GCE AS EXAMINERS' REPORTS

CHEMISTRY
AS

SUMMER 2018

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COMPONENT 1

General Comments

The paper proved generally accessible with candidates being able to demonstrate what they know. This led to a mean mark greater than 60%.

It was pleasing to note that many candidates coped well with questions that demanded the interpretation of data and with calculations. It was however noted that questions designed to allow candidates to demonstrate their **understanding** of practical procedures were less well answered. Teachers are advised that, when practical exercises are undertaken, they ensure that students think through the implications of the particular actions carried out.

Most candidates attempted all parts of the paper and there was no evidence that lack of time was a factor in performance.

Section A

1. Nearly all candidates gave the correct electronic structure for bromine.

2. Nearly all candidates gave the correct oxidation state for chromium.

3. There was some confusion with face centred cubic but most drew an acceptable structure.

4. A few candidates did not realise that Avogadro's number was needed but most calculated the number of oxygen atoms correctly.

5. Nearly all candidates deviated the beams in the correct direction but some did not make it clear that β particles would deviate more than α particles.

6. Even with the inclusion of the formula of the product, a significant number failed to balance the equation.

7. It was clear that atom economy is generally understood.

Section B

8. In general candidates appeared familiar with the chemical concepts involved in the question. In particular the structure of ice and the significance of three lines in the mass spectrum of chlorine were well explained. In (c) however candidates did not always include a comment on the link between degree of dissociation and H^+ ion concentration.

9. (a) This was the question in which the quality of extended response (QER) was assessed. Some candidates gave well-reasoned accounts of the differences in the boiling temperatures but others did not appear to recognise that, in all cases, it is intermolecular forces rather than intramolecular forces that are being broken.

   (b) (i) Most candidates drew an acceptable dot and cross diagram.

   (ii) Although many candidates stated an acceptable bond angle, a number did not score the second mark since, for this, it was necessary to state that it is bond **pairs** that repel.

10. This was an example where it was hoped that candidates had carried out similar practical exercises and understood the significance of each stage of the process. This did not appear to be the case for a significant number of candidates.

   (a) (i) Many candidates correctly added a mineral acid.

   (ii) Many suggested the use of a soluble sulfate or sulfuric acid but a number of insoluble compounds were given.

   (iii) There are encouraging signs that candidates are becoming more familiar with ionic equations.

   (iv) Overall responses were disappointing since, although most candidates filtered, few realised the significance of washing the residue and even fewer dried to constant mass. This was in spite of the question including, at this stage, the fact that the residue was needed for **quantitative** analysis.

   (b) (i) As already recognised, most candidates dealt well with calculations. Many correct answers were seen.

   (ii) A significant number of candidates realised that the total maximum error in two readings is 0.01g.

   (iii) This proved accessible only to the most able. Many candidates suggested that carbon dioxide would be produced but few explained the significance of this.

11. (a) This part was firmly based on techniques with which it was hoped candidates had become familiar during the practical work that they had undertaken throughout their course. A number realised that it was necessary to dilute the acid provided by a factor of 40 but few could quote appropriate apparatus for this dilution.

   (b) This calculation was generally well done.

(c) For full credit it was necessary to comment on what would be observed and also to explain why this change occurred. Answers based on the precipitation of calcium carbonate or calcium hydroxide were accepted.

(d) Many correct answers were seen.

(e) Most candidates chose to use flame tests and most gave correct flame colours. It should be noted that the brick-red colour for calcium cannot be described as being crimson.

12. (a) Most candidates gave an acceptable explanation of the meaning of a *reversible* reaction.

(b) A significant number of candidates realised that all the lines must become horizontal at the same time. Fewer recognised that line **A** should start at 2.5 and finish at 0.5 whilst line **B** should start at 0 and finish at 2.0.

(c) (i) Most candidates could write the expression for K_c and recognise that, in this case, it has no units.

(ii) Many candidates stated that this meant that the equilibrium position stayed approximately the same. Fewer explained the reason for this based on ΔH being approximately 0.

(d) The calculation was generally well done.

(e) This calculation was also often well done. However some candidates did not realise that, as the limiting factor, the number of moles of ethanol should be used. Others were penalised for approximating values to 1 significant figure.

13. (a) Answers based on measuring the increase in mass based on the use of suitable absorbing agents or of measuring the volume of carbon dioxide were accepted.

(b) & (c) A significant number of candidates did what the question asked and calculated the percentage of each of the elements present in (b) to then use these percentages in (c). Others however did not recognise that it was necessary to use the percentages of carbon and hydrogen to be able to calculate the percentage of oxygen for use in (c).

In (c) correct use of answers based an incorrect values in (b) were credited.

(d) Answers using pV = nRT or conversion to stp and use of standard volume of a gas were accepted.

(e) Candidates who had obtained answers in (c) and (d) generally gained this mark.

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COMPONENT 2

General Comments

Once again it was apparent that most candidates had prepared thoroughly for this examination and consequently, the responses seen were often well expressed and detailed. Due to this, a significant number of candidates scored over 75% of the marks and only a few failed to score 40%.

The highest mark was 70 and the lowest 2. Section A proved to be successful for the majority of candidates. In Section B, Q.7, Q.8 and Q.9 were well answered but Q.10 proved to be very difficult. The most accessible parts of the paper were Q.8(a)(i), Q.6(a) and Q.9(a), with the most challenging parts being Q.10(b), Q.10(e)(i) and Q.9(f)(ii) in that order.

Again a significant number of candidates performed very well in most questions involving calculation. It was pleasing to note that there was an improvement in analysing spectral data. Application of knowledge and understanding of practical work remains a weakness.

Section A

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

Q.1 A positive start to the paper. Around four fifths of candidates correctly named the catalyst.

Q.2 Part (a) was fairly well answered. Just over half could draw the skeletal formula of *Z*-but-2-ene. Some drew *E*-but-2-ene but a significant minority drew a displayed formula. In part (b) just over half successfully explained the difference between but-2-ene and but-1-ene in terms of the groups attached to the double bonded carbons but only a few referred to restricted rotation about the double bond.

Q.3 Well answered. Around two thirds of the candidates knew what was meant by heterolytic bond fission.

Q.4 Again around two thirds gained the mark by stating that the monomer was 2-methylbut-1-ene.

Q.5 The vast majority knew how a catalyst speeds up a reaction with almost everyone gaining at least one mark and over half gaining both marks.

Q.6 Part (a) was very well answered with almost everyone drawing a correct curve. Part (b) proved far more difficult with only about a third drawing a correct curve. The main error was a failure to start the flat line before 9 minutes.

Section B

Q.7 (a) Very well answered. The vast majority knew that sulfur reacts with oxygen to form SO_2 which then leads to acid rain.

(b) This calculation on bond enthalpy was well answered. Around three in five candidates scored all 3 marks with only around one in ten failing to score any marks.

(c) (i) The vast majority could correctly name the type of reaction mechanism.

(ii) Most candidates were clearly familiar with the radical substitution mechanism. Almost all knew the initiation and termination steps and around two thirds scored all 4 marks.

(d) This proved to be a good discriminator with around a quarter gaining all 3 marks. The main error was to confuse the boiling temperatures of propan-1-ol and ethanoic acid.

(e) In this six mark question, candidates had to consider ^{13}C NMR and mass spectrum data to identify compounds. This was generally well answered with about two thirds scoring a middle band mark. Almost all candidates correctly identified compounds **A** and **B** and most commented fully on the ^{13}C NMR peaks. A majority stated that the m/z peak at 60 for both compounds **A** and **B** gave the M_r of both and that the peak at 15 showed a CH_3 group. Only a few commented on the peak at 43 for compound **A** and the peak at 31 for compound **B**. A significant number failed to give any spectral data for the remaining compound.

(f) Only about one in six candidates gained both marks. Many did not mention that only ethanoic acid would show an absorption at 1650 to 1750 cm^{-1} due to the C=O bond. A significant number failed to refer to the O—H absorption being at different wavenumbers for both compounds.

Q.8 (a) (i) Extremely well answered. Almost all candidates correctly calculated the M_r of the compound.

(ii) In this 7 mark question candidates had to use the information given to identify five compounds and give their reasoning. The full range of marks was seen with about a third scoring the full 7 marks. The two main reasons for losing marks were

- identifying **B** as 1-bromobutane and **C** as 2-bromobutane instead of the other way round
- identifying **A** as butene instead of but-1-ene and **D** as butanol instead of butan-1-ol

(iii) The majority of candidates gained this mark.

(b) (i) Surprisingly only just over half of candidates could identify both functional groups in the compound. Some only gave one functional group while others incorrectly named “hydroxide” instead of “hydroxyl”.

(ii) Just under two thirds managed to give a correct formula. The commonest incorrect answer was $C_{10}H_{17}OH$.

(iii) Parts I and II were only fairly well answered with just under half gaining the mark in each part. In part I, the main error was to add bromine across only one of the double bonds. In part II, some candidates lost a mark for not showing the ester group clearly enough.

Q.9 (a) This enthalpy change calculation was very well answered with over three quarters giving the correct answer.

(b) (i) This percentage error question was well answered with around two thirds giving the correct answer.

(ii) Less well answered. Over a half of candidates failed to score a mark while around a third scored both marks. Many suggested that repeating the experiment and calculating a mean value for the temperature change would reduce the percentage error.

(c) (i) Over three quarters could suggest an improvement to reduce heat loss. The most popular answer was to put a lid on the beaker. Since the beaker was being heated, insulating the beaker did not gain a mark unless qualified.

(ii) Fewer candidates could give a reason why the enthalpy change was smaller.

(d) (i) Well answered. Around two thirds could give an equation for the complete combustion of $C_5H_{11}OH$.

(ii) Again well answered. Around three quarters used enthalpy change of formation values to give a correct answer.

(iii) Only around a third of candidates gained this mark. The main reason for losing the mark was for being too vague. A common answer was “because it’s in its standard state”.

(e) The vast majority could distinguish between a secondary and tertiary alcohol. The main error was to omit the conditions of the reactants.

(f) (i) The vast majority gained the “flow of water” mark but more than half incorrectly thought that the thermometer bulb was placed in the solution in the distillation apparatus.

(ii) This percentage yield calculation was poorly answered. Around three quarters failed to gain a mark. Since the compounds were liquids, most candidates simply changed the initial and final volumes into masses, then divided these and multiplied by a hundred. Most of the candidates that used the M_r of the compounds gained all 3 marks.

Q.10 This was the least successfully answered question on the paper.

(a) Poorly answered. Less than half the candidates realised that the student was correct and only about half of these could give a valid reason to justify their answer.

(b) This proved to be the most difficult part-question on the whole paper. Just under a third correctly stated that repeating the experiment and calculating a mean value would give more accurate results. Others stated that temperature had to be controlled, but no one gave two valid reasons.

(c) Only about a third could say why the peroxide was measured into a tube.

(d) Again, only about a third correctly suggested that the reaction time would be too short.

(e) Part (i) was very poorly answered. The vast majority simply stated that as the concentration of the peroxide increased the rate increased and gained no marks. Part (ii) was better answered. Over half scored at least 1 mark out of 2 with over two thirds of these gaining both marks. Some candidates lost the second mark for failing to convert $\frac{1}{time}$ into $time$.

(f) Around half the candidates suggested using a colorimeter and gained the marks.

(g) Although around two thirds gained at least one mark, only a few candidates gained both. Many failed to state that there were more molecules in the same volume. Others stated that there were more collisions with energy greater than activation energy rather than there being a greater chance of these collisions.

WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk