most candidates able to state in Part (a)(i) that pin A falls off first and in Part (ii) most knew that the type of heat transfer was conduction. Parts (iii) and (iv) were also answered very well.
- Part (b) was very badly answered, in Part (i) most candidates had the arrow at A going up and the arrow at B going to the right. In Part (ii) radiation was a very common incorrect answer.
- Q6** This question was on road safety. Part (a)(i) was very badly answered. Very few candidates could read off the two correct values and do the correct subtraction. Part (ii) was very well answered. Parts (b) and (c) were also well answered. In part (d) many candidates incorrectly wrote that traffic lights and speed limit signs were traffic calming measures.
- Q7** This question was on ultrasound. Candidates had to interpret data in this question, and it was very well received by the majority of candidates.
- Q8** This question about Ultraviolet radiation proved to be a good discriminator. In Part (a) most realised that the level of UV radiation was lower in winter, and some read the graph to state that the UV level didn't go above 3 units in winter and so sun cream sales decreased. In Part (b)(i) few could interpret the graph to state that sun cream Y was the most effective. In Part (ii) most realised that too much UV caused skin cancer. In Part (c) very could state a useful application of UV light.
- Q9** This question about waves was well answered, with many of the candidates able to give either the correct amplitude or the correct wavelength for the wave shown in Part (a). Some could give both correctly. In Part (b)(i) a lot of candidates were able to read the graph and determine that a 40m wavelength travelled twice as fast as a 10m wavelength while in Part (ii) most could calculate the correct frequency using the equation given.
- Q10** This question about a ball rolling down a slope was a good discriminator in the foundation paper. In Part (a)(i) most could interpret the diagram to work out that there was 1.8m between positions A and E but in Part (ii) few could deduce that it took 2s for this journey. In Part (b) most could use the equation to calculate the speed of the ball, even if they got Part (a)(ii) incorrect this error was taken into account. In Part (c) few could express that the ball travelled further between each position in the same amount of time thus showing that the ball was accelerating. In Part (d) most could state that the speed would reduce as the height of the slope decreased.
- Q11** This was the six-mark QWC question on the generation of electricity using wind turbines and it was pleasing to see so few blank spaces. This question proved to be a very good discriminator with most candidates able to define the term renewable and state that these turbines could be an unreliable energy source when the wind didn't blow or knew two other renewable sources. Those candidates who achieved four marks also described how the wind made the rotor blade turn which moved a magnet inside a coil of wire to produce electricity. Candidates who achieved full marks also explained why there was an increase in the production of electricity using renewables.

## Assessment Unit 3

## Physics

### Higher Tier

#### Unit Overview

This higher tier paper was well received by candidates across the ability spectrum. It was very pleasing to see very few blank spaces across most papers. Even the six-mark QWC question was attempted by most candidates. It was pleasing to see very few candidates scoring less than 10 marks which suggested that most were entered for the correct tier.

#### Q1, 2, 3 and 4

These were the overlap questions and the comments you see below are still appropriate for this paper although each question was a little better received by the higher tier candidates.

#### Q1 Ultraviolet Radiation

This question about Ultraviolet radiation proved to be a good discriminator. In Part (a) most realised that the level of UV radiation was lower in winter, and some read the graph to state that the UV level didn't go above 3 units in winter and so sun cream sales decreased. In Part (b)(i) few could interpret the graph to state that sun cream Y was the most effective. In Part (ii) most realised that too much UV caused skin cancer. In Part (c) very few could state a useful application of UV light.

#### Q2 Waves

This question about waves was well received. Most of the candidates gave either the correct amplitude or the correct wavelength for the wave shown in Part (a). Some correctly gave both. In Part (b)(i) many of candidates read the graph and determined that a 40m wavelength travelled twice as fast as a 10m wavelength while in Part (ii) most could calculate the correct frequency using the equation given.

#### Q3 Speed Down a Slope

This question about a ball rolling down a slope was well received. In Part (a)(i) most candidates could interpret the diagram to work out that there was 1.8m between positions A and E but in Part (ii) few candidates could deduce that it took 2s for this journey. In Part (b) most could use the equation to calculate the speed of the ball, even if they got Part (a)(ii) incorrect. In Part (c) few candidates could express that the ball travelled further between each position in the same amount of time thus showing that the ball was accelerating. In Part (d) most candidates could state that the speed would reduce if the height of the slope decreased.

#### Q4 Wind Turbines

This was the six-mark QWC question on the generation of electricity using wind turbines and it was pleasing to see so few blank spaces. This question proved to be a very good discriminator with most able candidates to define the term renewable and state that these turbines could be an unreliable energy source when the wind didn't blow or knew two other renewable sources. Candidates who achieved four marks also described how the wind made the rotor blade turn which moved a magnet inside a coil of wire to produce electricity. Candidates who achieved full marks also explained why there was an increase in the production of electricity using renewables.

**Q5 Ultrasound**

This question on heat transfer was very well received with most candidates able to state in Part (a) that ultrasound was a sound above 20kHz. In Part (b) most knew that the particles in a longitudinal wave vibrate parallel to the wave travel. In Part (c)(i) most candidates could read the graph to find the depth a 2 MHz wave was half its initial intensity. In Part (ii) most candidates stated at least one of the conclusions drawn from the graph; as depth increases, intensity decreases or as frequency decreases, depth through tissue increases.

**Q6 Current Flow**

This question was well received with most candidates knowing the path of electron flow around the given circuit. They could also work out that the current splits in a parallel circuit and give the correct ammeter readings in Part (b).

**Q7 Forces**

This question proved to be a good discriminator. Few candidates were able to state that the car was subjected to balanced forces and would continue to move at a constant speed in Part (a)(i). In Part (ii) most calculated the resultant force correctly with some also stating that friction or air resistance (drag) caused the backward force acting on this car. In Part (b) most candidates could use the given formula to calculate the acceleration of the car with some able to give their answer to 1 decimal place.

**Q8 Radioactivity**

This question also proved to be a good discriminator. In Part (a) most candidates could plot the points for the graph of carbon-14 activity against time but few could draw a smooth curve of best fit through those points. In Part (b) many of candidates knew that half-life was the time taken for something to happen, but few could state that the activity halved or the number of undecayed atoms reduced by half.

**Q9 Heat Transfer**

This question also proved to be a good discriminator with few able to explain fully, in terms of atoms, how heat travels through the glass rod in Part (a). Few candidates could state that the atoms vibrate more and collide with each other to pass the heat on. In Part (b)(i) most knew that convection was the heat transfer method shown in the diagram and that the purple dye would rise in Part (ii). In Part (c) most candidates also knew that dark, matt surface are the best absorbers of heat.

**Q10 Astronomy**

This question had varying degrees of success for candidates. Most candidates knew that the formation of the Sun involved Hydrogen or that gravity pulled the hydrogen atoms together. Some candidates also stated that this caused nuclear fusion to produce Helium in Part (a). In Part (b)(i) few candidates could deduce that as the distance of a galaxy from Earth increases so does the speed whereas in Part (ii) most candidates could state that Galaxy B showed the greatest red shift as it was the furthest away from Earth. In Part (iii) few candidates could state that the Universe was 14 billion years old and fewer were able to state that a light year was the distance light travels on one year. In Part (c) most candidates correctly stated that mass has no effect on orbit time.

**Q11 Energy**

In this question only the most able candidates were able to state the Principle of Conservation of Energy in Part (a). In Part (b) most realised that as the child moved on the swing potential energy was changed into kinetic energy but few could state that as potential energy decreased, kinetic energy increased. In Part (c) many candidates were able to use the given equation to calculate the kinetic energy.

## Assessment Unit 4 Practical Skills

**Booklet A****Foundation Tier****Unit Overview**

This foundation tier paper was well received by candidates across the ability spectrum. It was very pleasing to see very few blank spaces across the majority of papers. Most candidates were able to achieve double figure marks for this paper.

**Q1** This question was on finding the energy in burning crisps. In Part (a)(i) all the candidates were able to find the starting and final temperature of the water for both sets of crisps. In Part (ii) most candidates were able to calculate the temperature rise for each crisp although, some candidates found the average rather than the difference. In Part (iii) candidates were able to give the table a suitable heading although, many candidates forgot to write in the unit and put it in the body of the table instead. In Part (iv) candidates were able to calculate the average temperature. Part (v) was well answered by many candidates.

Part (b) proved to be very accessible for the majority of candidates.

Part (c)(i) was very badly answered by the candidates. Many candidates drew a line of best fit or a curve, as this was a biology question the points had to be joined by straight lines. No candidate was penalized for any plotting or line drawn between 0.0g and 0.5g.

In Part (ii) many candidates were able to identify the trend. In Part (iii) they were able to quote the correct independent variable. In Part (iv) most candidates were able to give one reason for the energy losses.

**Q2** This question was on the transfer of heat through four different conductors. In Part (a) candidates were able to complete the table with their results although, some candidates had used minutes rather than seconds. Part (b) was very accessible to the majority of candidates. In Part (c) the bar graph was very well done. Unfortunately, some candidates chose very awkward scales which made it very difficult for the candidates to draw their bars. Some candidates forgot to put a scale on the y-axis.

In Part (d)(i) the candidates were very good at ordering the conductivity with most achieving two marks. Many candidates found Part (ii) very difficult and just chose random numbers for the time it would take the paint to change colour on the glass. In Part (e) most candidates were able to give at least one way to ensure a fair investigation. In Part (f) most candidates were able to spot the variable in the given list. In Part (g) the candidates were given a list of possible answers and had to choose the correct answer, the choice made this more accessible to the weaker candidate. In Part (h) most candidates knew why the rods were placed in cold water for five minutes although, weaker candidates sometimes found it difficult to express themselves.

## Assessment Unit 4

## Practical Skills

### Booklet B

### Foundation Tier

### Unit Overview

This foundation tier paper was well received by candidates across the ability spectrum. It was very pleasing to see very few blank spaces across most papers. Even the six-mark QWC question was attempted by the majority of candidates. The style and format of the paper was similar to previous papers and candidates who practiced past papers fared well.

#### Q1 Microscopes and Slides

This question was well received by most candidates. Most were able to name the focus knob as the part used to get a clear image in Part (a). In Part (b)(i) most knew that the X4 objective lens was used to view the cells in the diagram and in Part (ii) most knew the correct diagram A showed the view of the cells that should be used when looking at them for the first time. In Part (c) most knew that Iodine was used to prepare a slide of onion cells, but few could state that the cells were covered with a cover slip.

#### Q2 Pulse Rates

This question was also well received by most candidates. Most were able to name pulse rate as the dependent variable in this investigation in Part (a). In Part (b) most could interpret the graph to state that the girls pulse rate increased and then decreased with time to gain one mark, but few could fully describe the trend shown in the results for the girl as her pulse rate increased through the first two minutes of exercise and then decreased after the exercise. In Part (c)(i) most knew that because the investigation was only done for one boy and one girl, this made the conclusion unreliable. In part (ii) most were able to suggest a safety precaution that should be taken before carrying out the exercise in the classroom.

#### Q3 Testing for Starch

This question proved to be a good discriminator with few realizing that the plant put in the dark for 24 hours to de-starch it in Part (a). Part (b) was the six-mark QWC question on the starch test and most candidates knew that Iodine was used to test for starch, the colour change involved or that the leaf was put in boiling water to kill it at the start of the experiment and so gained two marks. Those who gained four marks usually also knew that Ethanol was used to remove chlorophyll from the leaf and those that gained full marks could fully describe the method used when testing this leaf for starch including a reason for each step and the results for the covered and uncovered parts of the leaf. In Part (c) most knew that the green part of the leaf would have starch present.



**Q4 Photosynthesis**

This question was well received with most candidates able to use the graph to explain that more carbon dioxide increases the rate of photosynthesis as the number of bubbles produced increases with more spatulas in Part (a)(i). Few could give a full explanation that as the number of spatulas increases the rate of photosynthesis increases until 5 spatulas/110 bubbles when it stays the same. In Part (ii) most knew that the lamp was kept at the same distance from the plant to make it a fair test. In Part (iii) most could give one reason why counting the number of bubbles is not the most accurate way to find the amount of oxygen produced as you could miscount or that bubbles were of differing sizes. In Part (iv) most knew that the more light a plant gets, the higher the rate of photosynthesis. In Part (c) most could read the volume shown on the gas syringe.

**Q5 Reactivity of Metals**

This question was well received with most candidates knowing each metal was tested three times and an average calculated to make the results reliable in Part (a). In Part (b)(i), most could identify the anomalous result in the table and knew it was not included when calculating the average in Part (ii). In Part (iii), most could correctly calculate the average temperature rise for zinc. In Part (iv), some realised that iron was not the most reactive metal as it had the lowest temperature rise. In Part (c), most could correctly give 17.36 to one decimal place. In Part (d), most knew that bubbles or fizzing would indicate that a gas was being produced by this reaction. In Part (e), most could match the measurement made with the piece of apparatus needed. In Part (f), few realised that if the same investigation was carried out in a beaker wrapped in cotton wool, the temperature rises would increase.

**Q6 Magnesium and Acid Reactions**

This question was well received with most candidates recognising that the hypothesis being tested as the more concentrated the acid, the faster the reaction in Part (a)(i). In Part (ii), most candidates were able to plot four out of the five points correctly on the grid, but few could plot all five points and draw a smooth curve to gain full marks. In Part (iii), most realised that a more accurate time for when the reaction stopped producing gas could be achieved by measuring the volume of gas every 20s. In Part (iv), most candidates knew that a less concentrated acid would produce less gas in this reaction. In Part (b), most knew that hydrogen produced a squeaky pop when tested using a lit splint. In Part (c), most knew that washing it off with lots of water was the safest action to take if Clare spilled some acid on her hand.

**Q7 Soil pH Testing**

This question proved to be a good discriminator with most candidates realising that a pH meter is better than using universal indicator as it gives a more accurate result in Part (a). Few could go on to state that each universal indicator colour could be hard to distinguish and gave a range of pH. In Part (b), few realised that the gardener washed the pH meter after testing each area to prevent cross contamination. In Part (c), most could correctly draw a filter funnel.

**Q8 Friction**

This question proved to be a good discriminator with most candidates able to state the range of results shown in the table in Part (a)(i) and complete the bar chart in Part (ii). Most candidates also deduced that sandpaper produced the most friction in Part (iii). In Part (b)(i) few could conclude that the student started testing with the ramp at a height of 4 cm as this was the height that the ball would start to roll down the slope. Most candidates knew that a stopwatch should be used to measure a precise time in Part (ii) and recognised the correct formula used to calculate speed in Part (iii). In Part (c)(i) few candidates realised that the student was incorrect to suggest that more area produced more friction as the increase in surface area led to no change in the force required to move the blocks but in Part (ii) most knew that the student always used four blocks for each test to keep the total weight the same.

**Q9 Resistance and Length**

This question also proved to be a good discriminator. Few candidates realised that a voltmeter should be connected in parallel in Part (a)(i) or that the switch was the component used to control the temperature in Part (ii). In Part (b) some recognised the length of wire as the independent variable in this investigation or the thickness of wire as the controlled variable, but few candidates could get both correct. In Part (c) (i) most candidates correctly calculated the resistance of the 50cm length of wire and gave the correct conclusion in Part (ii) while also recognising the graph these results would produce in Part (iii). In Part (d) most candidates correctly chose the most precise ammeter.

**Q10 Echo method**

This question was well received. Most candidates were able to reorder the steps in the method given to logically complete the experiment in Part (a). In Part (b) few candidates correctly worked out the time taken by the sound to reach the wall in part (i) or the distance the sound would travel in part (ii). In part (c) most realised that the speed of sound would not change when the pupils moved further from the wall.

## Assessment Unit 4

## Practical Skills

### Booklet A

### Higher Tier

### Unit Overview

This higher tier paper was accessible to candidates across the ability range. It was pleasing to see very few blank spaces across the majority of papers. Most candidates were able to achieve double figure marks for this paper and demonstrated a good knowledge of practical skills.

- Q1** This question was testing candidate's knowledge of Prescribed Practical B2 - Investigate the energy content of food by burning food samples.
- (a)**
- (i)** The first two columns of the table were completed satisfactorily by most candidates. Candidates should, however, be encouraged to not place units in the body of the table. The boxes just required a value read from the thermometer and not the unit degrees Celsius.
  - (ii)** The values obtained for starting and final temperatures were reasonably easy values to work with. Therefore, most candidates were able to correctly subtract starting temperature from final temperature to get the temperature rise for each crisp. There were a few candidates who added the values or subtracted them incorrectly so lost this mark.
  - (iii)** Only the more able candidates were able to gain both marks for this question part. It was often the case that candidates failed to record the unit in the heading box, or they failed to reference 'temperature' in the heading title. Again, units must always be displayed in the column heading and not in the body of the table. It is also important to stress to candidates the need for the unit to be displayed in its correct format, oC, and not oC or oc as some candidates were writing. These alternatives will not be credited.
  - (iv)** Generally this was well done by most candidates. Some candidates did not know what calculating an average required so they simply added their values and did not divide by two to get the correct answer.
  - (v)** Overall, this was well answered by most candidates. However, some candidates lost the mark for giving the answer 'to make the results accurate' along with the correct answer 'to ensure reliable results'. This is conflict so candidates lost the mark for this question part.
- (b)**
- (i)** This was well answered, and most candidates realised that the boiling tube would be very hot after carrying out the experiment so would need to be left to cool down before removing it from the retort stand. On some occasions candidates gave vague answers, such as 'to allow the thermometer to cool down' and 'the tube was too hot'. These answers were not credited.
  - (ii)** This was well answered by most candidates. If the candidates failed to secure this mark it was often for giving the vague answer 'it affects the results'.

- (c) (i) (ii) Well answered.
- (d) (i) The same problems arose with this graph as arise with graphs plotted on unit 1 papers. Candidates use a mark to indicate the point which is too big, for example, an X which is over two or three small squares with the centre point of the X too far away from the answer point. This often results in candidates losing out on two plotting marks. For Biology graphs the points must be joined with straight lines dot to dot. It would be beneficial if candidates were encouraged to bring a ruler into the exam hall to facilitate the completing of Biology line graphs. The plotting lines must go through the centre of the point and not be double or staggered lines. Candidates should be encouraged to complete as many practice graphs from past papers as possible in preparation for their science exams.
- (ii) This was well answered by most candidates. For all trend questions it is important that candidates copy the labels on the axis in their entirety to ensure they gain credit for their answers. For example, with this trend question it was not acceptable to say 'As the mass of crisp increases the temperature increases' - this is not what was displayed on the graph. The correct answer required was 'As the mass of crisp increases the temperature rise increases'. This is the information displayed on the graph and is a good example of how important it is for candidates to read the wording on the axis and transfer it accurately when answering the question.
- (iii) Well answered.

**Q2** This question was testing candidate's knowledge of Prescribed Practical P3 - Compare the heat conductivity of different materials by measuring the time it takes heat to travel through a variety of conductors, and at least one insulator.

- (a) For this question the first mark was awarded for filling in the results obtained from the experiment in the first two columns of the table. If the results were recorded in seconds this was awarded a second mark and the third mark was awarded for correctly averaging the time taken for each material to change colour.

Most candidates were able to get the first two marks for this question part. However, only the more able candidates were able to gain the third mark for giving the correct averages for each material. Quite often the candidates correctly averaged the times for one or two of the materials but the mark was only awarded if every average time was correct. Again, as mentioned in the previous question, units should not be written in the body of the table.

- (b) This was well answered and 'error carried forward' (ECF) was applied if candidate's averages were incorrectly worked out from Part (a).
- (c) ECF was applied, and the bar chart marks were awarded from the average times candidates had calculated in their results table. Unfortunately, the bar chart was poorly constructed by many candidates. The first skill tested was correctly scaling the y-axis for the values they needed to plot. This proved challenging for some candidates and who lost this first mark. ECF was then applied to allow the candidates to gain the marks for plotting bars in the correct place according to their scale. When drawing bar charts candidates should be encouraged to use a ruler and ensure that the top line of their bar is at exactly the correct place on the gridlines. This is a skill which is tested regularly on the unit 1, 2 and 3 papers and should be practiced by candidates prior to the exam.

- (d) ECF was applied to take into account the order from the results obtained by the candidate.
- (e) Overall, this was well answered.
- (f) This question asked how the results would change and some candidates failed to recognise that this was about the change to results and not the conduction of the heat and did not get the mark for this question part. An example of the most common wrong answer was that ‘the heat would be conducted quicker through the rods’.
- (g) Well answered. The most common answer was ‘the rods were put into the water at the same time’.
- (h) This question part was well answered and the converse was also accepted if candidates clarified their answer with the fact that the lid was still present.
- (i) This was well answered by most candidates.

## Assessment Unit 4

## Practical Skills

### Booklet B

### Higher Tier

#### Unit Overview

This higher tier paper was well received by candidates. It was very pleasing to see that there were relatively few blank spaces across most papers. As expected, the quality of responses to the 6 mark QWC question was of a higher standard than the Foundation Tier. The Higher Tier paper required more free response answers which made the questions throughout the paper more demanding than the Foundation Tier equivalents.

#### Q1 Microscopes and Slides

This question was well received by most candidates. Many were able to name the focus knob as the part used to get a clear image in Part (a), common incorrect responses included vague descriptions like focuser. In Part (b)(i) most knew that the X4 objective lens was used to view the cells in the diagram and in Part (ii) most knew the correct diagram A showed the view of the cells that should be used when looking at them for the first time. In Part (c) most knew that Iodine was used to prepare a slide of onion cells, but few could state that the cells were covered with a cover slip.

#### Q2 Pulse Rates

This question was also well received by most candidates. Most were able to name pulse rate as the dependent variable in this investigation in Part (a), heart rate was also an acceptable answer. In Part (b) most candidates could interpret the data to state that the girl’s pulse rate increased and then decreased with time to gain one mark, but few could fully describe the trend shown in the results for the girl as her pulse rate increased through the first two minutes of exercise and then decreased after the exercise. In Part (c)(i) most knew that because the investigation was only done for one boy and one girl, this made the conclusion unreliable. In Part (ii) most were able to suggest a safety precaution that should be taken before carrying out the exercise in the classroom.

**Q3 Testing for Starch**

This question proved to be a good discriminator with only a small number of candidates able to state that the plant put in the dark for 24 hours to de-starch it in Part (a). Part (b) was the six-mark QWC question on the starch test and most candidates knew that Iodine was used to test for starch, the colour change involved or that the leaf was put in boiling water to kill it at the start of the experiment and so gained two marks. Those who gained four marks usually also knew that Ethanol was used to remove chlorophyll from the leaf and those that gained full marks could fully describe the method used when testing this leaf for starch including a reason for each step and the results for the covered and uncovered parts of the leaf. This question part was better answered in the Higher Tier compared to the Foundation Tier paper. In Part (c) there was a variety of parts of the leaf shaded, with only around half of the candidates able to correctly shade the parts of the leaf that would have starch present.

**Q4 Photosynthesis**

This question had varying levels of success with most candidates able to use the graph to gain at least one mark in Part (a)(i) and only a few could give a full explanation using the information in the graph. In Part (ii) most knew that counting 50 bubbles each time would make it a fair test. In Part (b) most candidates were able to name the gas syringe. In Part (c) (i) most candidates could interpret the information to sketch the correct shape of graph but in Part (ii) found it difficult to express in words why changing two variables means that the investigation is not fair.

**Q5 Reactivity of Metals**

This question was well received with most candidates knowing each metal was tested three times and an average calculated to make the results reliable in Part (a). In Part (b), most candidates could identify the anomalous result in the table and knew it was not included when calculating the average. In Part (c), most could correctly calculate the average temperature rise for zinc and quote the answer to one decimal place. In Part (d), most candidates realised that iron was not the most reactive metal as it had the lowest temperature rise, a reference to temperature rise was necessary to gain this mark. In Part (e), most knew that bubbles or fizzing would indicate that a gas was being produced by this reaction. In Part (f), most candidates could identify the thermometer as the correct apparatus to measure temperature, but very few were able to correctly state that a balance was used to measure mass. The most common answer was 'scales' which was not given credit. In Part (g), few realised that if the same investigation was carried out in a beaker wrapped in cotton wool, the temperature rises would increase but most candidates realised that the order of reactivity would not change.

**Q6 Magnesium and Acid Reactions**

This question was well received with most candidates recognising that the hypothesis being tested as the more concentrated the acid, the faster the reaction in Part (a)(i), this was aided with choices being given. In Part (ii), most candidates were able to plot four out of the five points correctly on the grid, but a smaller number could plot all five points and draw a smooth curve to gain full marks. Many candidates tried to use a ruler which was not given credit. In Part (iii), most candidates were able to predict a reasonable value for the less concentrated acid. In Part (iv), most realised that a more accurate time for when the reaction stopped producing gas could be achieved by measuring the volume of gas every 20s. In Part (b), most knew that hydrogen produced a squeaky pop when tested using a lit splint.

**Q7 Soil pH Testing**

This question proved to be a good discriminator with most candidates realising that a pH meter is better than using universal indicator as it gives a more accurate result in Part (a). Few could go on to state that each universal indicator colour could be hard to distinguish and gave a range of pH. In Part (b), many candidates found it difficult to put into words the answer that the gardener washed the pH meter after testing each area to prevent cross contamination. In Part (c), most could correctly draw a filter funnel, but some failed to realise that they needed some sort of vessel to collect the water underneath.

**Q8 Friction**

This question proved to be a good discriminator. Most candidates were able to state the range of results shown in the table in Part (a)(i) and complete the bar chart in Part (ii). Most also deduced that sandpaper produced the most friction in Part (iii). In Part (b)(i) there were more Higher Tier candidates that could conclude that the student started testing with the ramp at a height of 4 cm, as this was the height that the ball would start to roll down the slope, compared to Foundation Tier. Most knew that a stopwatch should be used to measure a precise time in Part (ii) and recognised the correct formula used to calculate speed in Part (iii). In Part (c)(i) few candidates realised that the student was incorrect to suggest that more area produced more friction as the increase in surface area led to no change in the force required to move the blocks but in Part (ii) most candidates knew that the student always used four blocks for each test to keep the total weight the same or to make it a fair test.

**Q9 Resistance and Length**

This question also proved to be a good discriminator. Most candidates realised that a voltmeter should be connected in parallel in Part (a)(i) but few were able to state that the switch was the component used to control the temperature in Part (ii). In Part (b) most recognised the length of wire as the independent variable or the thickness of wire as the controlled variable, but few could get both correct. In Part (c)(i) nearly all the candidates correctly calculated the resistance of the 50cm length of wire but in Part (ii) only the more able candidates were able to describe the features of a directly proportional graph. In Part (d) most candidates could correctly choose the graph required.

**Q10 Echo Method**

This question was well received with most candidates able to reorder the steps in the method given to logically complete the experiment in Part (a). In Part (b) most Higher Tier candidates correctly worked out the time taken by the sound to reach the wall in Part (i) and the distance the sound would travel in Part (ii). In Part (c) most candidates realised that the speed of sound would not change when the pupils moved further from the wall.

## Contact details

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