GCSE EXAMINERS' REPORTS

GCSE (NEW)
CHEMISTRY

SUMMER 2018

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GCSE CHEMISTRY

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CHEMISTRY UNIT 1 FOUNDATION

The mean mark on the paper was 33.8. In general, recall was poor whereas questions requiring application were better done. Graph work was generally good but interpretation of graphs posed problems.

1. Most candidates recognised the particles present in the atom but many were unable to give charges for all three. Interpretation of electronic configurations was particularly disappointing despite this type of question having been asked many times previously.

2. Most candidates scored well here but the reason why dye **C** contained the banned substance was poorly explained.

3. Part (a) was generally well answered. However, many were unable to fully explain distillation in terms of boiling and condensation. Part (b) was very disappointing with only a minority knowing the colour of the precipitates. Many gave blue, brown or grey.

4. Part (a) was fairly well done. Interpretation of table was good however, many were unable to recognise molecules of elements with CO_2 and CH_4 often given. Parts (b) and (c) were well answered. Credit was awarded for answers of 5 or 6 in part (c)(ii) due to many interpreting the formula as containing carbon (C) and iodine (I) rather than chlorine (Cl).

5. Part (a) very disappointing with only the better candidates able to give the correct formula of oxygen. In part (b) most recognised catalyst 1 as being least effective but were then unable to give a reason for their answer. Graph plotting was very good but candidates experienced difficulty drawing a suitable smooth curve. In part (iii), many did not understand the meaning of 'sketch' with a significant number calculating and plotting points that were double those on original plot. This was but very time consuming for a two mark question but of course credited. Part (iv) was not understood with many referring to accuracy rather than the idea that gas loss would be minimised.

6. Many failed to recognise the anomalous result when calculating the mean in part (a)(i). Thus 19 was the most common answer. In part (ii) most recognised the order of reactivity but were unable to give a reason for their choice. References to time were common with few relating this to stability. The equation was very poorly done with the majority giving Cu and CO_3 as products. Part (b) was very well answered.

7. In part (a) the meaning of a 'trend line' was not well known. The majority merely joined the bars with a curve. Communication caused a problem in part (b) with many making no reference to fossil fuels, cars or industry. In part (c) many stated 'use less fossil fuels' rather than suggesting a sensible change that we are making in everyday life to bring about a reduction in fossil fuel use. Credit was also awarded for reference to carbon capture technologies. Part (d) was generally well answered but some guesswork was evident.

8. Interpretation of the graph was very disappointing with many candidates merely describing it. Arguments for and against fluoridation were attempted with many recognising it as mass medication but misconceptions were evident with some referring to fluoride killing bacteria. Fluorosis was not often mentioned. It was worrying to see that some candidates confused fluoridation and hard water.

9. Most recognised **C** in part (a)(i) but many explained in terms of 'decreasing hardness' rather than 'removal of hardness'. Better candidates did recognise the amount of soap needed fell to that of soft water or sample **A**. In part (ii) many misread question and answered in terms of properties rather than composition e.g. difficult to lather with soap. Benefits of hard water were well known but drawbacks were not well known. Many confused scum and limescale in their discussion. Very few related limescale to loss of efficiency of boilers etc.

10. Many read from the incorrect axis and gave 80 in part (a)(i). Reading from the graph in part (ii) was very disappointing but a significant number gained a mark for correctly recognising the need to double their answer. The unusual temperature range was not well explained. Part (b) was generally well done but a significant number failed to include the charges on the ions. Loss of electrons was often given in part (ii) but few mentioned that they were from the outer shell. Balancing the equation in part (c) was poor.

11. Generally well known understood with most recognising the processes occurring at the different boundaries. The most common weakness was lack of knowledge of what happens when boundaries move apart in part (b).

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CHEMISTRY UNIT 1 HIGHER

The mean mark for this paper was 38.0. As expected, the common questions were much better answered by higher tier candidates.

1. As on the foundation tier paper, many failed to recognise the significance of the word 'only' in part (a)(i) and failed to gain the second mark. The benefits and drawbacks were generally well known although there was some confusion with fluoridation. Only a small number of candidates discussed the effect of limescale on efficiency of boilers etc.

2. In part (a) the reading of figures from the graph was generally good but a significant number failed to read 28 in part (ii). In part (iii), most candidates mentioned that the temperature went over 100°C but many failed to state that water boils at this temperature.

3. Very well answered.

4. Part (a) was very disappointing with few candidates able to work out the formula of sodium thiosulfate. The meaning of aqueous in part (ii) was not well known with many referring to liquid or a 'solution' rather than a solution in water. Most recognised the solution going cloudy in part (iii) but were unable link this to the formation of the precipitate of sulfur. A surprising number of candidates stated that sodium chloride, sulfur dioxide or hydrochloric acid caused the cloudiness.

   Part (b)(i) was very disappointing with only the better candidates recognising 29 as anomalous. A significant number stated that 6.6 was the incorrect mean as it should be rounded to 6.7. Many others said the results at 30 were incorrect as they would never get same result three times! Particle theory was generally well understood although a significant number failed to state a conclusion.

5. Most knew position of **A** but **B** was often put in Period 5. **C** was often put in the transition metal block. In part (b) plotting caused problems due to the use of negative numbers. The line or curve of best fit was disappointing. The majority of candidates merely connected first and last point. In part (ii) negative values caused some confusion when describing the trend. Part (c) was well answered but in (d), the uses of argon were not known with many saying 'as' light bulbs rather than 'in light bulbs'. Many referred incorrectly to 'signs' and light tubes.

6. The majority of candidates correctly described the reactions and made reasonable attempts at equations but few gave correct observations. A significant number of however referred to uses of limestone which were not relevant. Many extended their answer to the formation of limewater in a full description of the limestone cycle. Candidates must ensure that they answer only the question set.

7. In part (a) most recognised that one electron was gained and gave the idea of shielding but few gained the third mark for the attraction on the incoming electron. A significant number however talked about loss of electrons! Balancing the equation in part (ii) was well done but writing the full symbol equation in part (iii) caused problems. Many gave incorrect formulae e.g. CaF, H_2F and CaSO.

   Part (b) was well done by better candidates but others struggled. Most calculated the mass of chlorine to be 21.25 g but weaker candidates rarely managed to find the correct ratio of atoms. As in previous years, many incorrectly divided A_r by the mass. No credit was awarded for the correct formula with no working shown.

8. The calculation in part (a)(i) caused problems for all but the best candidates. Many failed to calculate the mass ratio from the equation and thus failed to calculate maximum possible mass. The percentage yield mark was often awarded by error carried forward but many were unable to calculate a simple percentage. In part (ii) many suggested incomplete reaction however in part (iii) few recognised that sodium formed would react with any water present.

   In part (b)(i) the calculation of A_r was well done although a surprising number of candidates failed to substitute numbers correctly into the equation. In part (ii) many gave a general definition of isotopes rather than describing the difference between the isotopes given. Some incorrectly referred to the mass numbers as the numbers of neutrons.

9. Very few understood the requirements of part (a) and answered in terms of temperature rather than stability. The mark most often gained was for recognising that nitrates are more stable than carbonates. Few recognised magnesium as an anomaly. In part (b) most referred to the use of limewater but few could describe how to carry the experiment. It was disappointing to see many referring to use of a lighted splint being extinguished. Attempts at the equation were disappointing with only a minority gaining all three marks. Incorrect formulae were often given.

10. In part (a) most candidates failed to use Figure 1 thus restricting themselves to one mark. It was pleasing however to see better candidates recognising the significance of 1 ppm as the point at which optimum balance between decay reduction and fluorosis is seen, although not many were able to express this clearly. Weaker candidates failed to use the graphs at all referring to benefits and drawbacks only. Some even confused fluoridation and hard water.

    Responses to parts (b) and (c) were mixed but part (d) was generally well answered, although many suggested that mass medication meant medicating a lot of people or putting a lot of fluoride in the water!

CHEMISTRY

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CHEMISTRY UNIT 2 FOUNDATION

On the whole candidates coped well with the paper. Questions towards the end of the paper discriminated well. Mathematical questions were generally well done. However, many marks were lost by candidates demonstrating poor literacy skills. Those candidates who had more experience of laboratory work performed significantly better than others on practically-based questions.

Candidates demonstrated lack of knowledge and understanding of the following areas of the specification

- writing chemical formulae
- writing symbol equations
- interpreting information from tables and text
- electrolysis
- bonding

1. (a) Parts (i) and (ii) were well answered.

   (b) Only weaker foundation candidates failed to gain both marks for this question.

   (c) Parts (i) and (ii) were well answered.
   - (iii) Poorly answered. The most common incorrect answer was part I was 'electricity'. Most answers to part II seemed to be guesswork as all four options were equally common.
   - (iv) Poorly answered and all three options were equally common.

2. (a) Well answered.

   (b) Surprisingly poorly answered. Weak candidates failed to use the information in the stems of the questions to help them.
   - (i) Candidates who missed out the ‘n’ on the repeating unit failed to gain the mark.
   - (ii) Common incorrect answers included 'poly', 'polyvinyl' and 'vinyl'.

   (c)
   - (i) Generally well answered. A few candidates calculated the relative molecular mass of ethanol rather than methanol.
   - (ii) A surprising number of candidates used the relative molecular mass from part (i) as the mass of water in the formula. These candidates gained 1 mark if they showed that they had calculated the temperature rise correctly.
   - (iii) All the letters were chosen which suggests candidates were guessing answers for this question. It was evident that many did not understand the subtle differences between the statements.
   - (iv) Generally well answered.

3. (a) Generally well answered.

(b) Most candidates were able to select the two correct fractions but a surprising number gave vague generic reasons, e.g. 'used in cars', 'both are fuels' and 'used in everyday life'. These were not credited.

(c) (i) The question asked for an environmental problem relating to *all* type of carrier bag − not specifically plastic ones. Answers referring to carrier bags 'taking hundreds of years to decompose' and 'bags being non-biodegradable' therefore gained no credit. The most common correct answer referred to litter.

(ii) To answer this question candidates were required to calculate the total number of bags sold, i.e. 8455 + 445. Weaker candidates were unable to add these two numbers correctly or simply used 8455 in their percentage calculation.

(iii) Combinations of all the statements were chosen which suggests candidates were guessing answers for this question. It was evident that some did not understand the subtle differences between the statements.

4. (a) Questions on bonding appear in almost every examination paper. Unfortunately, as in previous years, Foundation Tier candidates struggled with the concept.

(i) Weaker candidates did not use the information given in the diagrams to help them answer this question e.g. the charge on two Na^+ ions needs to be balanced therefore the single oxide ion must have a charge of 2− and the electronic structure of the oxygen atom is (2,6) therefore the ion must be (2,8).

(ii) Most candidates lost both available marks by not being able to write the correct formula of sodium oxide. Again, the information in the diagram, i.e. two Na^+ ions and one O^{2-} ion, should have been useful to candidates. The most common incorrect formula for sodium oxide was NaO_2. The balancing mark was only awarded if the formula was correct.

(b) Information in the table indicated that chlorine needs one electron to obtain an octet of electrons in the compound, therefore **A** cannot be correct. Both hydrogen and chlorine need to gain electrons so they cannot bond ionically as suggested in **B**. Despite this **A** and **B** were common answers.

(c) Most candidates gained two of the three available marks. Some lost marks by giving an irrelevant property as well as the correct one e.g. 'soft' and 'conducts electricity' for graphite. The most common incorrect answers related to fullerene.

5. Pleasingly well done. Most candidates were familiar with and demonstrated a sound understanding of the principle of the fire triangle. Unfortunately many candidates let themselves down by including methods impractical for fighting moorland fires, e.g. using fire blankets, foam or carbon dioxide extinguishers.

The quality of spelling, grammar and handwriting need improvement in this type of question in particular.

6. This question differentiated well with weaker candidates struggling to achieve any marks.

   (a) Unfortunately weaker candidates were unable to handle the quite large numbers involved.

   (b) Most candidates chose the endothermic energy profile.

   (c) Generally well done.
      (i) Weaker candidates obviously misread the table and stated that it yield increases with temperature.
      (ii) A small but significant number of candidates attempted to calculate their own value for the yield and therefore gain no credit.

   (d) This was a poorly answered question.
      (i) Few candidates could name any acid and the most common incorrect answers were 'nitrogen', 'nitrate' and 'ammonium'.
      (ii) I. The test for ammonia was not known by most candidates. Incorrect answers included 'red', 'purple', 'black' and 'yellow'.
      II. Most candidates did not know the meaning of the term property. The most common incorrect answers made reference to substances.
      (iii) This question was well answered. Any mechanism by which fertiliser travelled to waterways gained the mark e.g. 'rain washes fertilisers off the land'.

7. This question differentiated well.

   (a) Able Foundation Tier candidates gained both marks for the equation but weaker ones included at least one incorrect formula.

   (b) (i) Weaker candidates failed to name a pipette. The most common incorrect answers included 'burette', 'thermometer', 'temperature sensor' and 'dropping pipette'.
      (ii) Weaker candidates stated that an indicator 'tells you if a solution is acid or alkali' and made no reference to an end-point or neutralisation. This suggests that they did not read the question carefully enough.
      (iii) Generally well done.
      (iv) Poorly done by most candidates. The most common incorrect answer showed a temperature rising with a constant gradient.
      (v) Some candidates didn’t read the question carefully enough. Incorrect answers showed that some halved the original acid volume, some halved the volume of alkali and others doubled the volume of alkali.

8. This question differentiated well.

(a) (i) Able Foundation Tier candidates coped well with this question. A reference to the reaction temperature *and* the melting point of iron were needed to gain credit.

(ii) Weaker candidates failed to gain marks. No credit was possible for those who failed to give the correct formula for aluminium oxide.

(iii) A generic definition of oxidation was not accepted. Candidates needed to state that 'aluminium is oxidised because it has gained oxygen'. Answers which were not accepted included 'aluminium because it has gained oxide', 'aluminium because it has gained O_3' and 'aluminium because it has gained O_2'.

(iv) Generally well done.

(b) (i) Generally well answered.

(ii) Many candidates failed to gain the *explanation* mark by not referring to metals being 'unable to *displace* themselves from solution' or that they 'don't *react* with themselves in solution'.

(c) Very poorly done.

(i) Most candidates could not describe the appearance of either the metal silver (silver/grey) or copper(II) sulfate solution (blue).

(ii) Very few Foundation Tier candidates gained any credit for this equation. The most challenging aspect was the formula of copper(II) nitrate, which was usually given as $CuNO_3$.

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CHEMISTRY UNIT 2 HIGHER

On the whole those candidates who were correctly entered for the Higher Tier paper coped well. However there were a small but significant number of candidates who would have benefitted from being entered for the Foundation Tier.

Questions towards the end of the paper differentiated well. Candidates demonstrated good graph skills but many marks were lost by poor handling of positive and negative powers of 10. The mathematical demand of papers has increased for this new specification. Candidates should be advised to show workings in all calculations; many gained marks using error carried forward (ECF) principles even though their final answers were incorrect.

Candidates demonstrated a significant lack of knowledge and understanding of the following areas of the specification:

- writing chemical formulae
- writing symbol equations
- ionic bonding
- the Contact Process (QER question)
- chemical tests (e.g. ammonia , alcohol)
- electrolysis of copper(II) sulfate using copper electrodes

1. Generally well answered.

   (a) Well answered.

   (b) (i) Weaker candidates failed to name a pipette. The most common incorrect answer was 'burette'.

   (ii) Weaker candidates described the meaning of the term *indicator* .e.g. ‘it tells you if a solution is acid or alkali’.

   (iii) Well answered.

   (iv) It was very evident when candidates had carried out this practical in lessons. They answered this question well whereas most others had little idea where to start. The most common incorrect answer showed a temperature rising with a constant gradient.

   (v) Some candidates didn’t read the question carefully enough. Incorrect answers showed that some halved the original acid volume, some halved the volume of alkali and others doubled the volume of alkali.

2. Generally well answered.

(a) (i) Most candidates coped well with this question. A reference to the reaction temperature *and* the melting point of iron were needed to gain credit.

(ii) Weaker candidates failed to gain marks. No credit was possible for those who failed to give the correct formula for aluminium oxide.

(iii) A generic definition of oxidation was not accepted. Candidates needed to state that 'aluminium is oxidised because it has gained oxygen'. Answers which were not accepted included 'aluminium because it has gained oxide', 'aluminium because it has gained O_3' and 'aluminium because it has gained O_2'.

(iv) Well answered.

(b) (i) Well answered.

(ii) Many candidates failed to gain the *explanation* mark by not referring to metals being 'unable to *displace* themselves from solution' or that they 'don’t *react* with themselves in solution'.

(c) Usually poorly answered.

(i) Most candidates could not describe the appearance of either the metal silver (silver/grey) or copper(II) sulfate solution (blue).

(ii) Only more able candidates gained any credit for this equation. The most challenging aspect was the formula of copper(II) nitrate, which was often given as $CuNO_3$.

3. (a) (i) Poor expression resulted in many candidates failing to these marks. A general description, e.g. 'at the start the demand > than the supply, then the supply becomes > than the demand' gained 1 mark.
A reference to the point at which the change occurs, e.g. C_{16} / C_{17} / C_{13}-C_{16}, was needed to obtain the second mark.
Weaker candidates who described a trend for the supply or demand only gained no credit.

(ii) I. Surprisingly poorly answered. Many candidates did not spot the two molecules of ethene and gave either C_6H_{12} or C_6H_{14} for hydrocarbon **A** . Neither gained credit and no ECF was applied for part II.

II. This mark was often lost due to an incorrect hydrocarbon being given in part I.

III. Generally well answered.

(iii) This balancing question was well answered by all except the weakest candidates.

(b) Most candidates gained both marks for this PISA-style question. Weaker candidates struggled to deal with the reading demands of this question.

4. (a) (i) Questions on ionic bonding appear on almost every examination paper. Unfortunately, as in previous years, many candidates struggled with the concept. Only the more able gained both available marks.

Candidates lost mark(s) by:

- showing the two transferred electrons on the atoms and on the ions at the same time
- not showing the octet of electrons surrounding the oxide ion
- mixing up the charges
- drawing calcium oxide as a covalent molecule

(ii) The first marking point required candidates to link high melting points to strong ionic bonds. Mention of 'strong bonds' alone gained no credit. The second marking point required candidates to state that there is greater attraction between ions with greater charge. Very few candidates gained this mark.

(b) (i) Generally well answered. Most candidates gained one of the two available marks. A mark was deducted if any reference was made to metallic bonding.

(ii) Most candidates attempted this question and most gained the first mark for calculating the circumference of the nanotube. Many candidates failed to rearrange the expression given and incorrectly multiplied by 3.14. Only a fairly small number managed to correctly express the final answer as 9.1×10^{-10} m. Credit was given for 0.91×10^{-9} m.

5. (a) This question required candidates to demonstrate their knowledge and understanding of the Contact Process. The main issues were as follows.

Stage 1
Raw materials were omitted or incorrect, e.g. oxygen, and not air, was often given as a raw material. Candidates were vague about this simple reaction, e.g. 'sulfur is added to oxygen' or 'sulfur reacts with oxygen' instead of 'sulfur burns in oxygen'.

Stage 2
Only top band answers included all three conditions and an explanation as to why they are chosen. Middle band answers often gave only two of the three conditions with no explanations. Weak candidates simply stated that this stage was reversible.

Stages 3 and 4
Adding sulfur trioxide to concentrated sulfuric acid to form oleum, followed by the dilution of oleum was expected. Able candidates described these reactions with chemical equations. Many simply stated that sulfur trioxide is added to water to make sulfuric acid. This was considered irrelevant unless candidates qualified their statement by explaining why this method is not used on an industrial scale.

It was pleasing to see that many candidates used paragraphs and correct scientific terminology in this question.

(b) (i) Well answered.

(ii) Candidates needed to calculate the energy released (3138 kJ) when making six S=O bonds then find the difference between this value and the total amount used (2587 kJ) in bond breaking. This two-stage operation was beyond weaker candidates.

(iii) To answer this question candidates needed to recognise that the energy released on making bonds (3138kJ) is greater than that needed to break bonds (2587kJ) i.e. the reaction is exothermic.

6. (a) (i) Weaker candidates struggled with selecting the information needed from the table.

(ii) Well answered.

(b) This question was poorly answered.

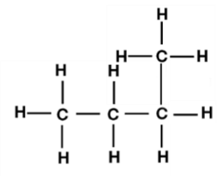
(i) This question required candidates to work out exactly what is produced during this reaction before being able to write the equation. They had to recall the formulae for water and ammonia and work out the formula for sodium sulfate. Surprisingly, most candidates gave the formula of sodium sulfate as $NaSO_4$ and that of ammonia as NH_4.

(ii) Only the most able candidates coped with ionic equations. Too many candidates entered for this Higher Tier paper had no idea what was being asked of them.

7. This organic chemistry question was generally well answered.

(a) Well answered. The most common incorrect answer was C_nH_{n+2}.

(b) The most common incorrect answer was exactly the same isomer drawn with a 'bent' carbon chain.



Weaker candidates were unable to name 2-methylpropane.

(c) Generally well answered. The most common error was the omission of the methyl group in both products.

(d) Poorly answered. Very few candidates knew the chemical test and the observation to identify an alcohol. Not surprisingly, the most common incorrect answer was 'bromine water turns from orange to colourless'.

(e) Generally well answered. Most candidates were able to interpret the spectra.

8. (a) Well answered. Most candidates were able to choose suitable scales and plot the points accurately. Some candidates left out the (0,0) point from the table. The main problem was drawing the line of best bit. The line was often drawn by hand instead of using a ruler and some candidates joined dot to dot. Neither of these gained credit.

(b) The question asked candidates to use their **graph** – not the table – to predict the mass of copper deposited using a current of 3.5 A. Those who obviously used the table gained no credit. Those who used their graph usually gained the available mark.

(c) This was extremely poorly answered although some of the most able candidates scored 2 or 3 of the 4 available marks. Many had no idea where to start. Electrolysis of aqueous solutions is new on the specification and it would appear that some of the applications may not have been studied in a great deal of depth during this first year. Marks were usually obtained for the half-equation at the cathode and stating that the concentration of Cu^{2+} ions stayed the same throughout the electrolysis process. Very few candidates gained the fourth marking point by recognising that the Cu^{2+} ions must leave and enter the solution at the same rate.

9. This question was well answered by the most able candidate.

(a) Weaker candidates did not apply the 1000 factor required to find the correct answer in this part.

(b) Many candidates failed to use the 1:2 ratio of carbonate:acid given by the equation. Some divided their answer by the number of tablets in the box despite the clear reference to one tablet in the question.

(c) Most candidates gained a mark for calculating the relative formula mass of calcium carbonate. However only the most able candidates successfully converted g to mg by multiplying by 1000. Most candidates missed this stage out completely whilst other multiplied by 100 or divided by 1000.

(d) Only the most able candidate obtained this mark. Candidates needed to recognise from the packet labelling that the tablets also contain magnesium carbonate which would also react with the acid.

Many candidates completely ignored the label information given in the question and answered in terms of shortcomings in the practical method used to collect results. These responses gained no credit.

CHEMISTRY

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CHEMISTRY PRACTICAL

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 pupils 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, pupils should be encouraged to check that values are sensible and not smaller or larger than all 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 graphs. 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.
- Control 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 temperature change and neutralisation

This practical was only available to candidates for the separate Chemistry qualification. Many showed a good understanding of the relatively straight forward practical required in this experiment.

Section A

The risk assessment in this investigation was completed to a slightly better standard than was generally seen across the suite of investigations, probably due to the familiarity with the acid and alkali involved. However as with other experiments a significant number of candidates were not able to clearly describe the action performed that was subject to risk.

The table of results was completed well.

Section B

(a) (i) The graph was poorly constructed by many candidates. There were two main issues. Many chose an inappropriate scale on the y-axis meaning that their lines often covered no more than two large squares. Poor choice of scale also made drawing lines of best more difficult and some candidates only drew one line.

(ii) Most candidates scored poorly here as their responses lacked a clear description, particularly in referencing the maximum temperature and identifying neutralisation.

(b) Many candidates lacked a fundamental understanding of the concept of neutralisation and lacked the specific terms acid and alkali in their responses to part (i).

Many more were able to correctly answer part (ii) with universal indicator being the most common acceptable answer.

(c) Part (i) was very well answered, but candidates were less successful in providing sufficient detail in part (ii) to gain a mark. Part (iii) showed a fairly good understanding of repeatability but candidates struggled to gain both marks as they could not clearly apply it to the experiment.

(d) Most candidates identified C as the group with the anomalous result but many then went on to conclude that this made the experiment not reproducible.

(e) This was very well answered with most candidates correctly calculating the energy. Many went on to correctly relate concentration and volume.

Investigating the solubility of potassium chlorate(V)

This practical was available to separate Chemistry, 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 complex graph scale causing a mis-read of the solubility value.

(h) As 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.

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

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