GCSE EXAMINERS' REPORTS

GCSE
APPLIED SCIENCE (DOUBLE AWARD)

SUMMER 2018

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APPLIED SCIENCE (DOUBLE AWARD)

GCSE (NEW)

Summer 2018

UNIT 1: ENERGY, RESOURCES AND THE ENVIRONMENT: FOUNDATION TIER

There were over 2300 entries for this tier paper. The vast majority of candidates attempted every question but no question had a 100% attempt rate.

The topics candidates found challenging were related to the hardness of water, digestion of foods and respiration.

Many candidates again a lack of scientific literacy and did not seem to use the extra reading time given in the paper. Candidates found the following challenging:

- Applying knowledge and understanding to novel situations
- Using equations and substituting values correctly
- Reading the questions carefully and extracting the most relevant parts
- Giving clear explanations

Q1.   Mean mark 4.8/11

The attempt rate for this question was 99.7%.

(a)   The majority of the candidates scored well on this first question, correctly identifying the correct extraction method.
(b)   Many candidates did not complete the table or did not follow the pattern shown by the boiling ranges for the other fractions. Many candidates could not name the process – fractional distillation or describe what happens to the crude oil prior to entering the column. In part (iv) most of the candidates used the information in the table to identify the correct fraction.
(c)   Many candidates failed to answer this part of the question and therefore gained no marks.
(d)   It was rare to see a candidate gain all three marks here. Most candidates were unable to give the structure of the polymer, however most candidates could give the correct molecular and structural formula.

Q2.   Mean mark 4.2/13

99.1% of candidates answered this question.

(a)   Most candidates were able to identify the series and parallel circuits however they did not gain all the marks here as they failed to correctly describe the current through the lamps correctly.
(b)   Many candidates failed to appreciate that there were two lamps in circuit 1 and therefore did not substitute the correct resistance value into the equation given. Many candidates correctly stated the current would increase if lamp Y was removed.

(c) The equation for power was used correctly, with the majority of candidates substituting the correct values and calculating the power correctly.

(d) Most candidates could not identify the correct circuit to measure voltage and current.

(e) It was rare to award two marks here. Often candidates gained one mark for recognising that if one lamp was broken the others would still work.

Q3.   Mean mark 0.7/10

92% of candidates answered this question.

(a) The candidates could not identify the dependant variable in the experiment and they could not describe how to check the reproducibility of the experiment.

(b) In this QER question very few candidates were awarded marks in the middle band. Those candidates who were awarded marks in the lower band correctly described the cities with hard and soft water. Candidates could not recall any knowledge about the hardness of water. Many candidates incorrectly used the data from the table and many candidates did not attempt this part of the question.

(c) Candidates usually gained credit here for recognising that lime-scale is formed in pipes causing blockages.

Q4.   Mean mark 1.9/13

The attempt rate for this question was 97.5%.

(a) The candidates needed to recall information about digestion. They rarely scored the 5 marks available in this section despite the fact that the key terms were given in the box.

(b) This question is based on a standard enzyme digestion practical involving starch and amylase. Many candidates were able to recognise that digestion speeded up with increased temperature. This was the most common mark awarded. Candidates did not recognise that digestion of the starch slowed after $40^{o}C$ or that there was an optimum temperature for enzyme action.

(c) If a candidate was awarded a mark here it was usually for recognising that no starch was digested. Very few candidates used the term 'denatured' in their explanations.

(d) Candidates needed to describe the test for glucose. Many candidates recognised that Benedict's solution is used but only a few candidates referred to heating the solution. For credit in part (ii) the candidates needed to state the colour change i.e. blue to brick red.

Q5.   Mean mark 2.4/9

94.1% of candidates answered this question.

(a) The majority of candidates were able to substitute the correct values into the equation and calculate the efficiency.

(b) Some of the candidates were able to use the information given and complete the table with the given equations to calculate the total cost for light for 50 000 hours for the traditional filament lamp and the cost of electricity for the LED. An error carried forward (ecf) was given if a candidate failed to calculate the number of traditional lamps correctly which was also carried forward to the total cost. Also an ecf was also awarded if a candidate failed to calculate the

correct units used for the LED. Most of the candidates who attempted this question failed to show any working and many missed this part of the question. For part (ii) the candidates needed to refer to the total costs calculated and state the saving that could be made. Very few candidates gained both of these marks.

Q6.   Mean mark 1.7/10

95% of candidates answered this question which was common with the higher tier paper.

- (a)   Most of the candidates could not complete the word equation and therefore gained no credit.
- (b)   Many candidates gave a suitable reason for the anomalous reading, however when calculating the mean most candidates used the anomaly in their calculation and so gained no credit for their calculation.
- (c)   Most of the candidates did not know the difference between the terms 'describe' and 'explain'. Only a few candidates were able to explain the pH changes shown on the graph. It was rare to award the 3 marks available here and usually it was for recognising that the low pH was due to the acid or the pH at the end was due to the alkali. This is a standard neutralisation curve and this term was required. Most candidates tried to describe the changes without any reference to acid or alkali.
- (d)   Most of the candidates were able to match the indicator to the range on the graph. The candidates were able to identify the indicator which would not be suitable. However, the candidates' explanations were often poor and gained no credit.

Q7.   Mean mark 0.7/9

85.4% of candidates answered this question which was common with the higher tier paper.

- (a)   Most of the candidates could not apply their knowledge and did not explain the reason for the colour change.
- (b)   Candidates usually gained one mark here for recognising that the mouse was bigger than the other organisms but very few candidates gave any other acceptable reasons.
- (c)   The candidates had a list of acceptable controlled variables, however many used the term amount – which is not accepted e.g. amount of indicator.
- (d)   It was very rare to see a candidate that could describe a control experiment and/or the expected result. Credit was given to candidates who correctly stated suitable controlled variables.

UNIT 1: ENERGY, RESOURCES AND THE ENVIRONMENT: HIGHER TIER

There was an entry of 105 for this higher tier paper. As stated in last year's report, a significant number of the candidates found the paper challenging and they may have been better suited to the foundation tier.

The vast majority of candidates attempted every question. The topics that were most challenging for candidates were electrical resistance, hardness of water, respiration and the composition of the atmosphere.

Generally, the candidates did not demonstrate scientific literacy and did not appear to use the extra reading time given. Candidates found it difficult to distinguish between the terms 'describe' and 'explain'. They also found the following areas quite difficult;

- Applying knowledge and understanding to novel situations.
- Using equations and substituting values correctly.
- Reading the questions carefully and extracting the most relevant parts.
- Giving clear explanations.

Completing past papers as a revision tool is essential and centres should be encouraged to use the WJEC past paper section and the OER's available on the website.

Q1.   Mean mark 2.8/10

100% of candidates answered this question which was common with the foundation tier paper.

(a)   Most of the candidates could not complete the word equation and therefore gained no credit.

(b)   Most of the candidates gave a suitable reason for the anomalous reading, however when calculating the mean most candidates used the anomaly in their calculation and so gained no credit.

(c)   The candidates did not know the difference between the terms 'describe' and 'explain'. Only a few candidates were able to explain the pH changes shown on the graph. It was rare to award the 3 marks available here and usually it was for recognising that the low pH was due to the acid or the pH at the end was due to the alkali. This is a standard neutralisation curve and this term was required. Most candidates tried to describe the changes without any reference to acid or alkali.

(d)   Most of the candidates were able to match the indicator to the range on the graph. The candidates were able to identify the indicator which would not be suitable. However, the candidates' explanations were often poor and they gained no credit.

Q2.   Mean mark 1.9/9

100% of candidates answered this question which was common with the foundation tier paper.

(a)   Most of the candidates recognised that the rise in carbon dioxide was from respiration, however many failed to link this to the indicator colour change - red to yellow.
(b)   Candidates usually gained one mark here for either recognising that the mouse was bigger than the other organisms or the mouse had a higher respiration rate. Very few candidates gave any other acceptable reasons.
(c)   Many candidates used the term 'amount', which was not accepted e.g. amount of indicator.
(d)   It was very rare to see a candidate that could describe a control experiment and/or the expected result. Credit was given to candidates who correctly stated suitable controlled variables.

Q3.   Mean mark 4.0/13

The attempt rate for this question was 100%.

(a)   Most of the candidates gained one mark here, usually for describing the role of the National grid in supplying electricity to consumers. Very few describes this as a reliable source.
(b)   Only a few candidates gained the four marks available here. Many recognised the changes in voltage and/or current, but few could explain why the transformers performed this change.
(c)   There were numerous ways to determine if the bio-generator could supply the necessary electricity. Credit was given for showing correct reasoning using the equation given or any suitable alternatives. Most candidates made an attempt at solving the problem. For part (ii) it was rare to award 2 marks. Most candidates recognised that the energy source was renewable but failed to explain this further.

Q4.   Mean mark 4.2/13

100% of candidates answered this question.

(a)   Many candidates were able to correctly label some parts of the digestive system and name the pancreas.
(b)   Most of the candidates failed to explain the pH changes, choosing to describe them instead. Candidates did not explain why the pH changed and the role of bile in the digestion of lipids to fatty acids and glycerol. For part (ii) credit was given to many candidates who recognised that there was no change in the pH, but it was quite rare to see the candidates use the term denatured in their explanation.
(c)   Only a few candidates were able to explain enzyme action and gain the 3 marks available here. Many recognised the active site on the enzyme but very few described the formation of an enzyme-substrate complex and the products of lipid digestion.

Q5.   Mean mark 0.6/9

The attempt rate for this question was 97.1%.
   (a)   Only a few candidates were able to choose the correct resistors with the circuit open, select the correct equation and calculate the current.
   (b)   In this part only a very few candidates were able to calculate the total resistance by selecting the correct equation for resistance in the two parallel circuits. An error carried forward was awarded if the calculations for resistance R_1 and R_2 were added together incorrectly to give the total resistance.
   (c)   There were no correct responses to this part of the question.

Q6.   Mean mark 1.0/11

97.1% of candidates answered this question.

   (a)   Only a few candidates were able to complete the equation to show how temporary hard water breaks down on boiling. In part (ii) only a very few candidates were able to explain why permanent hard water cannot be softened by boiling.
   (b)   The methods used to soften hard water were poorly explained, with only a few candidates gaining some marks. Most candidates could not explain any of the processes.
   (c)   Since the processes were not understood by most of the candidates, they could not identify a disadvantage to ion exchange.
   (d)   Most of the candidates gained at least one mark here. Usually for stating that hard water causes blocked pipes.

Q7.   Mean mark 1.8/10

98.1% of candidates answered this question.

   (a)   In this QER question the candidates generally simply described some of the trends/changes shown on the graph. This limited them to the 1-2 marks. Only a few candidates quantitatively described the changes with some explanation. The explanations were invariably very simple. This gave them marks in the middle band. No candidate was awarded marks in the top band.
   (b)   Very few candidates used the information given to recognise that the elements C, H, O and N in the flask were also found in biological compounds. In part (ii) only a few candidates used the information given on the apparatus to recognise that heat (hot earth) and electrical activity (spark discharge) were two important assumptions made.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE (NEW)

Summer 2018

UNIT 2: SPACE, HEALTH AND LIFE: FOUNDATION TIER

There were approximately 2 100 entries for this foundation tier paper. The vast majority of candidates attempted every question; however no question had a 100% attempt rate. There were some part-questions that were not attempted.

Three topics proved challenging to candidates in the context given in the paper. These were blood, treatment of infections (MRSA), and radioactivity.

There is more information provided on the exam paper but there is an additional 15 minutes allowed for reading time. There is evidence to suggest that not all candidates used this to their advantage. Candidates need to work on further developing the scientific. They need to be able to evaluate which information is required for a question part.

Many candidates had difficulty in:

- applying knowledge and understanding to novel situations.
- using equations and substituting values correctly.
- reading questions carefully so consequently often miss information contained within the question. In some instances responses were irrelevant and earned no credit.
- interpreting data.
- giving clear explanations.

It is recommended that teachers provide brief topic summaries up front, supplemented by short, regular progress assessments that could be peer marked. It is advised that selected exam questions are incorporated into the teaching programme. They can be used to teach how to read questions and how to pick out key words, etc. Candidates should be encouraged to annotate the question paper, e.g. circle or underline key points in a question. Candidates would benefit from using practice questions requiring extracting numerical quantities needed for the given equations. Teachers should emphasise the need to compare the units of values with the property in an equation that candidates substitute into. The use of 'anonymous' past student papers for peer assessment or modelling answers is recommended, as is reference to the OER section of the WJEC website.

Section A

Q1.   Mean mark – 6.0/10
      (a)   Most candidates gave correct answers here.
      (b)   Many candidates did well with a few gaining full marks. The question parts that caused most problems were (ii)II and (v). A common error was seeing the fox in the widest part of the pyramid and wheat in the narrowest.

Q2.   Mean mark – 7.5/16
   (a)   (i)   The parts of the blood were given in the stem and in the table in part. However, that did not prevent some candidates adding other parts of the body to the labels. Red blood cells were usually labelled correctly but the other parts of the blood were not as well known.
         (ii)   The functions of blood parts were not well known.
   (b)   Most candidates could make some comparison to earn a mark but few gave an appropriate health problem.
   (c)   The majority of candidates scored well on these calculations with some earning full credit. However, there were instances where candidates failed to calculate correct answers even though substitution was correct. The last question required the use of values from the two previous parts and this was correctly done by a majority of candidates.

Q3.   Mean mark – 4.7/8
   (a)   Most candidates gained at least 2 marks for arranging most steps in the correct sequence.
   (b)   (i)   The invertebrates were usually identified as was the water quality.
         (ii)   Candidates had difficulty in expressing their answers carefully and logically.
         (iii)   Mostly correct answers seen.

Q4.   Mean mark – 0.7/6
About 17% of candidates did not attempt the question.
Even for those candidates who attempted the question, only very few earned credit above the bottom band of marks. Most candidates just copied out the information in the poster. Problems caused by MRSA were not known.

Q5.   Mean mark – 4.5/10
   (a)   The full range of marks were evident. Candidates should be encouraged to read back the sentences after completion, to see if they make sense. Some did not.
   (b)   (i) Most candidates selected cobalt-60.
         (ii) A minority of candidates stated that it would halve.
         (iii)   I. Some candidates' numeracy skills were insufficiently developed to spot the patterns in the data, especially when dealing with fractions.
         II. A minority of candidates understood that an additional half-life was required to that shown in the table.

Section B

The following questions were based on the pre-release material. Candidates should have been familiar with its contents and interacted with it by the time they sat the exam. It is meant to provide a teaching resource upon which questions will be based. An obvious learner task would be for them to come up with their own questions based on its contents together with their own marking scheme. Therefore, it is disappointing that 7% failed to attempt question parts 6(c)(d)(e).

Past Science B pre-release articles and associated questions are available on the WJEC website and are useful teaching resources.

Q6. (a) & (b). Mean mark – 2.4/6
   (a)   Numeracy skills were required to compare five of the statements with the table in the pre-release. Candidates generally selected at least two correct statements.

(b)   Candidates had difficulty understanding the information in the spectra diagrams in the pre-release. As a result, few obtained any marks at all.

Q6. (c)(d)&(e). Mean mark – 4.1/19
About 7% of candidates did not attempt the question.
Some candidates made no attempt to plot the graph.

(c)   (i)   The relative position of the asteroid belt were between the values of Mars and Jupiter. Many answers for temperature did not lie between -65°C and -110°C.

           (ii)   There were references to the fact Pluto is classed as a dwarf planet but the question asked for information in table 1 to be used.

           (iii)   Candidates numeracy skills were put to the test here. A minority of candidates produced appropriate scales. Some scales were non-linear, others were labelled Mercury, Venus, etc. instead of using their distance values. Another error was failing to use at least half of the grid in each direction. Plotting errors were evident.

           (iv)   References to the line not being straight were insufficient to gain a mark.

(d)   Candidates did not respond well to the provided information.

(e)   Most candidates responded well with some earning full credit. Others identified a difference with respect to Aristotle but then also gave the opposite viewpoint based on the 2006 model. Such an example only earned 1 mark.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE (NEW)

Summer 2018

UNIT 2: SPACE, HEALTH AND LIFE: HIGHER TIER

There were 90 entries for this higher tier paper. Only two questions had a 100% attempt rate... A significant number of candidates found the paper challenging. These may have been better suited to the foundation tier paper.

Four topics proved challenging for the candidates in the context given in the paper. These were absorption spectra, blood vessels, a specified practical using indicator species, and radioactivity.

There is more information provided on the exam paper but there is an additional 15 minutes allowed for reading time. There is f evidence to suggest that not all candidates used this to their advantage. Candidates need to further develop their scientific literacy. They need to be able to evaluate which information is required for a question part.

Candidates had difficulty in:
- applying knowledge and understanding to novel situations.
- reading questions carefully so consequently often miss information contained within the question. In some instances responses were irrelevant and earned no credit.
- interpreting data.
- giving clear explanations.

Section A

The following questions were based on the pre-release material. Candidates should be familiar with its contents and have interacted with it by the time they sit the exam. It is meant to provide a teaching resource upon which questions will be based. An obvious learner task would be for them to come up with their own questions based on its contents together with their own marking scheme. Therefore, it is pleasing that 100% attempted question 1(a)-(c) but almost 4% failed to respond to question 1(d).

For a significant percentage of candidates, marks achieved in question 1 contributed approximately 50% of their total mark for the paper.

Past Science B pre-release articles and associated questions are available on the WJEC website and are useful teaching resources.

Q1. (a)-(c). Mean mark – 8.3/19
- (a)   Performance was much better than on the foundation tier. Quality of graphs was much improved.
- (b)   Candidates were able to interact more with the information in the pre-release but again marks were limited.
- (c)   Comparisons of both models of the solar system were well done.

Q1.   (d).   Mean mark – 1.7/6
About 4% of candidates did not attempt this part of the question. Candidates did not show their understanding of how the spectra could be interpreted to provide any relevant information.

Section B

Q2.   Mean mark – 6.2/16
(a)   A full range of marks was awarded. Some candidates realised the implications of the blood results whilst others confused deficiencies in a blood count with incorrect medical problems.
(b)   Knowledge of veins and capillaries was very limited.
(c)   (i)   A minority realised from the question that 'from rest' meant that starting velocity was 0 m/s. Most candidates used 10 m and 2.5 s to determine a velocity of 4 m/s. Then they used 96 m and 6 s to find another velocity of 16 m/s. This gave a velocity change of 12 m/s, which they divided by either of the times. Obviously, this was the incorrect method but some partial credit was earned.
(ii)   The majority of candidates arrived at the correct mass but others manipulated incorrectly or failed to square the height.

Q3.   Mean mark – 3.8/12
(a)   This question was based on a specified practical. Few candidates gained a mark above the bottom band and some scored zero. A common answer included a description of adding the indicator species to the water and seeing how long they survived. This often involved taking water samples back to the laboratory, adding invertebrates, then checking daily for survivors.
(b)   (i)   Some excellent answers were seen but these were in the minority. Often candidates used their own terminology instead of the water quality terms in the table. They sometimes gave a choice of water quality rather than the most likely.
(ii)   Candidates did not appreciate that difficulties would be caused by the fact ecosystems are dynamic situations.

Q4.   Mean mark – 2.7/12
(a)   Little credit was gained neither from describing a trend nor from completing the calculation.
(b)   (i)   Most candidates succeeded in calculating the waste energy of the shrew.
(ii)   Few candidates could provide an explanation of the different respiration energy amounts.
(iii)   Candidates recognised how this benefited the plants. However, some thought the benefit was due to protection from the fox.

Q5.   Mean mark – 1.7/10
(a)   (i)   Candidates described the properties of gamma rays instead. It is doubtful whether they understood the term nature.
(ii)   A minority explained that this was due to the highly penetrating and low ionising properties of gamma rays.
(iii)   Again a minority selected thallium-201 and fewer explained their choice. Popular choices were caesium-137 because it would last longer and palladium-103 because it had the shortest half-life. Units were ignored in this instance.

(b)   A minority of candidates arrived at the correct answer. Some showed the correct halving i.e. $1 \rightarrow 1/2 \rightarrow 1/4 \rightarrow 1/8 \rightarrow 1/16 \rightarrow 1/32$, but thought this showed 6 half-lives. Others divided 17 or 103 by 32.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE (NEW)

Summer 2018

UNIT 3: FOOD, MATERIALS AND PROCESSES: FOUNDATION TIER

There were approximately 1 660 entries for this foundation tier paper. The vast majority of candidates attempted every question; however, no question had a 100% attempt rate. Also, some part- questions were not attempted.

Attempt rates decreased from question 3 onwards. Four topics proved challenging in the context given in the paper. These were nuclear fission, half-life, a specified practical on rates of reaction, and leaf structure.

There is more information provided on the exam paper but there is an additional 15 minutes allowed for reading time. There is evidence to suggest that not all candidates used this to their advantage. Candidates need to further develop their scientific literacy. They need to be able to evaluate which information is required for a question part.

Many candidates had difficulty in:
- applying knowledge and understanding to novel situations.
- using equations and substituting values correctly.
- reading questions carefully so consequently often miss information contained within the question. In some instances responses were irrelevant and earned no credit.
- interpreting data.
- giving clear explanations.

Teachers should provide brief topic summaries up front supplemented by short, regular progress assessments that could be marked by their peers. It is recommended that selected exam questions are incorporated into the teaching programme and that these are used to teach how to read questions and how to pick out key words, etc. Candidates should be encouraged to annotate the question paper, e.g. circle or underline key points in a question. Candidates should practice questions requiring extracting numerical quantities needed for the given equations. Teachers should emphasise the need to compare the units of values with the property in an equation that candidates substitute into. It is recommended that 'anonymous' past student papers for peer assessment or modelling answers are used, and that teachers refer to the OER section of the WJEC website.

Questions

Q1.   Mean mark – 4.5/10
This was the best-answered question on the paper.
      (a)   (i)   Most candidates made two correct choices here. Composite was often selected for the top cell.
              (ii)   The question asked for a description of the structure of polymers but it was usual to see properties instead.
      (b)   (i) & (ii)The correct metals were usually selected in both parts.

(iii)   Steel was a common answer. In questions such as this, the reason needs to be a comparison so high**est** tensile strength was expected, not just high or because its tensile strength is 40×10^7 Pa.

Q2.   Mean mark – 4.8/13
(a)   The top two rows were usually completed correctly but the method that dries bacteria was not.
(b)   Answers to (i) & (ii) were well known but the term toxins was not. Common answers in (iii) were 'fungus' and 'mould'.
(c)   Candidates often tried explaining the difference between dilutions rather than refer to the colonies produced on the plates as shown in the diagram.
(d)   I.   Most candidates identified the anomalous result.
       II.   Often the anomaly was included in calculations to find the mean. Some candidates didn't find a mean but used the total number of colonies instead.

Q3.   Mean mark – 2.0/6
About 6% of candidates did not attempt the question.
(a)   (i)   Both cations were required and the majority of candidates earned this mark.
       (ii)   Most candidates stated that the colour of the flame would provide further evidence but did not go on to compare the colours produced by the cations they just selected.
(b)   Usually at least one of the anions was identified.
(c)   Very poor answers seen. Candidates were unable to match a cation and anion to come up with the name of a compound.

Q4.   Mean mark – 3.8/15
About 4% of candidates did not attempt the question.
(a)   (i)   Usually the only correct number inserted into the equation was the atomic number of Ba. The diagram showed that three fission neutrons were produced but rarely was the number 3 placed in front of the neutron symbol.
       (ii)   Every combination of underlining appeared. Candidates seemed insecure in the knowledge of a fission reactor.
       (iii)   Frequently there were different values placed in the number of protons boxes. Candidates did not demonstrate understanding of the term isotope.
(b)   (i)   Firstly some candidates penalised themselves by ticking more than two boxes. Statements 1 and 5 proved to be popular (incorrect) choices.
       (ii)   It was rare to see a correct answer.
       (iii)   Marks were rarely awarded and usually for comparing the half-lives.

Q5.   Mean mark – 1.5/12
About 12% of candidates did not attempt the question.
(a)   (i)   The quality of answers could have been improved in both content and in expression.
            A minority gave sufficient detail to be awarded any mark above the bottom band. It would be very difficult to use an answer to replicate the investigation.
            Some ignored the question and described an investigation based on a different independent variable other than temperature. Scientific

language was replaced with jugs and measuring tubes. Inappropriate volumes of solutions were given and they were referred to as amounts.
- (ii) Again references to amounts which were not accepted.
- (iii) Very rare to see acceptable reasons.
- (b) (i) Most candidates made a correct conclusion.
- (ii) Few candidates could use particle theory to explain the trend. They appeared to be unaware of collision theory.

Q6. Mean mark – 4.2/14
About 6% of candidates did not attempt the question.
- (a) (i) Most candidates gave a difference but very few gave a similarity.
- (ii) A majority made a correct calculation but disappointing to note that some candidates correctly arrived at a value of k for the wrong spring i.e. spring 2 earning zero marks.
- (iii) Most candidates recognised that all the points lay on line 1.
- (b) (i) A minority earned the scale mark for including 30 N. Some scales included data from the table placed at successive major grid lines so not producing a linear scale. Currently this loses the scale mark but in future years will result in a total mark of zero for the graph. Some candidates drew their own axes within those that were given.
- (ii) Usually E, if added, was not in the correct position. This meant an ecf was applied to find the force required to reach it.
- (iii) Few candidates explained whether the spring was suitable for the garage doors.

Q7. Mean mark – 0.9/5
About 17% of candidates did not attempt the question.
This was the least well-answered question on the paper.
- (a) Labelling of the leaf proved challenging.
- (b) It was thought the advantage of a transparent epidermis is it's see through.
- (c) Only a minority could state its purpose.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE (NEW)

Summer 2018

UNIT 3: FOOD, MATERIALS AND PROCESSES: HIGHER TIER

There were 97 entries for this tier paper. The vast majority of candidates attempted every question.

Four topics proved challenging in the context given in the paper. These were properties of metals, nuclear fission, half-life and catalysts.

There is more information provided on the exam paper but there is an additional 15 minutes allowed for reading time. There is evidence to suggest that not all candidates used this to their advantage. Candidates need to further develop their scientific literacy. They need to be able to evaluate which information is required for a question part.

Many candidates had difficulty in:
- applying knowledge and understanding to novel situations.
- using equations and substituting values correctly.
- reading questions carefully so consequently often miss information contained within the question. In some instances responses were irrelevant and earned no credit.
- interpreting data.
- giving clear explanations.

Questions

Q1.   Mean mark – 7.3/14
This was the best-answered question on the paper.
- (a)   (i)   Most candidates gave a difference but very few gave a similarity.
- (ii)   A majority made a correct calculation.
- (iii)   Most candidates recognised that all the points lay on line 1.
- (b)   (i)   A minority earned the scale mark for including 30 N.
- (ii)   Usually E, if added, was in the correct position. Most candidates found the force required to reach it.
- (iii)   A majority of candidates could explain whether the spring was suitable for the garage doors.

Q2.   Mean mark – 2.5/5

- (a)   Labelling of the leaf was better than on FT but few candidates could identify all three parts.
- (b)   The advantage of a transparent epidermis was suggested.
- (c)   Only a minority could state the purpose of air spaces.

Q3. Mean mark – 4.2/14
    (a)   (i)   This topic was not well known. Metallic bonding was often described as attraction between positive and negative electrons.
            (ii)   The term malleable was usually recalled but an explanation why metals are malleable was missing.
            (iii)   The presence of free electrons was known but the explanation of their contribution to conduction was not.
    (b)   (i)   Candidates were unable to explain why the presence of different size atoms affected strength.
            (ii)   I.   Good comparisons were made between alloy X and steel for the purpose of making wings.
                    II.   Few correct solutions seen. Some methods ignored the 4% contribution of vanadium so used a mass of 2 500 kg. There were errors in manipulating the equation and some used an incorrect density value from the table.

Q4. Mean mark – 4.8/14
    (a)   (i)   candidates recall that it is the time for *something* to halve but they do not recall a suitable *something*.
            (ii)   Few candidates made the correct calculation. There were errors in converting a billion, and which division to complete.
    (b)   (i)   A majority of candidates recalled that control rods absorb neutrons but could not explain further.
            (ii)   This was usually done well.
    (c)   Usually the first equation was completed correctly but those following were not.

Q5. Mean mark – 2.9/8
    (a)   Candidates could describe this difference.
    (b)   Only a minority of candidates correctly identified all the cations and anions.
    (c)   Most candidates described the flame test well.
    (d)   This was not well answered and rare to see a correct name or formula.

Q6. Mean mark – 4.0/12
    (a)   The full range of marks were seen. Some candidates could list five or six methods and also explain how each limited the growth of bacteria. Their expression was also clear. They achieved top bands marks. At the other extreme, lists were given with no explanations so bottom band marks were awarded.
    (b)   (i)   Most candidates selected a 1:10 000 dilution but were unable to suggest a suitable reason why.
            (ii)   Few correct calculations seen. Usually a correct calculation of the mean was the only creditworthy part of calculations.

Q7. Mean mark – 1.6/8
This was the least well-answered question on the paper.
    (a)   The effect of catalysts on activation energy was not well known.
    (b)   Candidates could usually earn credit for describing at least one benefit.
    (c)   This was not well answered. The link between temperature change and catalyst action was not made.

APPLIED SCIENCE (DOUBLE AWARD)

GCSE (NEW)

Summer 2018

UNIT 4: TASK BASED ASSESSMENT: FOUNDATION TIER

This was the first time that Unit 4, the task based assessment was available. There were just over 1 600 entries for this paper. The best facility factors were seen in the collecting and recording sections (Activity 1 – Task B), with a mean mark of 8.3/10. The lowest facility factors were seen in the risk assessment (Activity 3), with the mean mark being 2.7/10.

Pack A

Pack A Activity 1 Task A

Most candidates were able to state the independent variable as 'temperature', although a significant minority were confused between all three types of variable. Please note that 'temp' is not an acceptable abbreviation of temperature anywhere in the papers. Generally, of those candidates who stated controlled variables, the volume of the solutions involved was the most common correct response. Few candidates identified two controlled variables. As with 'temp', 'amount' is not an acceptable term for volume or mass (or weight). The dependent variable in this case is the volume of carbon dioxide froth produced by the fermenting yeast, which was given in the guidance to the candidates. Many candidates then went on to confuse the volume with 'height' of the froth in their method and recording of their results, although the examining team were alert to this confusion and were positive in their marking when this was evident.

The vast majority of candidates were able to produce an equipment list and a simple method. The quality of the methods produced by candidates was extremely variable. The examining team were particularly looking to see if the candidates were identifying a suitable way of measuring the dependent variable (the volume of froth), and that the suggested method would actually work in practice. This is where a significant number of candidates lost marks. The quality of candidates writing was assessed here. We were particularly looking for the correct use of the key terminology (keywords) for this method, and SPaG was assessed. Examiners were looking for the correct spelling of the scientific keywords and the correct, consistent use of capital letters and full stops. Centres are encouraged to remind candidates about this.

Pack A Activity 1 Task B

The vast majority of candidates managed to take a decent set of results on this experiment, with most producing the highest volume of froth at 40 $^{\circ}$C. Most candidates were able to produce their own table, and tested across the temperature range. A significant number of candidates again used the abbreviation 'temp', which is not accepted as a column header, and as stated before, the examining team were keen to award marks where candidates had stated 'volume' as their dependent variable in their plan, but had then measured the height change of the froth – either were accepted, provided that the header on the table reflected the measurement.

Good candidates managed to record an initial volume/height and a final volume/height and then subtracted one from the other to produce the volume/height of the froth. Most candidates managed to include $^{\circ}$C as the unit of temperature in the column header, but a

significant proportion did not include a correct unit of volume or height, or included the units in the rows of the table, which is not accepted. As the task brief did not require this experiment to be repeated, any mean averages, or errors involving these were ignored. Due to the nature of these results, most candidates recorded volumes/height to a consistent number of decimal places.

Pack A Activity 1 Task C

Most candidates were able to produce a line graph of their results. A few candidates plotted the volume (or height) of the froth at the end of their experiment – neglecting to subtract the initial volume (or height) of the combined yeast solution. The most common errors involved producing a volume (or height) scale that was too small (less than half the available area for the plotted points), or that was too complicated to work out the positions of the plotted points. Centres should practice this with their candidates. Where the scale was straightforward, most candidates were able to plot their points accurately (<1 small square).

The majority of candidates that produced a graph managed to identify the 'best' temperature ($40^{o}C$ for most centres). They also gave a reason (usually the one that produced the most froth), and their 'best' value was consistent with their data. Few candidates managed to link their answer to fermentation and Brewerz Ltd. Credit was also give to candidates who produced a coherent answer.

Pack A Activity 1 Task D

Candidates have found the evaluation tasks quite hard, and it is clear that they need more support from centres prior to the exams. Candidates were first asked to comment on the suitability of their method. This requires an answer (suitable or unsuitable) plus a plausible reason why. Many candidates were unable to give an answer, let alone a plausible reason, although the best candidates were able to suggest that the method was not very suitable due to poor temperature control. Many candidates were able to identify a source of inaccuracy, with most opting to suggest difficulties deciding where the top of the froth was on a scale, or the lack of temperature control.

The suggested improvements did not need to link to the suggested source of inaccuracy. Candidates did have to suggest a workable improvement, not just, for example, 'control the temperature'.

The final section required candidates to evaluate the quality of their data and to comment on the suitability of the experiment to answer the question 'Which temperature would be best to use with the yeast?'. Candidates did not do this well and generally failed to make a comment with a (correct) explanation, but a minority of the better candidates did make a comment about the quality of the data, generally suggesting the lack of repeats as an issue.

Pack A Activity 2 Task A

    (a)   (i)   A significant minority of candidates failed to notice this question or did not know the meaning of the term 'anomalous'. 99 was the most common wrong answer. Of those candidates that attempted this question, most identified 86 as the correct answer.

            (ii)   Few candidates that identified 86 as the anomaly (or identified another value as the anomaly) removed this value from their mean, and as such incorrectly calculated the mean to be 73.3. Most candidates managed to calculate the mean for 3 spatulas as 96.

(b)   Only a minority of candidates identified the maximum burn time of BBQ lighter gel as 96 seconds. A significant number of candidates obviously were confused by Graph 1 having more than one line on it.

(c)   (i)   Many candidates did manage to identify the minimum mass of tablet to be 7 g, and there was a tolerance of ± 0.1 g.

        (ii)   Many candidates were able to calculate the density of the tablet using the given equation and their value from (c)(i), and there were considerable numbers of candidates that needed error carried forward. Rounding was also considered when awarding marks although examiners accepted 1-4 decimal places.

Pack A Activity 2 Task B

Approximately half of all candidates identified the method as valid, although few then managed to give a correct reason for this based on the identification of a clear pattern, or words to that effect.

Many candidates managed to suggest a suitable improvement, with 'more repeats' being the most common suggestion, and measuring the mass (rather than 'spatulas') a common alternative.

A significant proportion of candidates did not identify a mass of lighter gel in spatulas, instead confusing the method with Figure 2. They also rarely gave a sensible reason for their choice.

Pack A Activity 3

The Risk Assessment was the least successful part of the examination across all the packs, both higher and foundation and single and double award.

Very few candidates at foundation level identified risks with actions. For example, whilst many candidates could identify that the drying oven being hot could produce a burn, very few identified that the burn would occur during handling of the samples in and out of the oven. This ensures parity with the risk assessment elements of the other GCSE sciences. Please note that when suggesting suitable protective equipment for handling hot objects 'heat proof gloves' are required, not just 'gloves'.

Candidates did have more success with identifying suitable control measures. Only a small minority of candidates identified the missing hazard as '2 mol/dm^3 hydrochloric acid is an irritant', and this is also an issue for candidates across the papers.

Objects/materials/procedures that are hazards also need the nature of the hazard i.e. irritant/hot/sharp etc. Centres are strongly recommended to revisit this with their candidates.

Pack B

Pack B Activity 1 Task A

Most candidates were able to state the independent variable as 'the type of material', although a significant minority were confused between all three types of variable. Generally, of those candidates who stated controlled variables, the mass of the pellets was the most common correct response. A few candidates identified two controlled variables, with the temperature or colour of the flame being the most popular choice. Please note that 'amount' is not an acceptable term for volume or mass (or weight) and 'temp' is not an acceptable abbreviation of temperature anywhere in the papers. The dependent variable in this case is

the burn time of the pellets, which was given in the guidance to the candidates. Some candidates identified burn time per gram as the dependent variable and the examiners were sympathetic to this variation.

The vast majority of candidates were able to produce an equipment list and a simple method. The quality of the methods produced by candidates was extremely variable. The examining team were particularly looking to see if the candidates were identifying a suitable way of measuring the dependent variable (the burn time), and that the suggested method would actually work in practice. This is where a significant number of candidates lost marks. The quality of candidates writing was assessed here. We were particularly looking for the correct use of the key terminology (keywords) for this method, and SPaG was assessed. Examiners were looking for the correct spelling of the scientific keywords and the correct, consistent use of capital letters and full stops. Centres are encouraged to remind candidates about this.

Pack B Activity 1 Task B

The vast majority of candidates managed to take a decent set of repeatable results on this experiment. Most candidates were able to produce their own table, and tested three materials, repeated twice. A significant minority of candidates failed to record the mass (or weight) of the materials. The better candidates managed to record an initial mass/weight and a final mass/weight and then subtracted one from the other to produce the change in mass/weight of the packaging materials.

Most candidates managed to include s or seconds as the unit of burn time in the column header, but a significant proportion included the units as 'secs' in the rows of the table, which is not accepted, and 'secs' is not accepted as an alternative to seconds or s. Some candidates also confused units when the burn time extended past 1 minute. A minority of candidates recorded their times with an inconsistent number of decimal places.

Pack B Activity 1 Task C

An erratum was issued for this Task. Candidates were asked to remove the word mean from the equations at the start of the task. Candidates that did not use the erratum version WERE NOT PENALISED in any way, and the mark scheme was altered to take this into account.

For candidates who received the erratum:
Some candidates were able to calculate the burn time per mass for both repeats for each packaging material, and were then able to calculate the mean of the two values for each material. Error carried forward was used for the mean results.

For candidates that did not receive the erratum:
Some candidates were able to calculate the mean burn time or the mean mass of each type of material, and were then able to calculate the mean burn time per gram.

The most common error, apart from simple arithmetic errors, was transposing burn times into the table and calculating the mean burn time rather than mean burn time per gram. Most candidates were able to suggest a 'best' packaging material and many then gave a reason for this usually based on the burn time per mass. Very few candidates gave a second reason, although some did reference 'flammability' or ease of ignition. Even fewer candidates related the reason to the use.

Pack B Activity 1 Task D

Candidates have found the evaluation tasks quite hard, and it is clear that they need more support from centres prior to the exams. Candidates were first asked to comment on the suitability of their method. This requires an answer (suitable or unsuitable) plus a plausible reason why. Many candidates were unable to give an answer, let alone a plausible reason. Many candidates were able to identify a source of inaccuracy, with most opting to suggest difficulties deciding when to start or stop the stopwatch; or using materials with different masses.

The suggested improvements did not need to link to the suggested source of inaccuracy. Most candidates suggested more repeats; or made comments about similar shapes. Any sensible suggestions were given credit.

Some candidates were able to discuss the repeatability of their results, although no credit was given to candidates who simply stated that their results were or were not repeatable, a qualification was needed as well.

Very few candidates discussed the suitability of the experiment to answer the question, with most candidates simply restating problems with the method.

Pack B Activity 2 Task A

(a) The vast majority of candidates were able to identify the three invertebrates correctly.
(b) Most candidates were able to recognise that there was a pattern in the change in the number of bristleworms, but fewer candidates were able to describe the change in terms of the sample points. Some credit was given to candidates who simply stated that the numbers went up and then down.
(c) The majority of candidates identified the source of pollution as the sewage works, but a significant majority were able to give a good reason for their choice in terms of the distribution of pollution tolerant and pollution intolerant species, upstream and downstream of the sewage works.
(d) (i) Almost all candidates were able to identify August as the peak month.
    (ii) There were many possible correct descriptions of the difference between the distribution of all three species, and most candidates were able to give at least one pattern, although only a minority were able to give two correct descriptions.

Pack B Activity 2 Task B

Approximately half of all candidates identified the method as valid, although few then managed to give a correct reason for this based on the positive nature of the test – identifying only pollution intolerant invertebrates in clean water (and vice versa).

Many candidates managed to suggest a suitable improvement, with 'repeating the tests' being the most common suggestion.

A majority of candidates could state that the method was unsuitable for determining the exact source of pollution, but few could give an explanation based of the sample points being too far apart.

Pack B Activity 3

The Risk Assessment was the least successful part of the examination across all the packs, both higher and foundation and single and double award.

Very few candidates at foundation level identified risks with actions. For example, whilst many candidates could identify that the sharp scalpel, could produce a cut, very few identified that the cut would occur during cutting the samples. This ensures parity with the risk assessment elements of the other GCSE sciences. Please note that when suggesting suitable protective equipment for handling hot objects 'heat proof gloves' are required, not just 'gloves'.

Candidates did have more success with identifying suitable control measures. Surprisingly, only a minority of candidates identified the missing hazard as 'the Bunsen burner flame is hot', and this is also an issue for candidates across the papers.

Objects/materials/procedures that are hazards also need the nature of the hazard i.e. hot/irritant/sharp etc. Centres are strongly recommended to revisit this with their candidates.

UNIT 4: TASK BASED ASSESSMENT: HIGHER TIER

This was the first time that Unit 4, the task based assessment was available. There were just over 175 entries for this paper. The best facility factors were seen in the collecting and recording sections (Activity 1 – Task B), with a mean mark of 8.6/10. The lowest facility factors were seen in the risk assessment (Activity 3), with the mean mark being 2.2/10.

Pack A

Pack A Activity 1 Task A

Most candidates were able to state the independent variable as 'temperature', although a minority were confused between all three types of variable, and some completely missed out describing the variables altogether. Please note that 'temp' is not an acceptable abbreviation of temperature anywhere in the papers. Generally, of those candidates who stated controlled variables, the volume of the solutions involved was the most common correct response. Few candidates identified two controlled variables. As with 'temp', 'amount' is not an acceptable term for volume or mass (or weight). The dependent variable in this case is the volume of carbon dioxide froth produced by the fermenting yeast, which was given in the guidance to the candidates. Some candidates then went on to confuse the volume with 'height' of the froth in their method and recording of their results, although the examining team were alert to this confusion and were positive in their marking when this was evident.

The vast majority of candidates were able to produce an equipment list and a simple method. The quality of the methods produced by candidates was extremely variable. The examining team were particularly looking to see if the candidates were identifying a suitable way of measuring the dependent variable (the volume of froth), and that the suggested method would actually work in practice. This is where a minority of candidates lost marks. The quality of candidates writing was assessed here. We were particularly looking for the correct use of the key terminology (keywords) for this method, and SPaG was assessed. Examiners were looking for the correct spelling of the scientific keywords and the correct, consistent use of capital letters and full stops. Centres are encouraged to remind candidates about this.

Pack A Activity 1 Task B

The vast majority of candidates managed to take a decent set of results on this experiment, with most producing the highest volume of froth at $40\,^{\circ}\text{C}$. Most candidates were able to produce their own table, and tested across the temperature range. A number of candidates again used the abbreviation 'temp', which is not accepted as a column header, and as stated before, the examining team were keen to award marks where candidates had stated 'volume' as their dependent variable in their plan, but had then measured the height change of the froth – either were accepted, provided that the header on the table reflected the measurement.

Good candidates managed to record an initial volume/height and a final volume/height and then subtracted one from the other to produce the volume/height of the froth. Most candidates managed to include $^{\circ}C$ as the unit of temperature in the column header, but a proportion did not include a correct unit of volume or height, or included the units in the rows of the table, which is not accepted. As the task brief did not require this experiment to be repeated, any mean averages, or errors involving these were ignored. Due to the nature of these results, most candidates recorded volumes/height to a consistent number of decimal places.

Pack A Activity 1 Task C

Most candidates were able to produce a line graph of their results and label it correctly, with units. A few candidates plotted the volume (or height) of the froth at the end of their experiment – neglecting to subtract the initial volume (or height) of the combined yeast solution. The most common errors involved producing a volume (or height) scale that was too small (less than half the available area for the plotted points), or that was too complicated to work out the positions of the plotted points. Centres should practice this with their candidates. Where the scale was straightforward, most candidates were able to plot their points accurately (<1 small square).

The majority of candidates that produced a graph managed to identify the 'best' temperature (40 $^{\circ}C$ for most centres). They also gave a reason (usually the one that produced the most froth), and their 'best' value was consistent with their data. Few candidates managed to link their answer to fermentation and Brewerz Ltd. Credit was also give to candidates who produced a coherent answer.

Pack A Activity 1 Task D

Candidates have found the evaluation tasks quite hard, and it is clear that they need more support from centres prior to the exams. Candidates were first asked to comment on their method. Examiners were looking for an assessment of the suitability of the method to measure the volume of the froth produced with changing temperature. This requires an answer (whether it is suitable or unsuitable) plus a plausible reason why. Many candidates were unable to give an answer, let alone a plausible reason, although the best candidates were able to suggest that the method was not very suitable due to poor temperature control.

Candidates found it easier to evaluate the quality of the data. Many candidates were able to identify a source of inaccuracy, with most opting to suggest difficulties deciding where the top of the froth was on a scale, or the lack of temperature control. Most candidates were also able to suggest improvements to the method. The suggested improvements did not need to link to the suggested source of inaccuracy. Candidates did have to suggest a workable improvement, not just, for example, 'control the temperature'. Many candidates managed to suggest adding more repeats to the experiment as a way of improving the quality of the data.

The final section required candidates to evaluate the validity of their conclusion. Candidates did not do this well and generally failed to make a comment about their conclusion; instead, they tended to repeat comments about the method.

Pack A Activity 2 Task A

    (a)   (i)   A minority of candidates failed to notice this question or did not know the meaning of the term 'anomalous'. 99 was the most common wrong answer. Most candidates identified 86 as the correct answer.

             (ii)   Most candidates that identified 86 as the anomaly removed this value from their mean calculation and managed to calculate the mean for 3

spatulas as 96. Some candidates kept 86 in their data set and incorrectly calculated the mean to be 73.3.

(b) The majority of candidates identified the maximum burn time of BBQ paper lighters as 126 seconds.

(c) (i) Many candidates did manage to identify the minimum mass of tablet to be 7 g, and there was a tolerance of ± 0.1 g.

(ii) Many candidates were able to calculate the volume of the tablet by rearranging the given equation and using their value from (c)(i), although there were a minority of candidates that needed error carried forward.

(d) (i) A significant minority of candidates did not score full marks for the graph. They drew the general shape but essentially joined two straight line together instead of a sharp curved joining line between the two more linear portions of the graph. Most candidates started and finished the graph line in the correct place.

(ii) The majority of candidates successfully commented on the suitability of using pellets over tablets in terms of the pellets burning for less time and therefore being less effective.

Pack A Activity 2 Task B

Most candidates identified the method as suitable, and gave a correct reason for this based on the identification of a clear pattern, or words to that effect.

Many candidates managed to suggest a suitable improvement, with 'more repeats' being the most common suggestion, and measuring the mass (rather than 'spatulas') a common alternative.

A significant proportion of candidates did not identify a mass of lighter gel in spatulas, instead confusing the method with Figure 2. They also rarely gave a sensible reason for their choice.

Pack A Activity 3

The Risk Assessment was the least successful part of the examination across all the packs, both higher and foundation and single and double award.

Very few candidates at higher level identified risks with actions. For example, whilst many candidates could identify that the drying oven being hot could produce a burn, very few identified that the burn would occur during handling of the samples in and out of the oven. This ensures parity with the risk assessment elements of the other GCSE sciences. Please note that when suggesting suitable protective equipment for handling hot objects 'heat proof gloves' are required, not just 'gloves'.

Candidates did have more success with identifying suitable control measures.

Most candidates could identify objects/materials/procedures that are hazards but were unable to state the nature of the hazard i.e. irritant/hot/sharp etc. Only a small minority of candidates identified 2 mol/dm^3 hydrochloric acid is an irritant, and this is also an issue for candidates across the papers. Centres are strongly recommended to revisit this with their candidates.

Pack B

Pack B Activity 1 Task A

Most candidates were able to state the independent variable as 'the type of material', although a significant minority were confused between all three types of variable. Generally, of those candidates who stated controlled variables, the mass of the pellets was the most common correct response. A minority of candidates identified two controlled variables, with the temperature or colour of the flame being the most popular choice. Please note that 'amount' is not an acceptable term for volume or mass (or weight) and 'temp' is not an acceptable abbreviation of temperature anywhere in the papers. The dependent variable in this case is the burn time of the pellets, which was given in the guidance to the candidates, and this was stated by most of the higher tier candidates. Some candidates identified burn time per gram as the dependent variable and the examiners were sympathetic to this variation.

The vast majority of candidates were able to produce an equipment list and a simple method. The quality of the methods produced by candidates was extremely variable. The examining team were particularly looking to see if the candidates were identifying a suitable way of measuring the dependent variable (the burn time), and that the suggested method would actually work in practice. This is where a significant number of candidates lost marks. The quality of candidates writing was assessed here. We were particularly looking for the correct use of the key terminology (keywords) for this method, and SPaG was assessed. Examiners were looking for the correct spelling of the scientific keywords and the correct, consistent use of capital letters and full stops. Centres are encouraged to remind candidates about this.

Pack B Activity 1 Task B

The vast majority of candidates managed to take a decent set of repeatable results on this experiment. Most candidates were able to produce their own table, and tested three materials, repeated twice. A significant minority of candidates failed to record the mass (or weight) of the materials. The better candidates managed to record an initial mass/weight and a final mass/weight and then subtracted one from the other to produce the change in mass/weight of the packaging materials.

Most candidates managed to include s or seconds as the unit of burn time in the column header, but a significant proportion included the units as 'secs' in the rows of the table, which is not accepted, and 'secs' is not accepted as an alternative to seconds or s. Some candidates also confused units when the burn time extended past 1 minute. A minority of candidates recorded their times with an inconsistent number of decimal places.

Pack B Activity 1 Task C

An erratum was issued for this Task. Candidates were asked to remove the word mean from the equations at the start of the task. Candidates that did not use the erratum version WERE NOT PENALISED in any way, and the mark scheme was altered to take this into account.

For candidates who received the erratum:
Many candidates were able to calculate the burn time per mass for both repeats for each packaging material, and were then able to calculate the mean of the two values for each material. Error carried forward was used for the mean results.

For candidates that did not receive the erratum:
Many candidates were able to calculate the mean burn time or the mean mass of each type of material, and were then able to calculate the mean burn time per gram.

The most common error, apart from simple arithmetic errors, was transposing burn times into the table and calculating the mean burn time rather than mean burn time per gram. Most candidates were able to suggest a 'best' packaging material and many then gave a reason for this usually based on the burn time per mass. Very few candidates gave a second reason, although some did reference 'flammability' or ease of ignition. Even fewer candidates related the reason to the use.

Pack B Activity 1 Task D

Candidates have found the evaluation tasks quite hard, and it is clear that they need more support from centres prior to the exams. Candidates were first asked to comment on the suitability of their method. This requires an answer (suitable or unsuitable) plus a plausible reason why. A few candidates were unable to give an answer, let alone a plausible reason. Most candidates were able to identify a source of inaccuracy, with the majority opting to suggest difficulties deciding when to start or stop the stopwatch; or using materials with different masses.

The suggested improvements did not need to link to the suggested source of inaccuracy. Most candidates suggested more repeats; or made comments about similar shapes. Any sensible suggestions were given credit.

Some candidates were able to discuss the repeatability of their results, although no credit was given to candidates who simply stated that their results were or were not repeatable, a qualification was needed as well.

Only a minority of candidates discussed the suitability of the experiment to answer the question, with most candidates simply restating problems with the method.

Pack B Activity 2 Task A

(a)	(i)	The vast majority of candidates were able to identify the invertebrates correctly.
	(ii)	Most candidates were able to spot the anomaly, but a significant minority ignored this question.
(b)		The majority of candidates identified the source of pollution as being either the sewage works or the industrial estate, or 'between sample points 2 and 3', and a majority were able to give a good reason for their choice in terms of the distribution of pollution tolerant and pollution intolerant species, upstream and downstream of the sewage works.
(c)		There were many possible correct descriptions of the difference between the distribution of all three species, and most candidates were able to give at least one or two patterns, although only a minority were able to give three correct descriptions.

Pack B Activity 2 Task B

Most higher tier candidates identified the method as valid, although few then managed to give a correct reason for this based on the positive nature of the test – identifying only pollution intolerant invertebrates in clean water (and vice versa).

Most candidates managed to suggest a suitable improvement, with 'repeating the tests' being the most common suggestion.

A majority of candidates could state that the method was unsuitable for determining the exact source of pollution, but only a minority could give an explanation based of the sample points being too far apart.

Pack B Activity 3

The Risk Assessment was the least successful part of the examination across all the packs, both higher and foundation and single and double award.

Very few candidates even at higher level identified risks with actions. For example, whilst many candidates could identify that the sharp scalpel, could produce a cut, very few identified that the cut would occur during cutting the samples. This ensures parity with the risk assessment elements of the other GCSE sciences. Please note that when suggesting suitable protective equipment for handling hot objects 'heat proof gloves' are required, not just 'gloves'.

Candidates did have more success with identifying suitable control measures. Surprisingly, only a minority of candidates identified the missing hazard as 'the Bunsen burner flame is hot', and this is also an issue for candidates across the papers.

Objects/materials/procedures that are hazards also need the nature of the hazard i.e. hot/irritant/sharp etc. Centres are strongly recommended to revisit this with their candidates.

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 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. Others lost a mark here because of a complicated graph scale causing a mis-read of the solubility value.
- (h) As with 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 effect of exercise on heart rate
This practical was a popular choice for both Applied Science (double award) and Applied Science (single award). Whilst most candidates attempted all sections of the assessment, responses were often very poor and the data collected was often of questionable quality.

Section A
Many candidates were able to make a good attempt at this section although the lack of clarity in the risk assessment often cost candidates marks. Similarly, the table often lacked headings and / or units.

Section B

    (a)   Whilst the dependent variable was often correctly identified many candidates were unable to identify controlled variables in this experiment.

    (b)   Both selection of suitable scales and plotting accurately was a challenge for many candidates although they could often describe the relationship between variables on the graph.

    (c)   Responses here were vague and lacked detail. Commonly candidates were able to gain a mark for identifying an increase in how quickly the heart pumps.

    (d)   It was pleasing to see some good attempts in (i) with candidates recognising the link between fitness and recovery time. However (ii), where candidates were asked to identify improvements to the method was inaccessible to most.

    (e)   Those candidates who interpreted the question correctly often were able to gain some credit for outline plans although their work again lacked detail and clarity.

Investigating the factors that affect the output of a solar panel.
This proved to be a popular practical for Applied Science (double award) and candidates produced consistent data from the method given.

Section A
Many candidates were able to make a good attempt at this section although the lack of clarity in the risk assessment often cost candidates marks. Similarly, the table often lacked headings and / or units and many candidates struggled to distinguish between input and output voltage.

Section B

    (a)/(b)   Many candidates failed to clearly distinguish between their independent and dependent variables and they were also unable to identify control variables in this experiment.

    (c)   Both selection of suitable scales and plotting accurately was a challenge for many candidates. Extrapolating the line to determine an answer for (d) was beyond most of these candidates.

    (e)   It was disappointing that many candidates were unable to name the instrument used to measure current in (i). (ii) Was almost never done correctly, with the majority of candidates failing to realise that they needed to determine the voltage across the solar panel in order to determine its power.

    (f)   Many candidates successfully identified the trend although the quantitative relationship was almost never seen. Many candidates were successful however in (g).

    (h)   The term repeatability was poorly understood and answers here were poorly expressed.

    (i)   Poor expression let down the majority of candidates here and many simply restated elements of the question.

(j)   Those candidates who interpreted the question correctly often were able to gain some credit for outline plans although their work again lacked detail and clarity.