



GCE AS EXAMINERS' REPORTS

**CHEMISTRY
AS**

SUMMER 2019

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COMPONENT 1

General Comments

The standard of response was generally excellent with a mean mark of 58.7 out of 80 and one in three candidates scoring at least 80% of the available marks. Answers were logically organised and showed genuine understanding of the underlying chemical principles. It was evident that most candidates understood the methods needed to solve calculation questions and that they had carried out practical procedures involving titrations.

Comments on individual questions/sections

Section A - Questions 1-7

These questions are designed as an introduction to the paper and, as such, should be readily accessible. This proved to be the case although some candidates appeared confused about the difference between a 'halogen' and a 'halide' in Q.4.

Section B

Q.8 (a) In this style of question, which asks whether or not a particular statement is correct, candidates are advised to start their response by stating whether or not the statement is actually correct before going on to justify their answer. Most candidates used this approach and recognised that it is the proton number that increases with the elements in the Periodic Table. Fewer really explained the significance of the relative numbers of neutrons in common isotopes of argon and potassium.

- (b) (i)** Quality of extended response was assessed in this question and it was evident that most candidates had a good understanding of the principles of the mass spectrometer. This meant that many well-ordered responses were seen.
- (ii)** Most candidates gave correct answers for the relative atomic mass.
- (iii)** This was a challenging AO3 question and was less well answered. For the award of the mark it was necessary to include both the mass number and the charge.

Q.9 (a) Apart from a small number who omitted state symbols, this was well answered.

- (b) (i)** Most candidates stated the significance of the increasing number of protons although a few did not explain the effect of this on the attraction for the electron being removed.
- (ii)** Many well explained answers were seen.

- (iii) Although most candidates recognised that **Z** would be below the highest energy shown, fewer realised that it would be below all of them.
- (c) (i) A definition based on the number of particles in 1 mol or the number of ^{12}C atoms in 12 g of carbon-12 was accepted.
- (ii) Although a few candidates did not use the fact that 12 oxygen atoms were involved most answers seen were correct.
- Q.10** (a) This was generally well done with the significance of the difference in the solubility of the sulfates being appreciated.
- (b) It was pleasing to note that most diagrams were 3D and that explanations included the significance of the number of bonding pairs.
- (c) The basic principles involved were clearly understood but, for full credit, it was necessary to apply these principles to the context given i.e. a street light.
- Q.11** (a) (i) Nearly all diagrams were correct.
- (ii) Nearly all bond angles were correct.
- (iii) Some candidates failed to use information regarding physical states given in the question and included one or more incorrect state symbols. Some omitted state symbols completely.
- (iv) Although most candidates realised that the difference was due to which attractive force was being overcome, some did not express clearly that it was intermolecular versus covalent.
- (b) (i) Most calculations were correct.
- (ii) Most calculations were correct.
- (iii) A few candidates thought that the decreased pH meant less H^+ but most stated that the equilibrium had moved to the right-hand side and the significance of this movement.
- (c) There were different methods of solving this calculation and many candidates correctly applied one of them.
- Q.12** (a) (i) Nearly always correct.
- (ii) Again, more than one method was successfully used to solve this calculation.
- (b) Most candidates gave correct responses.
- (c) Most candidates gave correct responses.

- Q.13**
- (a) For credit it was necessary to recognise that what was being removed was insoluble or solid impurities.
 - (b) Most candidates correctly recognised the need to use a volumetric flask.
 - (c) Most candidates stated the significance of the end-point.
 - (d) Some candidates apparently thought that it was necessary to carry out a specific number of titrations irrespective of the results recorded. Some realised that it is unnecessary to carry on once two concordant results are obtained.
 - (e) Most equations were correct.
 - (f) Correct answers were seen but a number of candidates used 'about 100 cm³' as the volume of hydrochloric acid rather than 'exactly 250 cm³'.
 - (g) This calculation generally followed the answer from (f).
 - (h) A small minority failed to divide their answer to (g) by 2 or calculated the percentage of barium carbonate, but most calculations were correct.
 - (i) An acceptable answer was only given by the most able. It was insufficient merely to say that impurities were present.

Summary of key points

Candidates should consider the following points to improve performance:

- Read questions carefully to ensure that all information given in the question is considered and that responses given are suitably specific;
- Set out calculations in a logical order to maximise the chances of gaining some marks when the final answer is not correctly given;
- Think carefully about the purpose of given steps in practical methods in order to be able to explain various aspects including how they work, potential drawbacks and possible areas for improvement.

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COMPONENT 2

General Comments

Once again it was apparent that the vast majority of 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 gained over 75 % of the marks and only a few candidates failed to gain 50 %. The mean mark was 56.3 out of 80.

The highest mark was 74 and the lowest 11. **Section A** proved to be very successful for the majority of candidates. In **Section B**, Q.11 was the best answered with Q.9 and Q.12 proving to be slightly more difficult. The easiest parts on the entire paper were Q.4, Q.9(b) and Q.8(c)(ii), with the hardest parts being Q.12(c), Q.12(e) and Q.8(d) in that order.

It was pleasing to note that there was a further improvement in analysing spectral data and again a significant number of candidates performed very well in most calculation questions. However, an area that still needs improvement is application of practical work.

Comments on individual questions/sections

Section A - Questions 1-7

This was very well answered, with the mean mark being just over 7.5 out of 10.

- Q.1** A positive start to the paper. Over four-fifths of the candidates drew a correct structure. For those who failed to score a mark, most were penalised for 'lazy drawing' of the structure rather than a lack of knowledge. Candidates were only penalised once in the whole paper for this type of error.
- Q.2** Again over four-fifths gained the mark by drawing the correct repeat unit of the polymer.
- Q.3** (a) Very well answered. The vast majority knew what was meant by an electrophile.
- (b) Just over two-thirds could give an appropriate example.
- Q.4** Proved to be the best answered question in the paper. Almost all could draw the skeletal formula and state why it was a secondary alcohol.
- Q.5** The vast majority could state Hess's Law and use it to calculate the value of ΔH in the energy cycle.
- Q.6** Very well answered, although some did not realise that the products had to be **compounds** and gave carbon or soot as an answer.
- Q.7** About two-thirds could give a balanced equation for this reaction. The main error was an incorrect formula for magnesium ethanoate.

Section B

- Q.8 (a)** In this six-mark question candidates had to consider how 1-bromobutane reacts with hydroxide ions. This was generally very well answered with about three-fifths scoring in the higher band. Almost all knew about the nucleophilic substitution reaction and the vast majority could draw the mechanism. The elimination reaction was less well-known and a minority thought that but-2-ene would also form. Unfortunately, some candidates only considered the reaction with aqueous hydroxide ions.
- (b)** The reaction between ethane and chlorine was well-known with the vast majority gaining all three marks.
- (c) (i)** Almost all could identify the products of this reaction.
- (ii)** Just under two-thirds could correctly explain which is the major product. A significant number failed to realise that the carbocation is formed in the intermediate stage of the reaction.
- (d)** Poorly answered. Half the candidates failed to score a mark. Many of the answers were too vague, referring to the CCl_3F being broken instead of the $\text{C}-\text{Cl}$ bond in the CCl_3F .
- Q.9 (a)** Only about a third could adequately explain why the student was incorrect. Some thought that it affected the reaction rate while others did not make it clear that it would affect the temperature change measured.
- (b)** Almost everyone correctly calculated the concentration.
- (c)** This enthalpy calculation was well answered. Just under a quarter scored all four marks and just under a half scored three marks. The main errors were using 50 g instead of 100 g for the mass, using the concentration of the peroxide instead of the number of moles and not giving the answer to an appropriate number of significant figures.
- (d)** Just under a half realised that the mass of solution used in the calculation expression included the catalyst.
- (e)** Just over two-thirds gave a correct reason. The main errors were to state that no further change in colour occurred or that the temperature became constant.
- (f)** Only fairly well answered. About one-fifth gained all four marks while around one-tenth failed to score. Common errors were insulating the polystyrene cup instead of using a lid to reduce heat loss and using a digital thermometer instead of a more accurate one.
- (g)** The vast majority knew that the value of an enthalpy change is not affected by a catalyst.
- Q.10 (a) (i)** Only a third gave the correct equation for the oxidation of ethanol. Many candidates did not give the structure of ethanal, others left out the water.

- (ii) Over two-thirds could name the oxidising agent and knew that distillation was required to prepare ethanal from ethanol. However, fewer could name the apparatus used and adequately describe the process.
- (iii) Over three-quarters knew the test for a carboxylic acid.
- (b) Almost all the candidates gained a mark for giving a similarity between the spectra but a significant minority lost the 'difference' mark because they did not explicitly compare ethanol with ethanal.
- (c) (i) This bond enthalpy calculation was very well answered with just under three-quarters gaining all three marks. Some lost a mark for using the bond enthalpy of C—O instead of C=O in carbon dioxide.
- (ii) Just under a half could give a disadvantage of biofuels. Availability and cost were considered to be too vague to gain credit.
- (d) Fairly well answered with around a third gaining both marks but a quarter failing to score. Marks tended to be lost for poor clarity of expression rather than lack of knowledge. Some referred to the size of the carbon chain without mentioning hydrogen bonding. Others ignored ethanol concentrating solely on hexan-1-ol.

Q.11 This was the best answered question in this section with around two-thirds scoring at least 8 out of 10. Candidates had to identify the possible structures of a compound given a variety of information about that compound. Almost all calculated the empirical formula and the vast majority gave the correct molecular formula. Only a few realised that there were four possible structures while some lost marks for not using all the data. Most of the candidates who did not realise that there were two oxygen atoms present in the structure still gained six marks.

- Q.12**
- (a) Just under three-quarters gained full marks for drawing the graph. Some lost a mark for an incorrect line of best fit while others lost a mark for not labelling both axes.
 - (b) Again well answered with around three-quarters gaining both marks. Some candidates did not use the graph, incorrectly giving $\frac{50}{20} = 2.5 \text{ cm}^3 \text{ s}^{-1}$.
 - (c) This tricky question was very poorly answered. More than three-quarters failed to gain a mark. The most common error was a failure to start the graph at (0,0). Most started at (8,0) or (0,28).
 - (d) Just over three-quarters scored at least one mark out of two. Some used an incorrect molar volume and so lost a mark.
 - (e) This proved to be the most difficult part on the whole paper. Four-fifths of the candidates failed to gain a mark. Most discussed the percentage error in the balance instead of focusing on the loss in mass. Of the ones who knew that the loss in mass of hydrogen would be very small, less than half showed that that it would be less than 0.01 g. Another demanding question.

- (f) Well answered. Most chose to decrease the temperature and many gained full marks. Some lost a mark for not mentioning activation energy. For candidates who chose an answer based on surface area some lost a mark for stating “fewer successful collisions” instead of “fewer successful collisions per unit time” or “lower chance of successful collisions”.
- (g) Very well answered. Almost all gained the mark for an exothermic plot but a significant minority lost the ΔH mark for not drawing precisely enough.

Summary of key points

Candidates should consider the following points to improve performance:

- Ensure that all bonds and atoms are positioned carefully and unambiguously when drawing structures of organic molecules;
- Ensure that comparison is explicit when describing how chemical tests or spectral data distinguish between various compounds;
- Think carefully about how knowledge, understanding and experience of practical work can be applied in unfamiliar contexts and problems.



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