



GCE A LEVEL EXAMINERS' REPORTS

**CHEMISTRY
A LEVEL**

SUMMER 2017

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**EDQUAS
GCE A LEVEL CHEMISTRY**

Summer 2017

COMPONENT 1 – PHYSICAL AND INORGANIC CHEMISTRY

General Comments

This was the first examination of this new specification and the move to a linear system means that it is not possible to make meaningful comparisons with last year. The paper differentiated well leading to a wide range of marks – from 13 to 110 out of 120.

The areas which challenged many candidates were the more extended questions where concepts needed to be linked or evidence needed to be evaluated. The new content, such as the Arrhenius equation, was sometimes answered well however the questions relying on the specified practical techniques did not always show the standard expected. This was disappointing as practical skills and understanding form the foundation of this science.

Section A

1. This question was well answered by most however weaker candidates were not able to draw appropriately labelled boxes.
2. Most were able to gain a mark here, although a minority of candidates left out the gaseous state which is an essential part of the concept.
3. The colour was given correctly by almost all candidates. The complex ion was poorly answered, with various errors, including tetrahedral shapes, ligands bonded through hydrogen rather than oxygen or nitrogen, or incorrect charges.
4. This was well answered. A few gave other types of equation or included spectator ions.
5. Most candidates used $E = hf$ correctly, although fewer used Avogadro's number to convert from J to J mol^{-1} .
6. Most realised that carbon was more stable in the +4 oxidation state although this was badly expressed by some. The equations were varied, with most using CuO, FeO or Fe_2O_3 as reactants. Some tried to use other metals and these were generally accepted although a few used reactive metal oxides such as Na_2O or MgO which would not be reduced easily by CO and these were not accepted.
7. Almost all recalled the ideal gas equation, but some did not convert the units of temperature or pressure correctly.
8. Most realised that entropy was the key factor and gained marks here.
9. Most gained at least one mark here for a pH value with an attempt at explanation however fewer gained the mark for a full explanation.

Section B

10. (a) (i) Almost all could calculate the atom economy correctly.
(ii) Candidates could select either route here as the credit was for their reasons. Most chose the steam reforming route as the better approach and used atom economy as a reason. A wide range of other valid advantages and disadvantages were discussed. Weaker candidates gave vague answers such as 'produces CO' or 'does not produce CO₂' without linking these to the principles of green chemistry.
- (b) This question differentiated well. Better candidates realised that the syngas contained hydrogen and so would shift the equilibrium of the water gas shift reaction.
- (c) (i) I The concept of a heterogeneous catalyst was well understood.
II Most candidates gave answers based on heterogeneous catalysts rather than the surface adsorption that is essential in heterogeneous catalysts. This is new in this course and is stated explicitly in the specification.
- (ii) I Almost all gained this mark.
II Most gained the mark for higher pressure giving a greater rate. The answers regarding lower pressure were generally correct but sometimes vague, e.g. 'lower pressure is cheaper', and needed greater detail to gain the mark.
- (iii) I Most could apply Le Chatelier's principle to this example and gained the marks.
II The expression for K_c was correct for almost all, although a few failed to use square brackets and were penalised for this.
III Many failed to answer this question correctly. Most realised that the concentration was linked to the percentage of CO in the sample, and that the concentration of the water matched that of CO. The most common error was to assume that the concentrations of the other gases were calculated from 99% rather than 49%. Some candidates attempted complex calculations of concentration with assumed volumes, and did not realise that for an equilibrium with equal moles of reactants and products the overall volume did not affect the calculation.
11. (a) Almost all candidates could balance this equation.
- (b) Few candidates gained all three marks here. Many answers did not address the question, with some not referring to all oxides and others discussing the chlorides rather than the oxides. The main errors for those that discussed all the oxides were to class SiO₂ as a molecular oxide or discuss breaking covalent bonds in the molecular compounds.
- (c) (i) Most knew that one was ionic and one covalent but it was surprising to see a significant minority saying the chloride was ionic and the oxide covalent. Only about half the candidates linked this to the differences in electronegativity.
(ii) Most discussed the movement of ions here but weaker candidates still refer to the flow of electrons when the oxide is molten.

- (d) (i) This was well answered and most gained both marks. Some candidates only referred to phosphorus and ignored nitrogen. A few candidates referred to the inert pair effect and gained no marks.
- (ii) This was generally well answered, although some candidates gave the oxidation state of oxygen in water at the start rather than in the sodium peroxide as required.
- (iii) Most candidates recognised that this was related to the inert pair effect but a small number referred to octet expansion and gained no marks.
- (e) Most candidates gained at least two marks here by correctly identifying the shape and linking this to the numbers of bonding and lone pairs. Some failed to link this to the concepts of VSEPR theory. Weaker candidates thought the structure was trigonal planar.
- (f) The majority of candidates were able to gain marks on this question, although a large minority made at least one error, such as leaving out the doubling of some energy terms.
- 12.** (a) Most gained this mark, however some gave very vague answers such as 'alpha is the least penetrating' and these were not given credit.
- (b) This is a standard term that candidates should be familiar with, however some failed to refer to the energy/frequency of the electromagnetic waves.
- (c) Most gained this mark.
- (d) Despite positron emission being a new aspect of the course, it was pleasing to see so many candidates able to identify the correct daughter nucleus.
- (e) (i) This question required candidates to combine calculation steps in an unfamiliar context and many found this difficult. Surprisingly it was not the chemical calculations that challenged some but the conversion of seconds into minutes with 24 appearing in some answers.
- (ii) This question required candidates to evaluate the data provided in the table and assess more than one factor; in this case the half-life and the radioactivity. The number of candidates able to do this was pleasing but only the best were able to explain their reasoning clearly.
- (f) A majority realised that a quarter of the longest lived radioisotope would remain after two half-lives, although vague answers such as 'some left after two half-lives' were common. Fewer could suggest a second reason with only stronger candidates realising that the daughter isotopes could also be radioactive.
- 13.** (a) (i) This question required candidates to manipulate titration data to obtain values to use in calculations. It was disappointing to see a significant number unable to calculate the values in the tables, and also to see some giving values to an incorrect number of decimal places – volumes of '22' rather than '22.00' were seen in some papers. Selection of appropriate data for calculation of the mean was also a problem for a significant minority of candidates. Many used the initial 'rough' values for calculating both means despite them being too far from the other values. The means calculated in this part were expected to be used in parts (ii) and (iii) and marks were awarded for errors carried forward.

- (ii) Most realised that concordance was linked to the reliability of the final value, however far fewer were able to give a second reason.
 - (iii) Most candidates were able to gain marks here, although weaker ones selected the incorrect value from part (i) or used the mean or sum of both values in part (i). Other common errors included omitting the 2:1 stoichiometry or the factor of 10 to calculate the mass of sodium carbonate in 250 cm³ rather than 25 cm³.
- (b) This is the first quality of extended response (QER) question of the new course. Most candidates were able to gain some credit but few scored higher band marks and the majority were in the lower band. Many candidates did not explain how an indicator works. Some candidates stated that indicators changed colour in acid and alkali. Only the best discussed the equilibrium between protonated and deprotonated forms of the indicator with these species having different colours. More candidates attempted to explain the use of two different indicators, however once again this was often vague. Comments such as 'phenolphthalein is appropriate for a strong acid-strong base titration' did not explain the differences between the two titrations and why certain indicators should be selected. It was common to see mid-ability candidates discussing equivalence points but not making the link to the range of the sudden pH change or vertical region of the graph.
- (c) (i) This was answered well by many candidates, although some tried to approach it as a buffer calculation.
- (ii) This was poorly answered. The titration of weak acids with weak bases is covered in specified practical work so all candidates should be familiar with the use of a pH probe and plotting the curve.
- 14.** (a) (i) There were many clear and correct answers given to this question.
- (ii) Most candidates gained at least two marks here. Some drew the standard hydrogen electrode connected to a second half-cell and were not penalised as long as the standard hydrogen electrode was clearly labelled. Some marks were lost due to careless errors, e.g. 1 mol H⁺(aq) rather than 1 mol dm⁻³ H⁺ (aq). A very small number of candidates showed a complete lack of understanding with reference to solid hydrogen electrodes or H⁻(aq) ions.
- (iii) The reactivity of lithium was recalled by most but weaker candidates could not apply this to its reaction with water or oxygen in the air. The weakest candidates thought lithium was an insulator.
- (b) (i) Many candidates gave the incorrect answer. It was particularly disappointing to see candidates writing out the half-equations for either lithium or chlorine (or even zinc!). Candidates will not gain credit if they cannot identify the reducing agent in the equation – the presence of both the reducing agent and oxidising agent will always lose a mark.
- (ii) This was well answered. A few obtained values of over 3 volts. These candidates seemed to multiply the values by two, presumably because there were two electrons in the half-equations.
- (iii) This question showed a more even spread of marks than the first QER question. Most candidates were able to write the relevant equations and predict the product with bromine. Explaining the patterns using standard electrode potentials was much more challenging, and many focused on the Fe³⁺(aq)/Fe(s) half-equation rather than the Fe³⁺(aq)/Fe²⁺(aq) half-equation. Weaker candidates simply discussed

the standard electrode potential for iron without indicating which of the two half-equations they were referring to. Only a few candidates linked the conditions not being standard to the final bullet point in the question.

- 15.** (a) This question was well answered. Most candidates gained at least two marks, although a few correctly calculated the number of lithium atoms but forgot to convert this to moles using Avogadro's number.
- (b) (i) Although many had an idea of the reasons for heating the sample, not all were clear that heating to constant mass ensures that ALL water has been lost.
- (ii) A few candidates simply stated an apparently random number without showing their working and gained no credit. The majority were able to select the calcium phosphate gravimetric data to answer the question but reached an answer of 2 or 0.5 as they forgot that there were two phosphates in each mole of calcium phosphate. Most candidates gained at least one mark on this question.
- (iii) This question was generally well answered. Most candidates were able to convert the units successfully and reach an answer of 1 but 2 was a common incorrect answer.
- (iv) Candidates that had been successful in most parts of this question generally identified the compound correctly. Where candidates made earlier errors these were expected to be reflected in the final answer. A common incorrect answer was Li_2VPO_4 and if this followed from an answer of 2 in part (iii) then it was awarded full marks.
- 16.** (a) (i) Most candidates knew that the rate changed over this time period. A minority linked this to concentration, with discussion of 'amount' of reactants seen in many answers.
- (ii) This clearly differentiated between candidates, with many clear and concise answers and many vague or incorrect answers.
- (b) (i) Candidates are familiar with using tables of data to calculate orders of reaction, and some referred to the initial table to attempt an answer. Better candidates linked the unit of the rate constant to the overall order and gained their mark.
- (ii) This differentiated between candidates that understood the difference between 'overall order' and 'order with respect to'. Weaker answers did not refer to the rate determining step and were penalised for this.
- (iii) This was well answered, with almost all candidates able to write an expression for the Arrhenius equation. A few gave the expression in terms of natural logs but the majority used the exponential expression.
- (iv) This was surprisingly well answered. It was clear that candidates were well prepared for this new content and the majority gained at least two marks and many gained all three. A range of mathematical approaches were seen but all correct methods gained credit.

**EDUQAS
GCE A LEVEL CHEMISTRY**

Summer 2017

COMPONENT 2 - ORGANIC CHEMISTRY AND ANALYSIS

General Comments

This was the first paper for the new linear specification and it was clear that, for a number of candidates, some questions proved to be challenging. This was partly due to the requirement that the mathematical content of the papers overall at this level needed to be 20% and the reduction in the number of questions needing only recall. Some questions too, had a focus on the practical aspects of the qualification.

This was a long paper designed to take two and a half hours and carrying 120 marks. There was little evidence of the paper, however, being too long and candidates having to rush their answers.

The responses to this paper produced a very wide range of marks from about 20 to about 110. Some excellent work was seen, with evidence of careful revision but some of the weaker candidates clearly resorted to guessing what the particular reagent required might be. It is appreciated that the paper was required to cover both years of the organic section of the specification, so a balance was required between the first and second years in the question topics.

Section A

1. Some candidates did not state that ultraviolet light was needed to break the Cl—Cl bond / produce chlorine radicals. The second mark was for giving an equation for showing the formation of chloroethane. The examiners were looking for an overall equation starting from ethane and chlorine but this was not always provided. Some candidates did not read the question carefully enough and used methane as the starting alkane.
2. Nearly all candidates gave the correct formula for hexane but the equation was not always balanced correctly.
3. (a) Most candidates gained both marks for calculating the percentage of nitrogen in urea.
(b) The question stated that urea was an amide but a surprisingly large number of candidates could not recall that if a primary amide is heated with an alkali, ammonia is produced.
4. (a) The question stated that the reagent required reacted in alkaline solution but some candidates insisted that the correct reagent was **acidified** potassium manganate(VII). The correct oxidation state for manganese was essential. A correct formula also gained credit.
(b) The correct by-product with an M_r of 150 was the partially oxidised product with an aldehyde and a carboxylic acid group on the benzene ring. Some candidates gave alternative answers that did not have the required M_r .

5. The question asked for a compound that had the same molecular formula as ethanal, but a different displayed formula. Some candidates simply wrote the displayed formula of ethanal. The acceptable answers were the displayed formulae of ethenol or epoxyethane.
6. In this question candidates were asked to draw a dot and cross diagram for the hydroxide ion. A substantial number of wrong answers were seen – some with the charge missing and others with an incorrect number of outer electrons (7 being a common answer). Those who gave the charge as -1 lost the mark.
7. Candidates were asked how they would obtain a pure sample of 1-butyl butanoate, which was contaminated with around 10% of butanoic acid. These differ in boiling temperature by just 2°C . Many candidates described fractional distillation, but this would be unsuitable, given their similar boiling temperatures. Very few candidates removed the acid by reaction with aqueous sodium carbonate/hydrogencarbonate followed by the use of a separating funnel and then distillation.

Section B

8.
 - (a)
 - (i) The use of both hot **and** cold water baths was a simple acceptable answer that was often seen.
 - (ii) Many candidates gained both marks for calculating the percentage yield as 32.6%. It was important to recognise the mole ratio given in the chemical equation.
 - (iii) The expected answer was that ethanedioic acid would have only one signal in its ^{13}C NMR spectrum, whereas oxopropanoic acid would have two signals. This was often seen. Alternative answers based on the position of the ^{13}C NMR signal for the carbonyl group also gained credit.
 - (b) It was surprising to see a number of incorrect equations. Common errors included HNO_3 being written on both sides of the equation and the omission of NO .
 - (c) There were a number of acceptable answers to this question and many candidates gained both marks.
 - (d) Although the question was straightforward and many gained two of the three marks, candidates were required to give their answer to an **appropriate** number of significant figures. Since all the numbers in the question were given to three significant figures, it was expected that the answer would be given as 0.360 g. This was not always seen.
 - (e) Many candidates used the figures provided in various ways to show that the strontium carbonate was pure.
 - (f) Many candidates gained all three marks for showing how the three compounds reacted with aqueous bromine and with sodium hydrogencarbonate.

9. (a) (i) Ethanoyl chloride / CH_3COCl was commonly seen and gained a mark.
(ii) The question asked for the nitration of N-phenylethanamide, leading to the 2-nitro derivative. A few candidates spoilt their answer by producing the 4-isomer. The examiners expected the correct curly arrows, the correct formula for the intermediate and an equation showing H^+ as the other product. In general this question was done quite well.
(iii) Many candidates suggested that raising the temperature or using an excess of the nitrating agent would encourage dinitration.
(iv) This question was about recrystallisation. For those who knew this, it provided a straightforward four marks. There are still a number who need to learn the simple steps required.
- (b) (i) The need for HNO_2 and a lower temperature gained two marks for many candidates.
(ii) I The azo dye Permanent Red 2G is red in white light as it absorbs the blue end of the visible spectrum. In blue light therefore no colour is seen i.e. it is black.
II In red light, the colour seen is red, as the red is not absorbed by the dye. The responses for these two parts suggest that this topic is poorly understood by a number of candidates.
- (c) (i) Some candidates did not read the question carefully enough. The stem stated that limonene has two carbon-carbon double bonds. If this information was used, then the M_r of limonene worked out at 136. Many candidates gave an answer of 68 or used the mole ratio the wrong way round and ended up with 272.
(ii) Marks were awarded for an answer 4 greater than that given in part (i).
10. (a) (i) To gain a mark it was expected that some reference was made to the zwitterion nature of hydroxyproline and its positive and negative charges. The second mark was for indicating that more energy was needed to melt this compound because of its ionic nature. One mark was the more common credit.
(ii) Many candidates gained this mark. The examiners felt that the positive charge should be seen near the nitrogen atom, but some latitude was given in awarding credit.
- (b) (i) The formula of the amino acid was generally correct. A few candidates read the question incorrectly and showed the formula of 2-aminopropanoic acid.
- (c) In secondary protein structure the hydrogen bonding is between the N—H and C=O groups. This was not always appreciated by some candidates, who used other polar groups to explain their answer.
- (d) The emphasis in this question was on hydrogen bonding and that this was a prominent feature in the methanol molecule but did not occur in thiols. Many candidates found it difficult to explain their ideas clearly.
- (e) (i) A number of candidates did not spot that **gaseous** hydrogen chloride was a product in the reaction with ethanoyl chloride and would therefore be lost from the reaction, moving the position of equilibrium to the right.
(ii) The need for a fume cupboard was the commonest correct response.

- (f) This was the first quality of extended response (QER) question. It was pleasing to see that many candidates could at least gain a middle band mark. The commonest weak area was to not realise that the diamine **L** was a 2-methylpropyl derivative rather than the butyl derivative, $\text{H}_2\text{N}(\text{CH}_2)_4\text{NH}_2$.
11. (a) (i) Most candidates gained a mark for calculating that the difference in enthalpy of hydrogenation values was 61 kJ mol^{-1} . Fewer then went on to suggest an acceptable reason for this. Furan shows aromaticity and the difference in values is due to its more stable delocalised structure.
- (ii) The appearance of the 2,4-DNP derivative and its identification by its melting temperature were well known.
- (b) (i) The answer to this question was butan-1-ol and the response 'butanol' was considered to be inadequate.
- (ii) Both the functional group and its stretching frequency were required for the mark.
- (iii) Nearly all candidates gave the correct answer of nucleophilic addition.
- (iv) Most candidates recognised that the conversion of a hydroxyacid to a ketoacid was an example of oxidation and provided an appropriate oxidising agent. Sometimes however, the oxidising agent given lacked acid.
12. (a) (i) The question asked for the test for a C—Cl bond in a compound. This carried four marks but a number of candidates lost a mark for not using an alkali to hydrolyse the C—Cl bond.
- (ii) This proved to be not as straightforward as hoped and some candidates found it difficult to work backwards.
- (b) (i) One of the reasons why DDT does not dissolve in water is because it does not contain suitable polar groups that can hydrogen bond with water. Many candidates found it difficult to put these ideas into words and lost credit as a result.
- (ii) It was necessary to give both hydrogen and a suitable catalyst to gain the mark.
- (iii) This was an easy addition question but many candidates were mystified by the gas chromatogram. This is an area that perhaps needs more attention.
- (c) This was the second of the QER questions. As before, many candidates gained middle band marks. The examiners felt that nearly all candidates knew the material but some could not organise it well enough to score as highly as they should have done.
- (d) Most candidates stated that the ^{13}C NMR spectrum would consist of two peaks as there were two separate environments. Many candidates lost one or both marks in describing the mass spectrum of chloropentafluoroethane. This compound contains only one chlorine atom. Many candidates had forgotten that commonly occurring chlorine contains a mixture of ^{35}Cl and ^{37}Cl in a 3:1 ratio. As a result the mass spectrum would show molecular ions at 154 and 156 in a 3:1 ratio. A large number of candidates described the molecular ion as having an m/z value of 154.5.

13. (a) (i) The meaning of the term 'chiral centre' was well known.
(ii) Many perfectly correct diagrams were seen. However, a number of candidates did not give their mirror image forms in a 3-D representation which sometimes meant that credit could not be awarded.
- (b) Many candidates correctly described the use of Tollens' reagent in testing for an aldehyde.
- (c) Many candidates substituted the figures into the equation and correctly obtained the concentration as 179 g dm^{-3} . Some did not multiply their answer by 1000 and arrived at 0.179 g dm^{-3} , with loss of some credit.
- (d) (i) A number of correct dehydrating agents were given.
(ii) Candidates should be careful when describing *E-Z* isomerism. Some still wrote that 'the double bond cannot rotate' rather than 'there is no free rotation about a double bond'. The displayed formula of the diene was often correct.
- (e) This long question carried a number of marks. Compound **S** was the carboxylic acid $(\text{CH}_3)_3\text{CCOOH}$, compound **T** was ethanol and **R** was the ester $(\text{CH}_3)_3\text{COOCH}_2\text{CH}_3$. A number of candidates identified compound **R**, although the use of the information provided was sometimes described in a sketchy manner. Candidates are advised to clearly explain each step as they go along, so that credit can be given where deserved.

**EDUQAS
GCE A LEVEL CHEMISTRY**

Summer 2017

COMPONENT 3 – CHEMISTRY IN PRACTICE

General Comments

This was the first paper for this new GCE specification and it proved successful in that it differentiated well. Some marks were accessible to almost all candidates whilst others were gained only by the most able. This led to a good distribution of marks ranging from 6 to 56 out of 60. The mean mark was 34.8. The most successfully answered question was question 1 with question 5 being the least successfully answered.

1.
 - (a) Surprisingly poorly answered by some candidates, with a number making no reference to transfer of the solution into a 250 cm³ volumetric flask.
 - (b) Nearly all candidates completed the table 'titre volumes' correctly, although a few did not record all the readings to 2 decimal places.
 - (c) Well answered with the molar mass of C₄H₃KO₈.nH₂O, based on a mean titre volume of 21.00 cm³ from part (b), correctly calculated as 254.3, thus giving the value of n as 2. The most common error was not multiplying the number of moles of hydrated potassium tetraoxalate present in the 25 cm³ sample by 10 in order to give the total number of moles present in the 250 cm³ flask. This one error gave a value of n as 129 which was awarded 4/5 marks.
 - (d) It was clear that most candidates understood how to calculate the maximum percentage error due to the burette; however, a minority did not realise that the maximum error of ±0.05 cm³ should be doubled because the burette is read twice. An answer of 0.47 %, given to 2 significant figures, was required for award of the mark.
2.
 - (a) Poorly answered with very few correctly identifying magnesium as the metal. To gain the mark a correct equation for the reaction of magnesium with steam was also required, but many gave magnesium hydroxide rather than magnesium oxide as the product.
 - (b)
 - (i) This calculation was well done with the vast majority of candidates correctly identifying metal Y as strontium and scoring 3 marks.
 - (ii)
 - I Poorly answered by some candidates. Many did not balance the equation for the precipitation reaction, forgetting to include 2NaOH as one of the products and omitting one or more of the state symbols.
 - II Again, this calculation was well done with a large proportion of candidates scoring 3 marks.
 - (c) This was the quality of extended response (QER) question and as expected a whole range of answers were seen. A few candidates gave the incorrect trend in the thermal stability of the carbonates of Group 2 and the mark awarded was limited to the lower band. A minority stated that the carbonates should be heated using a hot water bath and some did not identify any control variables. The majority of candidates stated that 'the same mass of each

carbonate should be used' but to access the top band 'the same number of moles of each carbonate' was required as one of the control variables.

- (d) Candidates were asked to give a precipitation reaction for aqueous Ba^{2+} ions, which would not give a positive result for Mg^{2+} ions, and this was generally well done. The equation for the reaction proved to be difficult for a few candidates.
3. (a) Pleasingly, the majority of candidates could describe how to make the salt bridge and name a suitable electrolyte.
- (b) Well answered with many candidates scoring both marks. However, some candidates did not balance the equation correctly giving the ratio of $\text{MnO}_4^- : \text{Fe}^{2+}$ as 1:1 rather than 1:5 and a minority of candidates incorrectly gave the conversion of Fe^{3+} to Fe^{2+} .
- (c) Poorly answered. Very few candidates could correctly describe the observation at half-cell **A**, despite giving the correct equation for the overall cell reaction in part (b). More were able to describe the observation at half-cell **B**.
- (d) This was well answered with the full range of mark scheme answers seen across the scripts.
4. (a) Poorly answered with very few candidates correctly identifying the hazard (bromine is toxic or bromine is corrosive) and the associated risk (bromine produces a vapour which is toxic if inhaled or bromine causes burns if spilt onto the skin or eyes).
- (b) (i) The most common error in calculating the number of moles of Br_2 added, was dividing the mass of bromine by 79.9 rather than 159.8.
- (ii) The majority of candidates managed to score at least two of the four marks, using the titration data to calculate the number of moles of sodium thiosulfate used and then the stoichiometric equation to calculate the number of moles of iodine used. A minority of candidates were then able to calculate the number of moles of bromine that had reacted with the straight chain alkene **U**.
- (iii) Again, the majority of candidates managed to score two of the five marks for correctly calculating the number of moles and hence the M_r , of **U**. However, because of errors in part (b)(i) and/or (b)(ii), the calculated M_r did not allow the identification of an alkene of general formula $\text{C}_n\text{H}_{2n-2}$ and a wide variety of incorrect structures were suggested.
5. This question clearly differentiated between those that had thoroughly revised the organic functional group tests and those that had not. Many excellent answers were seen to this four mark question. Conversely it was surprising to see that some A level candidates were unable to score any marks for this question.

6. (a) This was well answered.
- (b) To gain this mark it was necessary to state that the concentration of the peroxodisulfate / iodide needs to remain constant. It was insufficient merely to say 'keep the concentrations the same'. Alternatively, candidates could also have referred to the keeping the volume of each component / reactants the same.
- (c) The majority of the candidates gained two marks for correctly plotting the data in the results table and drawing a line of best fit. However, they then did not realise that the x -axis was $1/\text{temperature (K}^{-1}\text{)}$ rather than $1/\text{time}$ or that the values on the x -axis had been multiplied by 1000. Thus, only a small minority were able to calculate the gradient correctly. Application of the Arrhenius equation proved to be the most difficult calculation on the paper and the majority of candidates simply did not know where to start. Many got into difficulty because they were using a jumble of numbers instead of explaining what they were doing at each stage, which would have benefited them. Very few candidates rearranged the Arrhenius equation and went on to calculate the activation energy correctly. The most common error was to give the gradient as $-E_a / 2.30RT$ and substitute $T = 298\text{K}$ into the expression.

GCE A level Endorsement: Chemistry

General

JCQ was responsible for allocating centres with GCE A level entries to awarding organisations to monitor. Unless the centre was defined as being a large centre, one A level subject was monitored in the first round of visits.

Lead Monitors from the different awarding organisations met on a number of occasions over the first two years to ensure that they maintained a common and fair assessment of CPAC as well as to share information. These meetings will continue into the second round of monitoring. The second series of visits to centres will commence from September 2017.

Approximately 90% of all centres visited by Eduqas passed on their first visit. This outcome is very close to that from other awarding organisations. Centres which failed the first monitoring visit were given support and were visited a second time in the same subject. All centres who failed the first visit made by Eduqas subsequently passed the second visit. In the event that a centre fails a second visit then a first visit is triggered in all the other science subjects offered at A level. Since none of the Eduqas centres failed a second visit this was not triggered.

Centres need to be commended for the way in which they have approached the practical endorsement and assessed CPAC. There was plenty of evidence of good practice and it was evident from conversations with teachers that the practical endorsement has enabled most centres to offer a wider range of practical experience to their candidates than the previous A level model of assessment. There was evidence in a number of centres that additional investment had been made to facilitate the wide range of practical work that candidates now need to complete over the two years.

The monitoring visit requires that the monitor examines evidence that the centre has planned to complete the necessary range of practical work required by the specification; check records of candidate assessment; examine a sample of candidate laboratory books and observe a practical class in which assessment of CPAC is taking place.

The following points describe some key features observed in centres where the practical endorsement was successfully implemented:

- There was clear planning of practical work and the CPAC statements to be assessed in each practical.
- Candidates were well informed about the practical endorsement and the meaning of CPAC statements. Please do not leave candidates in the dark about CPAC; they need to understand it!
- Practical books were used in 'real time' and at the bench by candidates when completing an observed practical. (I should note that their books may get stained as a result of this; that's fine! We want candidates to move away from writing on scraps of paper, filter paper or on the back of the hand. Data should be recorded directly to their books. Practical books are therefore not expected to be in immaculate condition.)
- The teacher targeted appropriate assessment of CPAC in the practical lesson monitored. Do not be over ambitious in your assessment. Early on in the course give your candidates time to settle in before assessing practical work and then start with the more straight forward CPAC statements (e.g. 1 and 3).
- Suitable feedback was given to candidates particularly about why they may have failed to achieve a CPAC statement and what they need to do next time to evidence it. For example, if they do not get CPAC 4 because their table omits units then please tell them the reason.

- There was use of peer assessment and self-assessment to reflect on practical work. Candidates can self-annotate work to facilitate learning and save teacher time, where necessary. This is also an important skill candidates need to acquire for future learning.
- There is evidence of good communication between staff teaching the same qualification in a centre. For example, information from CPD was fed back to other members of the team delivering the qualification.

CPAC statements

- CPAC 1 This was generally well assessed by centres.
- CPAC 2 This is the most difficult CPAC for candidates to evidence since it involves higher level skills and there are relatively few occasions where it can be observed. Please make sure that you know where you are going to assess this CPAC and give time to your candidates to develop the necessary skills before assessing it. Generally we do not expect to see this CPAC assessed in the first two terms of an A level.
- CPAC 3 There is plenty of opportunity to assess this so please choose the occasions you want to do that on. There is no need to assess it every time. Candidates do not have to do a risk assessment but they should be able to identify the risks and hazards and act accordingly. Occasionally a few candidates found difficulty in identifying hazards and risks when asked. There were also a few isolated examples observed of candidates sitting at a desk in front of equipment while carrying out a potentially hazardous procedure.
- CPAC 4 There are two elements to this: (1) making accurate observations and (2) obtaining accurate, precise and sufficient data
Please see the earlier comment about recording data into practical books. You also need to make sure that they are making appropriate tables to present this data.
There were a number of times where this CPAC statement was awarded but not fully supported by candidate work; often because data was not recorded to the expected precision (e.g. burette readings were not always to two decimal places) or units were omitted from a table.
- CPAC 5 Occasionally CPAC 4 and 5 were confused by centres. CPAC 4 is about recording data whereas CPAC 5 has two main elements: (1) processing data and (2) referencing information.
Processing data may involve making the use of graphs or calculations. Centres may use software (e.g. Excel) to draw graphs if they wish. It is probably a good idea from the point of view of the candidates' development that they use software and also draw graphs by hand over the two years. The second element is also important. Candidates should get use to referencing sources of information whether it is a data value or a statement from a text book or website. It is not necessary to use the Harvard system for recording websites but we do expect to see the URL and date accessed. A few candidates tended to confuse referencing with a bibliography. There is an important difference.

Many documents to support the teaching of the practical endorsement are available on the Eduqas A level science web pages.



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