GCE AS EXAMINERS' REPORTS

CHEMISTRY
AS

SUMMER 2017

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EDUQAS
GCE AS CHEMISTRY

Summer 2017

COMPONENT 1

General

The paper produced a range of marks with well-prepared candidates being able to demonstrate real understanding of chemical principles, practical techniques and the mathematical processes involved in Chemistry at this level. Weaker candidates were able to gain some marks, although often marks were not awarded when the answer given did not actually address the question as set. Some candidates appear to see a particular word/ phrase in a question and then answer it as though it said 'write all you know about ...' rather than addressing the **particular** question.

Most candidates attempted all questions and there was no evidence that shortage of time was a factor in performance.

Comments on Individual Questions

Section A

1. Most candidates can write electronic structures with only a few incorrect responses. Since the paper is at AS standard, the removal of either 4s or 3d electrons was allowed.

2. Most candidates gave the correct mass of the remaining isotope.

3. *(a)* Some candidates did not state that the attraction must be for a **bonded pair** of electrons. It is not acceptable merely to describe how attractive to electrons a particular atom is.

(b) Even with an incomplete definition in *(a)*, most showed that they understood the concept of electronegativity by giving correct dipoles.

4. The calculation of the value of the equilibrium constant was generally well done.

5. Any temperature above 900 °C was accepted and most candidates commented on the trend. It was not necessary to go on to discuss the reason for this trend.

6. The oxidation state was generally given correctly.

7. Any soluble hydroxide and copper(II) compound were accepted. Most, perhaps not surprisingly, suggested sodium hydroxide and copper(II) sulfate.

8. Although, by the number of crossed out and rewritten equations, candidates had to use a fair degree of ‘trial and error’, the inclusion in the question of the 3 meant that many correctly balanced equations were seen.

Section B

9. *(a)* The presence of metallic bonding was recognised by most with only a few candidates incorrectly involving protons in a description of its nature.

(b) This question needed a comment on the relative strengths of covalent and dipole attractions. The majority of candidates realised this with only a few apparently confusing intermolecular and intramolecular forces.

(c) Although the fact that both the compounds involved are ionic was generally appreciated, some answers did not describe between which particles the attraction was.

(d) Some marks were lost when the 'orange/brown' at the end was not identified as bromine in **both** reactions. Candidates should be advised to be more careful in their use of, for example, bromine and bromide and recognise that these words are not interchangeable.

10. *(a)* (i) Most candidates gained one mark for this part but a significant number failed to include the fact that standard conditions were required.

(ii) It was evident that most candidates did recognise that the increase in ionisation energies was due to increasing attraction between the electron being removed and the nucleus. Some explanations for this increase however lacked the precision needed.

(b) *(*i) This was the question in which the quality of extended response (QER) was assessed. To access the higher band marks it was necessary to recognise that any coloured lines seen in the hydrogen spectrum are in the Balmer series and that in order to determine the ionisation energy, the Lyman series must be used. Most candidates recognised the use of $E = hf$ but in many cases description of the significance of the lines becoming closer together was omitted.

(ii) Nearly all candidates knew the basis of this calculation and many were able to obtain a correct answer. Some however apparently had difficulties in using the powers of 10 required.

11. *(a)* (i) The expression $pH = -\log[H^+]$ was all that was expected and most candidates quoted this.

(ii) This calculation was generally well done.

(iii) Most candidates recognised that the difference in pH was linked to the relative strengths of the acids. Some marks were not awarded if the description was imprecise. It was necessary for example to refer to the difference of **concentration** of H^+ ions rather than the **number** of H^+ ions produced.

(b) (i) Most candidates drew diagrams with the correct number of atoms and electrons. For full credit it was necessary to show that one electron pair came solely from the oxygen atom.

(ii) The terms 'co-ordinate bond' or 'dative covalent bond' were both accepted.

(iii) A few candidates clearly thought that the molecule would be planar trigonal but most recognised that it is a distorted tetrahedron. The relative strength of lone pair and bond pair repulsion was generally well described.

(c) Most candidates were able to give an acceptable statement of le Chatelier's principle and to apply this to the chromate(VI)-dichromate(VI) equilibrium.

12. *(a)* It was pleasing to note that candidates were familiar with practical exercises of this type although comments on accuracy still produced some difficulties.

(i) There is clearly more than one way to carry out this determination so it is essential that candidates show sufficient explanation/working to really show what they are doing. Many correct answers were seen.

(ii) This was an example where candidates had perhaps not considered possible sources of error. It was not acceptable, for example, to suggest that the loss of water or of a gas should be prevented by keeping the lid in place.

(iii) A number of acceptable answers were seen but vague answers such as 'repeat the experiment' or 'heat for longer' were not considered worthy of credit.

(iv) Only the most able candidates realised that, since the final answer must be an integer, significant inaccuracies would still produce the correct final calculated answer.

(b) (i) It appeared that many candidates saw the positive result when barium chloride was added and therefore concluded that **W** contained sulfate. However if they had gone on to read the observation when dilute nitric acid was added they should have realised that **W** actually contained carbonate.

(ii) This was more successfully answered with many realising the significance of 'no visible reaction' with aqueous sodium hydroxide.

(iii) Some correct equations were seen. Correctly completed equations were credited for sulfate if this had been given in part (i).

13. *(a)* Most candidates realised that an indicator for a titration must involve a single colour change.

(b) Most candidates also calculated a correct mean titre and ignored the anomalous result.

(c) The initial calculations of number of moles of acid and alkali were correctly carried out by most candidates. A number however did not realise that it was necessary to calculate the number of moles in 100 cm^3 of acid.

(d) Although a number of candidates balanced the equation successfully some did not then divide the number for H^+ by two to obtain $n(CO_3^{2-})$.

(e) Candidates who worked out the correct values in parts *(c)* and *(d)* generally did so in *(e)*. It was possible to gain credit for a conclusion consistent with incorrect values carried forward.

(f) Candidates tackled this calculation better than a similar one last year. More realised that they had to use $\pm$ 0.1 cm^3 as the maximum error.

(g) It was evident that most candidates were familiar with this type of calculation and many calculated the number of moles correctly. The conclusion had to follow that reached in *(e)* whether this was correct or not.

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COMPONENT 2

General Comments

This was the second examination of this component for the new GCE AS specification. This component contains less mathematical material and more 'clear learning' than Component 1. It is apparent from the papers that most candidates had prepared thoroughly for this examination and consequently, the responses seen were often well expressed and detailed. As a result, a significant number of candidates gained over 75 % of the marks and only a few failed to gain 50 %.

The highest mark was 74 and the lowest 3. Section A proved to be very successful for the majority of candidates. In Section B the best answered question as a whole was Q.10. The easiest parts of the paper proved to be Q.11(a), Q.4(a) and Q.8(a)(iv), while the hardest parts were Q.7(e), Q.11(e) and Q.4(b) in that order.

It was good to see that a question on practical work in organic chemistry (in this case oxidation of ethanol) was answered well. It was also pleasing to note that a significant number of candidates performed very well in the calculation questions. However, areas that need improvement are analysing spectral data and percentage yield calculations.

Section A

This was well answered with the mean mark being over 6 out of 10.

1. Both parts proved to be a fairly positive start to the paper. Around two thirds of the candidates correctly named the compound in part *(a)* and gave an equation for the cracking process in part *(b)*. The main error in *(b)* was to give an incorrect formula for decane.

2. Well answered. Around three quarters could draw the repeat unit in polypropene.

3. Again well answered. Most could differentiate between a primary and secondary alcohol.

4. Part *(a)* was very well answered with the vast majority gaining the mark for the skeletal formula. Part *(b)* proved far more difficult with a significant number giving the observation as 'orange to green colour change'.

5. Both parts were very well answered with the vast majority being able to draw and label energy profile diagrams.

6. Poorly answered. Less than half could give a chemical test for a carboxylic acid group.

Section B

7. *(a)* This proved to be a good discriminator with a quarter of the candidates gaining full marks. The main errors were failure to mention the bonding between the carbon and hydrogen atoms and to refer to 'electrophilic attack' instead of 'electrophilic addition'.

(b) This proved to be a tricky question. Only about a quarter named both types of isomerism while a third drew all four isomers. However, the vast majority correctly drew the structures of at least two isomers and so gained a mark.

(c) (i) Most candidates were clearly familiar with curly arrow mechanisms but some need to take more care in showing exactly where each arrow begins and ends. Over half scored all 3 marks.

(ii) Well answered. Over two thirds correctly explained in terms of the stability of the secondary carbocation.

(d) (i) Again well answered. Around three quarters could correctly classify the type of reaction mechanism.

(ii) Less well answered. Just under a half knew the reagent and conditions necessary for this reaction.

(e) Very poorly answered with around two thirds of candidates failing to score a mark. Only about a quarter realised that since there were only two environments in the spectrum the compound had to be 2-bromopropane.

(f) In part (i) most candidates knew what is meant by a radical and in part (ii) most realised that the C—F bond is stronger than the C—Cl bond. About two thirds of candidates gained both marks.

8. *(a)* (i) Very well answered. Around three quarters of candidates could name the type of reaction and give a suitable reagent.

(ii) In this part candidates had to produce a diagram for heating under reflux. To gain credit it was necessary to draw a flask with a vertical condenser, unsealed apparatus and a suitable heat source. The examiners accepted any shape flask for the reaction vessel and were lenient with the drawing of a condenser. The standard of the diagrams was much better than last year with just under two thirds scoring at least 3 marks out of 4.

(iii) Fairly well answered. While over two thirds could give one reason why the escape of vapour during reflux should be prevented only around 40 % could give two reasons.

(iv) This mole calculation was very well answered with the vast majority scoring both marks.

(v) Fairly well answered. Around two thirds managed to explain why ethanoic acid was not formed in this reaction. However, only half of these could give a full explanation.

(b) This percentage yield calculation proved to be a 'marmite' question with about 60 % getting the full 3 marks and the remaining 40 % failing to score anything.

9. *(a)* (i) This calculation was very well answered with around three quarters giving the correct empirical and molecular formulae.

(ii) Proved to be trickier. Just under half could draw a displayed formula for the ester and correctly name it.

(b) In this six mark quality of extended response (QER) question, candidates had to consider the advantages and disadvantages of two processes to produce ethanol. It was generally well answered with the majority scoring in the middle band. All candidates commented on the difference in the energy used and were able to give an opinion on which process to choose. Over two thirds commented on the atom economy of the processes and the renewability of the reactants. A significant number also considered the relative effect of the processes on the environment. However, only a few commented on the availability of the raw materials.

(c) About three quarters could give a reagent for the dehydration of ethanol. However a significant number only referred to either the wavenumber or bond in the IR spectrum and so lost a mark.

10. This was the best answered question in this section.

(a) (i) Well answered. Over two thirds could give an assumption made when finding a value from experimental results.

(ii) In part I, the vast majority managed to score at least 1 mark and about 60 % used the data correctly to score the full 4 marks in this enthalpy calculation. The main error was incorrectly calculating the number of moles of magnesium carbonate. In part II, although most knew that the value of the enthalpy change would be smaller, less than a quarter could explain why.

(iii) Most candidates could give an advantage of using a volumetric pipette and a measuring cylinder.

(iv) Poorly answered. Only about 40 % correctly calculated the percentage error. Many did not realise that measuring the temperature rise involved two thermometer readings and that the error should therefore be doubled.

(v) The vast majority correctly used the Hess cycle to calculate the enthalpy change of the reaction.

(b) This enthalpy of formation calculation was well done. Around two thirds gained both marks with the vast majority scoring at least one mark.

11. *(a)* This proved to be the easiest mark on the whole paper. Almost every candidate correctly named the gas syringe.

(b) Generally well answered. Just over half the candidates gained both marks. Some candidates lost a mark for omitting a weighing balance and others for not mentioning time.

(c) Fairly well answered. Around 60 % calculated the moles of carbonate and acid but only just over half of these realised that because of the 1:2 ratio, the carbonate was in excess.

(d) Almost all the candidates correctly drew a tangent and measured the initial rate. Some lost a mark for an incorrect unit.

(e) Poorly answered. Although all candidates knew that the reaction would be slower only about a third could adequately explain why. Most did not use collision theory but simply stated that the reaction was slower because there was a decrease in concentration. Also less than half the candidates realised that the volume of carbon dioxide produced would be halved since the number of moles of hydrochloric acid was halved.

(f) Surprisingly only about half the candidates stated that the surface area of the magnesium carbonate had to be kept constant.

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