GCSE EXAMINERS' REPORTS

GCSE (NEW)
CHEMISTRY

SUMMER 2019

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UNIT 1 - FOUNDATION TIER

General Comments

The majority of the paper was accessible to most candidates but some items proved to be beyond many. Questions 3(c) and 7(c) were surprisingly poorly answered. The common questions were not well answered by foundation tier candidates, with several very low facility factors and high 'not attempted' rates. Recall was often a weakness whilst extended answers caused candidates some problems with many unclear and often contradictory responses. The QER question was straightforward and well answered by some but one in six candidates did not attempt it. The graph was well plotted but mathematical questions, and percentages in particular, did cause problems.

Comments on individual questions/sections

Q.1 Well answered although in (b) there was some confusion with many candidates failing to distinguish between protons and neutrons when labelling **Y**. The explanation was disappointing with candidates failing to recognise a total of 7 protons and neutrons. Stronger candidates scored marks by saying that the nucleus contained 7 particles.

Q.2 Part (a) was well answered although a significant number were unable to recognise the method. In part (b) most recognised the presence of **E** in the dye but few stated that it also contained one unknown. Calculation of R_f values was good although candidates need to recognise the need to measure distance to the centre of the spot.

Q.3 In part (a) the most common error was saying that an element contained one atom rather than one **type** of atom. Interpretation of formulae was generally good although the total number of atoms caused some problems. The formula of iron(III) hydroxide was very disappointing with only one in ten scoring this mark. Many omitted the brackets.

Q.4 Type of boundary was generally well known but there was some confusion between constructive and conservative boundaries. The descriptions caused some problems. Most recognised that magma rises at **A** but did not explain the formation of new rock in terms of cooling. The occurrence of earthquakes at boundary **C** was better understood.

Q.5 Well answered although a significant number gave carbon as a semi-metal.

Q.6 Part (a) was well answered. In part (b) most were able to calculate M_r for GeO_2 but few then went on to calculate the percentage of oxygen correctly. Balancing the equation was disappointing.

Q.7 (a) Some very good answers were seen from those who had learnt their work well. Many others showed poor recall of a very simple process and the mean mark was 2 out of 6. A surprisingly large number did not attempt an answer. Most recognised that particles were removed during sedimentation and filtration but few used the term insoluble. There was also some confusion

between chlorination and fluoridation despite the question stating that no reference to fluoridation should be included.

(b) Many still believe that fluoride strengthens bones rather than tooth enamel.

(c) This was very poorly answered with few recognising the need to subtract 76 from 150. The facility factor was less than 20%.

Q.8 (a) This included a different style of question on balancing equations but again responses were very disappointing. Few candidates knew exactly what is meant by a precipitate. The graph was well plotted although a significant number attempted to draw a straight line of best fit through the points. Candidates showed a poor understanding of the difference between time and rate in parts (iv) and (v). Candidates must refer clearly to both variables when describing conclusions from data, i.e. 'rate goes up' is not worthy of credit in part (v).

(b) Most recognised that rate increases with temperature but failed to use the graph to explain their conclusion. Few recognised the reason for the curve at 20 starting at a lower light intensity. This would have been very difficult unless they had practical experience of this reaction.

Q.9 (a) The trend in density was identified by the majority although a significant number tried to relate it to other properties, e.g density increases as boiling point decreases. Few candidates were able to explain trend in reactivity.

(b) Safety precautions suggested were disappointing. Credit was awarded for points specifically relevant to the elements sodium and chlorine rather than general safety rules. Many did not appear to know that chlorine gas is toxic and that it should only be used in a fume cupboard. Once again the equation caused problems with a significant number giving the formula of sodium chloride as $NaCl_2$.

Q.10 Very disappointing. The type of reaction was generally well known although many gave endothermic or exothermic. Observations were disappointing as were the equations. A good example of poor recall of straightforward content.

Q.11 (a) Most recognised that a catalyst speeds up a reaction but few gained the second mark.

(b) Most gained the mark for optimum pH but the second marking point proved more difficult. The sketch of the graph was very good.

Summary of key points

- Mathematical skills, especially percentages, need to be practised throughout the course.
- Writing chemical formulae and equations are important skills in chemistry and should be practised regularly throughout the course. A total of around 9 marks were awarded for these skills on this paper.
- Specific safety precautions need to be emphasised when carrying out common practical work.
- Candidates must ensure that they refer to both variables and use words such as

'increase' and 'decrease' when drawing conclusions from data.

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UNIT 1 - HIGHER TIER

General Comments

It was pleasing to see that candidates performed well on this paper. The mean score was 36 out of 80 and a full range of marks were seen. The vast majority of candidates attempted all questions. Communication in general was very good but it was evident in some cases that candidates had misread some questions. Mathematical questions were satisfactory although some candidates clearly have difficulty in dealing with negative numbers.

Comments on individual questions/sections

The common questions were better answered that they were on the foundation tier paper although same comments are still relevant.

Q.1 Most candidates recognised trend in reactivity in part (a)(ii) but failed to relate the distance of the outer shell from nucleus with ease of losing the electron.

Q.2 Much better with observations and equations much better known.

Q.3 In part (c) most recognised the fact that activity increased to an optimum and then decreased. Few scored the mark for recognising the difference in rate of increase and decrease.

Q.4 (a) The evidence used by Wegener is better understood but still we see 'same' rather than 'similar' rocks. Few mentioned rock patterns or formations.

(b) Many knew that magma rises to form new rock but lost marks for not referring to magma cooling to form new rock.

Q.5 (a) Graph work was satisfactory although many candidates chose a difficult scale which often lead to loss of plotting marks. Those who used a sensible scale with one large square representing 2 g / 100 g of water generally scored full marks for plotting. It was disappointing to see a significant number of candidates attempting to draw a straight line through the points.

(b) A significant number of candidates failed to extrapolate their graph thus using data from the table to carry out their calculation. This part question was not attempted by 7% of candidates

Q.6 Parts (a) and (b) were generally well answered.

(c) This was quite a difficult question and many candidates struggled to apply their knowledge of fractional distillation in this context. Most recognised the gases having different boiling points but many incorrectly stated that oxygen has the lowest boiling point and thus boils first. The facility factor here was

32%.

(d) This was poorly answered with few candidates recognising the need to use data on percentage present from the table on page 10. Many merely used the 700 000 and converted it to standard form or multiplied various figures in the table Some of those that did use the percentage failed to divide by 100.

Q.7 (a) Most were able to compare the isotopes but a significant number lost mark by giving a general definition. The calculation was well done although many failed to give their answer to three significant figures as required

(b) Most candidates described similarities better than they did differences. A wide range of answers were acceptable but answers had to refer to both metals to gain credit for the differences. The equation was disappointing with many giving K_2O as a product.

Q.8 (a) Most candidates were able to explain results in terms of particle theory.

(b) The change in rate over time was poorly understood with many focusing on comparing different temperatures or explaining why the reaction ends.

(c) Validity was generally well known but candidates were unable to explain the reason behind improvements. Most suggested the use of a gas syringe and many gave 'repeat' as an improvement but were unable to correctly explain why this improved validity.

(d) The calculations caused some problems although a significant number gained full marks. Errors included using 1 as M_r of hydrogen and incorrectly rounding values too early in the calculation. Most were able to use the formula in part (ii) but many lost marks by using mass rather than number of moles.

Q.9 Most recognised the order of reactivity of the halogens with the majority then explaining in terms of displacement. It was disappointing however to see a significant number describing halide ion tests or the reaction of the halogens with alkali metals or iron. Equations were often poor. Those that gave correct symbol equations rarely gave all three. It was surprising to see how many actually used displacement by fluorine in their answer. The facility facto for this question was 23%.

Q.10 (a) Global warming is generally well understood however, candidates lost marks by not referring to both the levels of oxygen and carbon dioxide when describing photosynthesis and respiration. The word 'more' was often omitted when referring to burning of fossil fuels or heat being trapped. CCS is not well understood and candidates generally gave vague descriptions, e.g 'carbon is trapped'. Those that recognised it as carbon dioxide being trapped and stored often said it was stored 'under the sea' or 'in boxes' rather than underground.

(b) This was generally well answered although a significant number still divided A_r by mass thus incorrectly getting N_2O. In part (ii) few recognised that 92 is twice 46 and of those that did, many gave $2NO_2$ rather than N_2O_4 as their molecular formula.

Summary of key points

- Writing chemical formulae and equations are important skills in chemistry and should be practised regularly throughout the course. A total of around 9 marks were awarded for these skills on this paper.

- Candidates need to practise questions involving the use of negative numbers.

- The correct use of significant figures in calculations needs to be emphasised as is the need to round at the end rather than mid-calculation.

- Practical work is a fundamental part of chemistry and those with a broad experience and good understanding of the steps involved in experiments are likely to score higher marks in written papers as well as the practical assessment.

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UNIT 2 - FOUNDATION TIER

General Comments

Many marks were lost throughout the paper by candidates not knowing the difference between the different command words used in questions namely 'state', 'describe' and 'explain'. Once again spelling and basic grammar were often poor.

Those candidates who had experience of practical work were at a distinct advantage in a number of questions.

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

- writing chemical formulae
- balancing simple equations
- general reactions of acids
- preparation of insoluble salts
- advantages and disadvantages of plastics in given contexts
- organic chemistry

Comments on individual questions/sections

Q.1 (a) Very well answered. Candidates were able to identify thermochromic materials and hydrogels.

(b) Very well answered. Candidates were able to link uses and properties of nano-materials.

Q.2 (a) Surprisingly poorly answered. Able foundation tier candidates coped well but weaker candidates scored only 2 or 3 marks for this question. The presence of 'molten alumina' and 'molten aluminium' in the choices confused some weaker candidates. Many candidates chose 'oxygen' as the other component of the electrolyte.

(b) This balancing question required candidates to complete only one box and as a result many gained credit.

(c) The percentage calculation was generally well answered.

(d) Weaker candidates were unable to evaluate the information given to draw the correct conclusion. More able candidates coped well.

Q.3 (a) Parts (i) and (ii) were generally well answered.
(iii) Poorly answered. Much guesswork was evident and some did not attempt an answer. The most common incorrect answers included 'sulfuric acid', 'alkali' and 'chlorine'.

(iv) Only the stronger candidates gave the correct formula for sulfur trioxide but many who managed this also gained the second mark for balancing the equation.

(b) This calculation was generally well done but it was surprising to see that some candidates were unable to add together the six numbers to get a total of 91. A few candidates made an error in subtracting 91 from 100.

(c) Poorly answered. The most common incorrect answer was 'ammonium'.

Q.4 (a) (i) The shared pairs of electrons between hydrogen and oxygen and the octet around the oxygen atom were marked separately. This enabled most candidates to gain at least one mark for this bonding question.

(ii) Generally well answered.

(b) (i) I Most candidates gained both marks for this very simple graph. A ruler was required to draw a straight line through the points.

II Common errors in this question included:

- drawing a line from the origin to (5,50) rather than to (10,25) i.e. using a hydrogen:oxygen ratio of 1:2 rather than 2:1
- drawing a line parallel to their hydrogen line
- drawing a line 90^{o} to their hydrogen line i.e. from (0,50) to (10,0).

III Most candidates scored at least 1 mark here.

(ii) Generally well answered. The most common incorrect answer was **A**.

(c) This question was poorly answered. Candidates demonstrated a lack of understanding of electrolysis.

(i) Many candidates failed to gain this mark by stating that 'plastic is not a metal'. Reference to plastics being insulators or not conducting electricity was required.

(ii) Poor expression and use of terminology prevented many candidates from gaining any marks for this question. The first mark was for stating that the spoon is negatively charged and the second for reference to attraction between opposite charges. The second mark was only gained by more able candidates.

(iii) Poorly answered. All four answers were equally chosen by candidates.

Q.5 (a) This question was one of the worst answered on the paper. The preparation of insoluble salts is a new topic on the specification and candidates demonstrated poor knowledge and understanding.

(i) Candidates only had to exchange the positive and negative ions but this was completely beyond most. Some candidates even introduced different ions into the equation. Weaker candidates failed to correctly copy the symbols of the elements from the left side of the equation to the right.

(ii) Poorly answered with few candidates appreciating that silver chloride is insoluble.

(iii) Surprisingly poorly answered with some candidates suggesting evaporation or distillation. These were not credited.

(b) Well answered by most candidates. The most common error was not multiplying the relative atomic mass of oxygen by 3.

(c) Generally well answered. The most common error was not giving the answer to 1 decimal place as required by the question.

Q.6 (a) This QER question was not well answered even though the topic was well within the grasp of foundation tier candidates. Many failed to read the question carefully. The question did not ask for a list of advantages and disadvantages of plastics. It asked for advantages and disadvantages of plastics in three specific uses. The advantages and disadvantages identified by candidates were vague and often described using non-scientific vocabulary e.g. 'see through' for 'transparent'.

As in previous years the standard of handwriting, spelling and grammar were often poor. Very few candidates planned and organised their answers. The disadvantages of plastics were not well known. Better responses gave good detail e.g. linking non-biodegradability to litter problems and availability of landfill.

(b) This PISA-style question was generally well answered except for part (iv). The most common incorrect answer was 'microplastics carry contaminants from sea water into animals'.

Q.7 (a) This was generally well done but a surprising number were unable to name propanol.

(b) (i) Only the better candidates identified gas **X** as CO_2.

(ii) This question was particularly poorly answered. It is apparent that candidates do not appreciate why 'conditions' are often written above the arrow in a chemical equation.

(c) This question is a prime example that demonstrates the lack of understanding of the command word 'explain'. Most candidates simply extracted information from the table without explaining the relevance. Giving 'less carbon dioxide released' as an advantage was insufficient without the link being made with global warming. As a disadvantage, a comment such as 'more fuel per mile needed' gained credit when linked to less energy being released.

Q.8 (a) (i) A significant number of candidates failed to gain this mark. These candidates simply read the maximum temperature and gave 28°C.

(ii) Some candidates lost two marks for this question by not reading the question carefully enough. The **total** volume of the reaction mixture was 50 cm^3 and not 25 cm^3. A few were unable to subtract 21.5 from 28 correctly and included a value of 7.5°C in their calculation.

(iii) This question was poorly answered. The most common incorrect answer was 28°C. Candidates misunderstood the question and gave the maximum temperature reached in the reaction, which has been asked for on previous examination papers.

(b) The graph was well plotted by the vast majority of candidates.

(c) Although most candidates chose the correct acid not all could express their reason clearly enough to gain the available mark.

(d) (i) Poorly answered. Candidates were required to state that using a temperature sensor would not reduce the amount of heat lost during the reaction. As in previous years, candidates are incorrectly convinced that using a temperature sensor is 'more accurate'.

(ii) More able foundation tier candidates gained this mark.

Q.9 Very few foundation tier candidates coped with this question. Candidates demonstrated a poor understanding of the reactions of acids and writing basic chemical equations.

(a) (i) Most candidates missed or didn't see the relevance of the word 'compound' in the stem of the question. The most common incorrect answer was 'magnesium'. Another less common incorrect answer was 'magnesium carbonate' which was not accepted because no gas was formed.

(ii) Some foundation tier candidates did gain the 'carbon dioxide' mark but very few named copper(II) chloride.

(b) Many of those who did write $ZnCl_2$ for zinc chloride then lost the products mark by giving 'H' for hydrogen. Some candidates only attempted to give the products and omitted the reactants completely. It is expected that foundation tier candidates can write simple symbol equations. In this case, much of the information needed is given in the question.

(c) This was surprisingly poorly answered for a straightforward question.

Q.10 Poorly attempted by foundation tier candidates.

(a) Only able foundation tier candidates gained this mark.

(b) Poorly answered. Many gave the names of the correct products rather than their formulae but this gained no credit.

(c) Poorly answered. Most candidates realised that propene contains three carbon atoms but failed to include a C=C bond in their structure. Many of those who did include a C=C bond failed to ensure that each carbon atom had four bonds. Many candidates gave the structure of propane.

(d) Most candidates knew that bromine water is orange but did not know it turns colourless with an alkene.

Summary of key points

- Writing chemical formulae and equations are important skills in chemistry and should be practised regularly throughout the course. A total of around 10 marks were awarded for these skills on this paper.

- Practical work is a fundamental part of chemistry and those with a broad experience and good understanding of the steps involved in experiments are likely to score higher marks in written papers as well as the practical assessment.

- Ensure a good understanding of methods used to prepare soluble and insoluble salts.

- Take a short time to plan longer written responses, including the QER question, before beginning to write. Consider the scientific terminology that should be included and the order in which to make your points.

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UNIT 2 - HIGHER TIER

General Comments

There were a small but significant number of candidates who would have benefitted from being entered for the foundation tier paper. Many marks were lost throughout the paper by candidates not knowing the difference between the different command words used in questions, namely 'state', 'describe' and 'explain'.

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

- formulae of simple molecules e.g. CO_2, H_2 and NH_3
- writing balanced symbol equations
- chemical analysis
- the purpose of limestone in the blast furnace
- electrolysis of aqueous copper(II) sulfate (as noted in 2018)

Comments on individual questions/sections

Q.1 (a) (i) Generally well answered. The most common incorrect answer was 28°C.

(ii) Well answered. Weaker candidates used 25 cm^3 instead of 50 cm^3 as the total volume of reaction mixture when carrying out the calculation.

(iii) Generally well answered. The most common incorrect answer was 28°C. Some candidates misunderstood the question and gave the 'maximum' temperature reached in the reaction, which has been asked on previous examination papers.

(b) Well answered.

(c) Well answered.

(d) (i) Poorly answered. Candidates were required to state that using a temperature sensor would not reduce the amount of heat lost during the reaction. As in previous years, candidates are incorrectly convinced that using a temperature sensor is 'more accurate'.

(ii) Generally well answered.

Q.2 Surprisingly, many candidates did not cope well with this familiar question style. Many demonstrated a poor understanding of reactions of acids and writing basic chemical equations.

(a) (i) Some candidates missed or didn’t see the relevance of the word 'compound' in the stem of the question. The most common incorrect answer was 'magnesium. Another less common incorrect answer was 'magnesium carbonate' which was not accepted because no gas was formed.

(ii) Most candidates did gain the 'carbon dioxide' mark but very few named copper(II) chloride.

(b) Many of those who did write $ZnCl_2$ for zinc chloride then lost the products mark by giving 'H' for hydrogen. It is expected that higher tier candidates should be able to write and balance chemical equations for familiar reactions without too much difficulty. Some candidates however failed to give the formula of hydrochloric acid even though it was given in the question!

(c) This was surprisingly poorly answered for a straightforward question. Not all candidates were aware that magnesium is more reactive than zinc.

Q.3 (a) Only weak candidates failed to gain this mark.

(b) Only 1 in three candidates gained this mark. The elements 'carbon' and 'hydrogen' were often given and incorrect formulae for carbon dioxide and water were sometimes seen.

(c) Common mistakes included giving the structure of butene instead of propene and drawing one or more carbon atoms with five bonds.

(d) Surprisingly poorly answered. Fewer than 1 in 2 recalled this colour change.

Q.4 Parts of this question were the worst answered on the paper. Those candidates who had seen or had carried out a similar experiment were at a distinct advantage when answering this question.

(a) (i) The Guidance for Teaching document states that candidates should know that when the dissolved salt contains ions of metals higher in the reactivity series than hydrogen, it is hydrogen gas rather than the metal that forms at the cathode. Only more able candidates gained this mark as would be expected.

(ii) Generally well answered.

(iii) Poorly answered. Candidates should have recognised that this system is analogous to that used in the manufacture of sodium hydroxide.

(b) (i) Most candidates did not read the question carefully enough and simply stated that reduction is a gain of electrons. This gained no credit as it contains no reference to the reaction occurring at the cathode.

(ii) This question was the worst answered on the paper. Candidates demonstrated a lack of knowledge of the electrolysis of copper(II) sulfate solution using copper electrodes even though a similar question appeared on last year's paper.

(iii) The bonding in an oxygen molecule well answered.

Q.5 (a) Most candidates were able to name the two types of smart material. Unfortunately, some were unable to describe their unusual properties. The unusual property of shape memory alloy was the better known. The best answers here included reference to the changes being reversible.

(b) (i) Poorly answered. Many candidates did not know that the advantage

of nano-scale titanium dioxide particles is that they are 'transparent'.

(ii) Well answered.

(iii) Able higher tier candidates gained both available marks. The expected answer was 1000 but 1200 was also accepted.

Q.6 Candidates were provided with a lot of information in the labelled diagram but many chose not to use it when answering parts (a)(i) and (ii).

(a) (i) Poorly answered. Candidates were told that carbon monoxide is formed from carbon dioxide and both formulae are given in the diagram. Reaction **1** also showed carbon (C) being used in the furnace. Despite this help only the most able candidates managed to write the balanced equation for reaction **2**.

(ii) The majority of candidates stated that 'limestone reacts with sand to form slag' although they were asked to describe the **two-stage** process in the formation of slag. The Guidance for Teaching document states that candidates should be able to write word and balanced symbol equations for the decomposition of calcium carbonate and the neutralisation reaction between calcium oxide and silicon dioxide. Recall of these two reactions was poor.

(b) (i) Generally well done.

(ii) As in previous years only the most able gained both available marks for this question. Weaker candidates simply re-wrote the given equation splitting up all the reactants and products into ions. An ionic equation such as this should have the precipitate as the only product and therefore only two ions on the left-hand side.

(c) This PISA-style question was generally well answered. Most candidates coped well with information given in a range of diagrams, tables, graphs and text.

Q.7 This was a difficult question but differentiated well.

(a) Able candidates coped well with this demanding question. The question required candidates to discuss the compromise needed when choosing the operating temperature for the Haber process, i.e. a low temperature gives a high yield but a slow rate. The rate is increased by using a catalyst.

(b) A mark was awarded for the formula of ammonium sulfate. However, many candidates lost the reactants mark by not using the correct formula for ammonia, even though it is given in the introduction to the question.

(c) This QER question required the correct sequencing of a three-stage preparation. Many candidates coped well and gave a detailed description of the three stages. Unfortunately, most failed to read the question carefully enough and did not explain the purpose of each stage as required. The first stage is required to find the relative volumes of acid/alkali required for neutralisation. The second stage is used to ensure that the salt formed is pure and the final stage is when crystals are formed as water is removed.

Q.8 (a) Able candidates coped well with this question. Weaker candidates were let down by poor writing skills and not understanding the meaning of the 'explain' command word. Candidates gained no credit for simply re-writing what was

present in the table. They needed to select appropriate information and **explain** why it is an advantage or disadvantage. The mark scheme allowed credit for a wide range of answers.

(b) Only 1 in 5 candidates scored this mark. Most did not know the formula for ethanoic acid but some lost the mark for not including water as a product despite this being stated in the question.

(c) All parts of this question were generally well answered.

(d) This was very well answered with a facility factor of more than 80%.

Q.9 (a) This was very poorly answered and it is possible that some centres have not realised that ion tests specified in Unit 1 may also be assessed in Unit 2.

Only the most able candidates gained all 3 marks for this question. The tests for ammonium ions and carbonate ions were best known. Some candidates confused the flame test for barium ions with that for copper ions. 'Iron(II)' was required for the positive ion in compound **A**.

(b) (i) It was clear that centres were aware this year that calculations specified in Unit 1 may also be assessed in Unit 2.

More able candidates gained both marks for this question.

(ii) The formula of lead nitrate was given in the question stem but weaker candidates were unable to calculate its relative formula mass. The answer was 20.6875 g and candidates who rounded this figure up to 20.7 g occasionally struggled with part (iii).

(iii) Most candidates gained the mark here for a mass of 20.69 g.

Summary of key points

- Writing chemical formulae and equations are important skills in chemistry and should be practised regularly throughout the course. A total of around 10 marks were awarded for these skills on this paper.

- Practical work is a fundamental part of chemistry and those with a broad experience and good understanding of the steps involved in experiments are likely to score higher marks in written papers as well as the practical assessment.

- Ensure a good understanding of the electrolysis of molten ionic compounds such as lead bromide and aluminium oxide and of aqueous solutions such as copper(II) chloride, copper(II) sulfate and sodium chloride.

- Read questions very carefully paying particular attention to command words, information given to help with the answer and also the number of marks available.

- Take a short time to plan longer written responses, including the QER question, before beginning to write. Consider the scientific terminology that should be included and the order in which to make your points. Ensure that your answer is as concise and relevant as possible.

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GCSE (NEW)

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UNIT 3 - PRACTICAL ASSESSMENT

General Comments

It was pleasing that there was again a good spread of marks with the vast majority of candidates attempting most questions. Positive achievement was seen from all candidates. However, explanations requiring demonstration of scientific knowledge were often poor.

Section A Risk Assessment

The nature of the hazard was not always clearly identified (e.g. acid is an irritant) and the risk often lacked an action (e.g. acid splashes on skin whilst pouring into beaker). Where candidates accessed the provided student safety sheets, they did not always select information which was relevant to the task.

Table of results

The majority of tables were well structured and logically organised although candidates tended to lose marks for incorrect units or putting units in the body of the table.

Section B Graphs

Many candidates were able to plot graphs correctly, although lines of best fit were often poor or not attempted. Many candidates did not start their scale at the origin and should be encouraged to do so.

Variables

Generally, candidates are confident in identifying the independent and dependent variables in different investigations indicating that these terms are well understood. Candidates were usually able to identify controlled variables but stating how they were controlled referencing both instrumentation and the value measured was not done well.

Evaluation of quality of data

Repeatability and reproducibility were generally well understood; however, the terms accuracy and precision are still poorly understood. The idea of random error was not well-known. Calculating uncertainty from a given equation proved very difficult. Suggesting improvements however was often well done.

Comments on individual questions/sections

Investigating the effect of the concentration of sulfuric acid concentration on electrolysis

This investigation was only available for separate science candidates and it was not commonly used.

Section A

(a) The hypothesis was usually correct.

(b) The risk did not always have a clear or relevant action associated with it with many candidates talking about acid splashing into eyes.

(c) The table was usually well done.

Section B

(a) (i) (ii) and (iii) This was well done by almost all candidates.

(a) (iv) Most candidates are confident at identifying controlled variables although they do not always explain how they will be controlled.

(b) Almost all candidates demonstrated secure graph plotting skills.

(c) It was rare to award 3 marks here with candidates struggling to link the trend from the graph with the scientific principles.

(d) Most gained some credit here and could usually identify at least one inaccuracy in the method.

(e) (i) Only the best candidates were able to identify the correct ions.

(e) (ii) Many knew the gas tests.

(f) The final section of the paper was very discriminating and the weaker candidates could not access the marks. Better candidates typically attained 2 out of the 3 marks.

Investigating the heat energy released by burning different fuels

This practical was very popular with many centres.

Section A

The risk assessment in this investigation was completed to a slightly better standard than was seen across the suite of investigations. Many candidates used the student safety sheets effectively. However a few candidates extracted information without considering the actual practical being performed and used inappropriate safety guidelines.

The table of results was completed well.

Section B

2. (a) The control variables were identified by the majority of candidates. However there were still some who used 'amount' instead of volume. Marks were also lost due to candidates not referring to the correct instrument or stating the value of control variable i.e. 100 cm^3 of water using a measuring cylinder.

(b) Most candidates correctly identified how to check repeatability and reproducibility, although some did not seem to realise that the experiment was not repeated.

(c) (i) The graph was drawn with varying degrees of success. The scale was drawn better than in many other tasks due to the assistance of the point labelled at the beginning of the graph. However many candidates used this as a point and consequently lost the line of best fit mark.

(c) (ii) As was the case with most of these types of the questions, the relationship was correctly stated but the description of the graph was poorly answered with candidates unable to describe the decreasing rate of the gradient.

(d) The numerical questions here were well answered.

(e) Candidates correctly identified heat loss as a factor but many were unable to communicate clearly two improvements or explain how one of the improvements would improve the results.

Summary of key points

- Encourage candidates to identify the nature of any hazard and to always link a risk with an action in the method.
- Allow plenty of opportunity for candidates to plot graphs. They should have suitable practise in determining their own scales which include values at the origin and they should develop a clearer understanding of what constitutes a good line of best fit.

- Practice method writing to ensure that candidates write concisely and clearly in a suitable style.
- When undertaking practical work, encourage candidates to draw links between the results collected and scientific theory.
- Give candidates experience of judging the reproducibility and repeatability of given data.
- Ensure that candidates understand the significance of a dot above a digit on their calculator screens so that they do not make errors in rounding.

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