GCSE EXAMINERS' REPORTS

CHEMISTRY

JANUARY 2017

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SCIENCE: CHEMISTRY

General Certificate of Secondary Education

January 2017

CHEMISTRY 1 - FOUNDATION TIER

1. The majority of candidates achieved 2 or 3 marks in this question. Common errors included 'hydrogen' instead of oxygen for the gas that relights a glowing splint, 'proton' instead of electron as the negatively charged particle and 'argon' instead of copper as the malleable element.

2. (a) Many candidates confused the terms *reactant* and *product*. 'Calcium chloride' and 'water' were often incorrectly given with quite a few incomplete answers such as 'calcium' seen.

   (b) (i) Generally very well answered although 'hydrogen' was sometimes wrongly given.

   (ii) Poorly answered with the unacceptable answer of a 'lighted splint being extinguished' often seen. Many also referred to the 'pop test' even though carbon dioxide correctly appeared in (b)(i).

   (c) Well answered although weaker candidates often wrote symbols in the box instead of a number.

   (d) A poorly answered question with many referring to a colour change instead of the bubbling.

3. (a) (i) Well answered although 'sodium chlorine' was given by some.

   (ii) Incorrect answers here included reference to chlorine being 'explosive' or 'flammable'. A significant number of candidates did not attempt this question.

   (b) Only the stronger candidates managed to gain this mark. One common wrong answer often seen was 'Zn_2Cl_2'. A few also answered this question using words instead of a formula.

   (c) The majority of candidates failed to gain the two marks available here. Many wrongly thought that 'sulfate' was an element.

4. (a) A well answered question.

(b) A poorly answered question. The most common unacceptable answer seen was '**B** since it is a good conductor of heat'. Many candidates failed to gain the second mark because they simply listed the properties seen in the table.

5. (a) The majority of candidates were able to answer this question correctly.

(b) Generally quite well answered.

(c) Poorly answered. The majority of candidates gave typical general properties of metals such as high melting/boiling points or a good conductor of electricity.

(d) Although some candidates gave the correct expected values for the melting and boiling points of caesium and part of the explanation, very few managed to gain all three marks.

6. (a) (i) Although the graph question was well answered as in previous years, a considerable number of candidates plotted the 'Age of the Earth's' last point as being 5 billion years instead of 4.5 as given. The line was incorrectly drawn as a series of straight lines by many.

(ii) Well answered.

(b) (i) This question was about what happens to the level of **water** inside the test tube, not about the volume of air inside the test tube. 'Decreases' was therefore not an acceptable answer.

(ii) Very few correct responses seen here. Many wrongly thought that 'moving the ruler down to the bottom of the container' would be helpful.

(iii) Very poorly answered.

(iv) Only a small number of the better candidates were able to give the correct percentage of oxygen in the atmosphere.

7. (a) A fairly well answered question although a significant number of candidates gave the correct elements, **C** and **E**, but then missed out on the reason mark by stating that they were on the 'right hand side of the Periodic Table'.

(b) Although a fairly well answered question a few candidates either used the letter **F** instead of **L** as asked for or made no attempt.

(c) The main error appearing here was stating that element **F** was in Period 3 rather than 4.

(d) A poorly answered question. Very few appreciated the unreactive nature of **D**/argon. Many of the uses given were related to **D** being a metal.

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

(ii) Many incorrect answers seen here.

(iii) A poorly answered question. The most common incorrect answer given was ✓, ✓, ×, ✓.

(b) (i) A significant number of candidates did not attempt this question. Common errors seen were stating that 'bubbling took place' or the 'formation of rust'.

(ii) Fairly well answered by the better candidates but the majority struggled to gain the mark.

9. (a) Well answered.

(b) This question was poorly answered, especially in the case of the reactants. Many failed to gain the product mark because they did not show the arrow, even though the correct formula for water was given.

(c) A very poorly answered question. Many of the candidates gave answers that were too vague to gain any marks, e.g. 'expensive', 'not easy to obtain', 'flammable', 'gives less energy than other fuels', etc.

10. Candidates gained more credit for their knowledge of how global warming affects the environment than they did for describing how burning fossil fuels causes it. Many incorrectly discussed the ozone layer and acid rain, therefore gaining a lower band mark.

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CHEMISTRY 1 - HIGHER TIER

1. (a) A well answered question.

   (b) Well answered.

   (c) Well answered.

   (d) A poorly answered question. Very few appreciated the unreactive nature of **D**/argon. Many of the uses given were related to **D** being a metal.

2. (a) (i) Very well answered.

   (ii) Well answered.

   (iii) A poorly answered question. The most common incorrect answer given was ✓, ✓, ×, ✓.

   (b) (i) A poorly answered question. Common errors seen were stating that 'bubbling took place' or the 'formation of rust'. Many candidates also failed to gain the mark by either discussing displacement reactions or giving the unacceptable answer of 'copper formed'.

   (ii) Well answered by the majority of candidates. A few of the better candidates, however, missed out on the mark by attempting to give ionic equations which were incorrect.

3. (a) Well answered.

   (b) Fairly well answered although only the stronger candidates scored the maximum three marks.

   (c) A poorly answered question. Many of the candidates gave answers that were too vague to gain any marks, e.g. 'expensive', 'not easy to obtain', 'flammable', 'gives less energy than other fuels', etc.

4. Well answered with the majority of candidates giving enough information to gain a middle or higher band mark.

5. (a) (i) Poorly answered.

(ii) The filtration part of this question was well answered but answers regarding the formation of the **dry** crystals were poor.

(iii) Many candidates lost the mark here by giving 'oxygen' instead of water as one of the products.

(b) (i) Only the stronger candidates were able to give both reactants to gain the available mark.

(ii) Well answered.

6. (a) (i) A very well answered question.

(ii) Very well answered.

(iii) Generally a well answered question.

(b) Generally well answered with most candidates achieving at least one of the two marks available.

7. (a) Although the majority of candidates were familiar with the ability of oxygen to 'rekindle a glowing splint' and with hydrogen producing a 'squeaky pop noise' with a lighted splint, very many lost the second mark because they did not give the observation for both gases as asked for.

(b) A poorly answered question with many not attempting it.

(c) Very poorly answered with many not attempting it.

8. (a) (i) Well answered.

(ii) Well answered although a significant number of candidates used the '45 %' instead of the 55 % value to calculate the maximum mass of iron.

(b) (i) Very well answered.

(ii) Very well answered.

(iii) Describing what happened to the percentage of nitrogen was fairly well done but only the better candidates gained the explanation mark.

9. (a) Although candidates from some centres succeeded here, it was poorly done by the majority of candidates. Incorrect answers for the hydrogencarbonate ion included HCO_3^{2-}, $H^+CO_3^{2-}$ and CO_3^{2-}.

(b) Again although some very good responses were seen the majority were poor. The most common error seen was a discussion of 'positive ions attracting negative ions' rather than an account of electron transfer from potassium to chlorine.

10. Generally a well answered question with most candidates gaining 3 or 4 marks. Some excellent top band answers were also seen during the marking.

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CHEMISTRY 2 - FOUNDATION TIER

1. (a)&(b) Most candidates gained a total of 2 marks for this question. Marks were lost by not including reference to 'heating' when describing the unusual property.

2. Well answered. Common mistakes included:

   (a) Drawing a C=C in the repeating unit; giving polythene as the repeating unit; putting a C—C in vinyl chloride.

   (b) (i) 'C_2H_6'; alkane; methane; ethene; carbon hydroxide

   (iii) **B**

   (iv) butane; 'C_4H_8'

3. This question was poorly answered.

   (a) All combinations of the letters were given, the most common being '**B** and **D**' or '**B** and **C**'.

   (b) This part was missed out by many candidates. When attempted most candidates gained credit.

   (c) Most candidates were able to identify the distance moved by the substance but failed to identify the correct value for the distance moved by the solvent front. The most common error was to calculate a value of 2 which gave an incorrect R_f value of 3.

4. (a) Well answered.

(b) (i) Most candidates gained the first mark for ‘lead oxide’ but weaker candidates failed to describe how the diagrams helped them make their choice. Answers which simply stated ‘it reacted the fastest’ or ‘it had the biggest reaction’ gained no credit. A reference to bubbles / foam / froth / lather was needed to gain the second mark.

(ii) The most common incorrect answer related to the ‘washing-up liquid’, despite being told in the stem of the question that the same amount and same type was used.

(iii) Poorly answered. Candidates were required to be precise in their language here and credit was awarded for stating that either the 'hydrogen peroxide' or the 'reactant' must have been used up or that 'all the oxygen had been released'. Common answers not credited included ‘all the reactant***s*** used up’ and vague use of 'it' and 'the substance'.

(iv) Surprisingly poorly answered. Many candidates chose 'less than 2g'.

5. Most candidates gained their marks on parts (a) and (b).

(a) (i) Well answered.

(ii) Most candidates gained the first marking point by identifying the large difference between time 1 and time 2 for 32 g/dm^3. However, many candidates failed to attempt the second part. An answer identifying the '22s' reading as being incorrect was expected. Those candidates who did attempt this part often gave vague descriptions relating to a 'different person having carried out the experiment', 'stirring' or a 'change in temperature'.

(b) (i) Well answered.

(ii) Once again most candidates gained one of the two available marks. One mark was awarded for a qualitative answer, e.g. 'the mean time decreased with increasing concentration of sodium thiosulfate'. A quantitative answer gained both marks, e.g. 'as the concentration doubled, the mean time halved'.

(c) Extremely poorly answered. Most candidates did not know the significance of the state symbols in the equation and/or the meaning of 'precipitate'. Both ‘NaCl(aq)’ and ‘SO_2(g)’ were often circled as being the yellow precipitate.

(d) Most candidates demonstrated a lack of knowledge of the use of 'sensors' in experimental work. Use of the 'light sensor method' was not known by most candidates. Vague references to 'measuring with a computer' were not credited.

6. (a) (i) Most candidates gained both marks on this question. Weaker candidates gave the electronic structure of the sodium ion as 2.8.1 or 2.8.2 and the charge on the chloride ion as '+'.

(ii) Very few candidates gained this mark.

(b) Most candidates gained this mark. Weaker candidates subtracted 23 from 35.5.

(c) (i) Well answered.

(ii) Poorly answered. The most common incorrect answers were 'yellow precipitate' and 'cream precipitate'.

7. (a) (i) Common incorrect answers included (2.1), 7 and 4.

(ii) Common incorrect answers included 11, 20 and 39.

(iii) Weaker candidates failed to draw the electronic structure and often showed more than one electron in the outer shell and/ or too many shells.

(b) (i) Stating that 'reactivity increases' without reference to going '*down the group*' gained no credit.

(ii) Surprisingly not known by many candidates. Incorrect answers included 'in a vacuum', 'in a preservative', 'in paraffin', 'in kerosene', 'in a dry cupboard' and 'in water'!

(iii) Few candidates were able to give the formula of potassium oxide, K_2O. The most common response was KO_2. Candidates generally scored 0 or 2 marks.

(iv) Very few candidates recognised corrosion and combustion as examples of oxidation.

8. (a) (i) Most candidates were able to plot all the points correctly and draw a reasonable curve of best fit. Candidates dropped marks here by not reading the vertical scale correctly and by joining the points with a ruler.

(ii) Most candidates gained one mark by describing the general pattern of their curve i.e. 'as the mass of sodium chloride *increases*, the volume of solution absorbed *decreases*'. The strongest candidates gained both marks by referencing a **sharp** initial decrease up to a given mass followed by a more gradual decrease, e.g. 'sharp decrease in volume of solution absorbed until 0.4 g then small decrease'. Candidates should be reminded that two points are usually required in response to a two-mark question.

(iii) In order to gain both marks here candidates were required to quote volumes of solution absorbed (or collected) e.g. '**A** is more efficient because it absorbs 47 cm^3 of solution and **B** absorbs only 42 cm^3'. '**A** is more efficient because it absorbs more solution than **B**' gained one mark. No credit was given for simply choosing hydrogel **A**.

(iv) Surprisingly poorly answered. Few candidates appreciated that the smallest of the three measuring cylinders should be chosen to measure 8 cm^3 of a solution as it has the smallest gradations and would therefore allow more precise or more accurate measurement. Some candidates failed to read the question carefully and did not realise that a volume of 8 cm^3 was to be measured.

(b) Well answered. 'Nappies' was the most common correct response.

9. It was clear that candidates had used a previously set question on hard water in their revision as many responses included reference to temporary hard water, which was not relevant to this question.

Here candidates were simply required to describe a fair test to compare the hardness of three water samples. Boiling was not required at any stage and was considered to be irrelevant, preventing a top band mark being awarded.

Those candidates who identified the factors needed for a fair test and gave a concise conclusion scored well on this question.

It is evident that many candidates are not aware of the criteria for a QWC question. Many answers were poorly organised and lacked the necessary sequencing. Many statements were slotted in at the end as an after-thought.

Common weaknesses included:
use of 'amount' instead of 'volume' of soap solution
omission of 'shaking' the mixture
not stating that ‘shaking’ must be kept the same
referring to the lather being formed 'more quickly' or 'more easily'

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CHEMISTRY 2 – HIGHER TIER

1. (a) (i)-(iii) Well answered.

(b) (i) Stating that 'reactivity increases' without reference to going '*down the group*' gained no credit.

(ii) Well answered.

(iii) Weaker candidates were not able to give the formula of potassium oxide, K_2O. The most common incorrect response was KO_2. Candidates generally scored 0 or 2 marks.

(iv) Surprisingly few candidates recognised corrosion and combustion as examples of oxidation.

2. (a) (i) Well answered.

(ii) Most candidates gained one mark by describing the general pattern of their curve i.e. 'as the mass of sodium chloride *increases*, the volume of solution absorbed *decreases*'. Some candidates gained both marks by referencing a **sharp** initial decrease up to a given mass followed by a more gradual decrease, e.g. 'sharp decrease in volume of solution absorbed until 0.4 g then small decrease'. Candidates should be reminded that two points are usually required in response to a two-mark question.

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- not stating that ‘shaking’ must be kept the same
- referring to the lather being formed 'more quickly' or 'more easily'

4. (a) Weaker candidates did not know the formula of oxygen gas therefore failed to access either mark. The balancing mark is dependent upon the correct formulae being given for the reactant and products.

(b) Generally well done. Some candidates failed to refer to the graph when giving their reason. Simply stating 'it is the fastest reaction' did not gain credit.

(c) Many candidates gave a mass of *less than* 2g. Stating that 'a catalyst does not take part in a reaction' was considered to be a neutral answer, which gained no credit.

5. (a) Extremely poorly answered. It was obvious that many higher tier candidates did not understand the principles of chromatography. Many failed to read the question carefully and missed the fact that each pen contained **two** dyes. The most common error was to draw **one** spot per pen, invariably not located 4cm from the start point.

(b) This question did not ask candidates to describe what happens during the distillation process; it asked for an explanation, i.e. <u>why</u> separation happens. Very many candidates filled the five lines with a description of ethanol evaporating then cooling, condensing and being collected. None of this gained any credit.

6. (a) Weaker candidates included a C=C bond in the product.

(b) Most candidates gained the marks for the repeating unit and for stating that the C=C bond 'opens'. Fewer explained clearly the idea that monomer units join together to form a long chain.

(c) This covalent bonding question looked a little different to previous examples and used three different symbols to represent electrons, allowing electrons from both carbon atoms to be distinguished. The best candidates drew perfect representations but those who used the ✕ symbol to show all eight electrons from the carbon atoms were potentially awarded full credit. Most gained at least one mark for the C—H bonds. A number of candidates correctly showed the double bond electrons but lost this mark by including more than eight electrons around the carbon atoms.

7. (a) (i) This ionic bonding question was also set out in a different way. Arrows from the outer shell electrons of magnesium to the spaces in each chlorine atom were expected but the left hand side was often left blank. This marking point was credited if the electrons were all appropriately located on the right hand side. The second mark was awarded for a full octet around each chloride ion **and** correct charges on all three ions.

Common errors included:
- putting eight electrons around the magnesium ion on the right
- omitting the octets around the chloride ions on the right
- incorrect charges on the ions

(ii) The difference between ‘structure’ and ‘bonding’ is not well known. Only the most able candidates gained this mark.

(iii) Only able candidates used the correct terminology in this question.

Common errors included:
- referring to 'atoms' and/or 'intermolecular bonding'
- referring to 'moving electrons'

(b) Only able candidates gained all three marks for this question. The main issue was that while many candidates were able to calculate the correct M_r for magnesium chloride they were not able to do so for magnesium hydroxide. The 'error carried forward' principle enabled access to the remaining two marks. Weaker candidates did not attempt the question.

8. (a) Well answered.

(b) Poorly answered. Ionic equations are asked for regularly but very few candidates appeared to know what was expected.

9. This QWC question was set on an accessible and well understood topic. Most able candidates scored in the top band and weaker candidates generally gained 2 or 3 marks.

Able candidates clearly and concisely explained two factors using two paragraphs in ten lines.

Weak answers were disorganised and failed to include reference to 'greater chance of successful collisions' or to 'activation energy'.

A few able candidates failed to achieve a top band mark by including irrelevant material in their answer. The most common irrelevant inclusion was reference to a catalyst; the question specifically asks for two factors relating to the hydrochloric acid.

Candidates should be made aware that a top band mark can be obtained without using all the lines available. Clear concise scientific writing is required for this question.

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